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ABSTRACT

This report represents the findings and recommendations of the "Resolving the Digital Divide: Information, Access, and Opportunity" conference, the first in a series of conferences designed to provide feedback to the President's Information Technology Advisory Committee (PITAC) on issues of the digital divide. Conference panelists were a diverse group of African American, Native American, and Hispanic expert policymakers and practitioners who were asked to discuss both findings and recommendations based on their experiences in working to resolve the digital divide. Panelists from the conference agreed that there is a digital divide based on demographics, including geographic area, income, race, age, education, and household type. The following findings are discussed: barriers to access (infrastructure, education, economics, content, ease of use); information technology is a tool; community technology centers, libraries, and schools have an important role to play; and public/private partnerships are essential in eliminating the digital divide. Recommendations for resolving the divide are then discussed. Recommendations include: resolving the digital divide demands a national initiative; community relevance and community involvement is essential for solving the divide; rethink educational approaches; continue and expand government programs and provide additional funding to resolve the digital divide; rethink market approaches; more research, data collection and evaluation are necessary to solve the digital divide; and better technology

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and more minority owned businesses. A summary of conference recommendations and the conference program agenda are provided at the beginning of the report. (Contains 18 endnotes.) (AEF)

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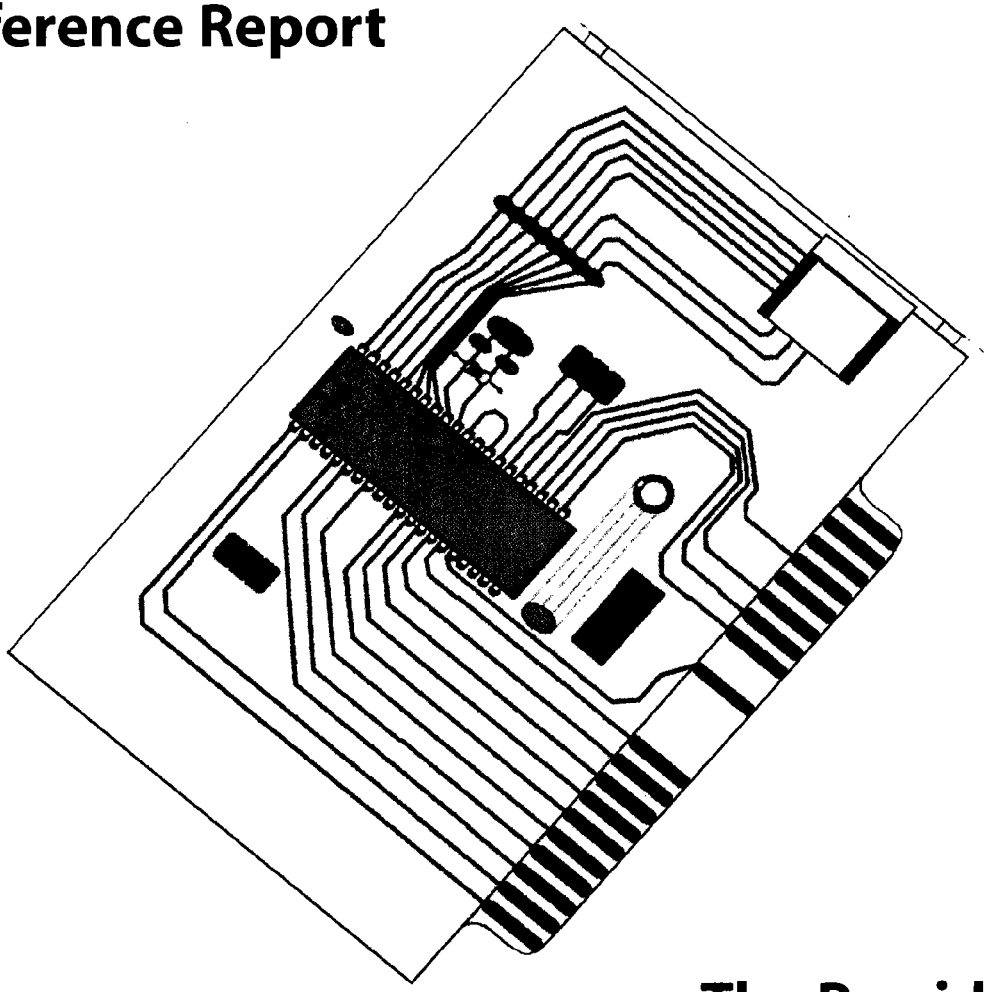
Resolving the Digital Divide: Information, Access, and Opportunity

Conference Report



The President's Information Technology Advisory Committee

February 2000

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Conference participants. *First column:* 1) Bruce Lincoln, Dr. John Alderete, Dr. George Campbell, Jr.; 2) The Honorable Lee Hamilton; 3) Bruce Lincoln; 4) James Casey. *Second column:* 1) Larry Irving; 2) Eddie Williams and Dr. Irving Wladawsky-Berger; 3) The Honorable Charles Rangel; 4) Dr. Raj Reddy; 5) Diane Mourning. *Third column:* 1) Dr. Paula Bagasao; 2) Max Gayton; 3) Karen Buller; 4) B. Keith Fulton.

Resolving the Digital Divide:

Information, Access, and Opportunity

Conference Report

The President's Information Technology Advisory Committee

In association with

The Joint Center for Political and Economic Studies

and

The Woodrow Wilson International Center for Scholars

February 2000

Second Printing
July 2000

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February 2, 2000

The President of the United States
The White House

Dear Mr. President:

PITAC is enthusiastic about the way this nation, both public and private sectors, has begun to develop the necessary strategies to resolve the Digital Divide. In our report to you last February, *Information Technology Research: Investing in Our Future*, we called for policy decisions and research to help our nation better understand the impact of information technology on the society. Part of this effort includes the access issue, which is at the heart of the Digital Divide discussion. Clearly, if the nation is to realize the vision of a transformed American society that we articulated in our report, it is essential to ensure that all Americans have access to the information infrastructure, along with the relevant tools and skills necessary to fully participate in the information age.

On October 19, 1999, the PITAC held a conference to explore this issue. *Resolving the Digital Divide: Information, Access, and Opportunity*, hosted in association with the Joint Center for Political and Economic Studies and the Woodrow Wilson International Center for Scholars, focused on information technology access for racial and ethnic groups in the U.S. The conference report and a brief summary of the major findings are attached. We are planning two additional conferences in the coming year on the issues of geographic disparities and small university access to information tools.

One of the major conclusions of our October conference is that a national initiative is required to close the gap between the information haves and have-nots. Thus, we were very encouraged by your December 9 Executive Memorandum, *Narrowing the "Digital Divide:" Creating Opportunities for All Americans in the Information Age*, directing various cabinet agencies to develop strategies and strengthen programs to make information infrastructure accessible to the information "have-nots." We believe that attention to Digital Divide issues is a national imperative, and this type of leadership provides a much needed catalyst to better understand them and develop meaningful strategies to address the issues.

PITAC would like to work with you to foster the efforts of government, industry, academia and non-profit sectors to ensure that partnerships and properly coordinated activities will help to resolve the digital divide in the near-term. We hope that the findings of our October conference and those planned for later in 2000 will help guide the development of a more comprehensive national agenda for advancing opportunity among individuals and institutions in the digital society. We look forward to continuing to advise you on these important issues.

Sincerely,

Raj Reddy
Co-chair

Irving Wladawsky-Berger
Co-chair

c/o National Coordination Office for Computing, Information, and Communications
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[Attachment to the PITAC Transmittal Letter]

Summary of Conference Recommendations

Resolving the Digital Divide Demands A National Initiative

A national strategy will help to ensure coordinated efforts and widely dispersed benefits. While many distinct efforts are presently under way, panelists cautioned that piecemeal efforts would do little to alleviate this complex problem.

Community Relevance and Community Involvement is Essential for Solving the Divide

Panelists strongly recommend that communities be involved in strategies to increase use of information technology tools and that the tools be used to solve existing community problems. It is imperative that solutions are culturally relevant and acceptable to the community involved.

Rethink Educational Approaches

A constructivist approach to teaching and learning is recommended. Using technology to educate is much more important than educating students about technology. Also, curricula must be made culturally relevant. Content is extremely important to communities-content should be relevant, culturally acceptable and of interest to the community. In higher education, there should be a major initiative to increase access in engineering and computer and information technology fields.

Continue and Expand Government Programs and Provide Additional Funding to Resolve the Digital Divide

Panelists recommended the continuation of government programs and an increase in government investment targeted toward programs designed to resolve the digital divide. Especially relevant are: The Community Technology Centers funding from the Department of Education, the Universal Service Fund (e-rate), the National Telecommunications and Information Administration (NTIA), the Technology Challenge grants, the U.S. Department of Housing and Urban Development's partnership with Communities in Schools (CIS) and the Cisco Networking Academy Program.

Rethink Market Approaches

While the market approach is important to this Nation, it is necessary to realize that the market often fails to address issues of information inequality. Viable and sustainable economic development as well as training, data collection and research are critical to solving these market failures.

More Research, Data Collection and Evaluation Are Necessary to Solve the Digital Divide

In order to combat the problem of the digital divide, continuing research, data collection and evaluation is important. Research teams should consistently assess community access to technology and engage the community in ways to solve access problems or to create better uses for existing access.

Better Technology and More Minority Owned Businesses

Better technology can help increase the use of information technology tools. Minority owned companies, a growth in minority researchers, and an increase in policy-oriented employees will help to overcome content and cultural barriers.

Acknowledgments

The President's Information Technology Advisory Committee (PITAC) would like to thank the Joint Center for Political and Economic Studies and the Woodrow Wilson International Center for Scholars for helping sponsor the conference, *Resolving the Digital Divide: Information, Access and Opportunity.* In particular, we are grateful to Eddie N. Williams, President, Joint Center for Political and Economic Studies and Lee H. Hamilton, Director, The Woodrow Wilson International Center for Scholars for their insight and dedication to resolving the digital divide.

PITAC would also like to thank Yolanda L. Comedy, PITAC Liaison, National Coordination Office for Computing, Information and Communications for authoring the report and working with the following people to put together the conference: Denise L. Dugas, Vice President for Communications and Marketing and her staff at the Joint Center for Political and Economic Studies; Robert Litwak, Director, Division of International Studies and his staff at the Woodrow Wilson International Center for Scholars; and Taffy Kingscott, Public Policy Director, Science and Technology, IBM. In addition, PITAC thanks the staff of the National Coordination Office for Computing, Information and Communications and the White House Office of Science and Technology Policy.

PITAC would like to thank the following corporations for their financial support: Microsoft, Qualcomm, Intel, MCI Worldcom, AT&T, 3Com, Hughes Electronics, and IBM. PITAC, the Joint Center for Political and Economic Studies, and the Woodrow Wilson Center especially thank the conference panelists and speakers.

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Forward

The following report represents the findings and recommendations of the *Resolving the Digital Divide: Information, Access and Opportunity* conference. This conference was the first in a series of conferences designed to provide feedback to the President's Information Technology Advisory Committee (PITAC) on issues of the digital divide. PITAC is dedicated to resolving issues of access, as noted in its report to the President, *Information Technology Research: Investing in Our Future*, where PITAC recommended that both research and policies are critical to understanding the societal implications and workforce issues associated with the information revolution.

Resolving the Digital Divide: Information, Access and Opportunity

Program Agenda

Tuesday, October 19, 1999
9:00 AM - 3:00 PM

8:30 AM Registration

8:30 AM-9:00 AM Continental Breakfast

9:00 AM **Welcome**
Lee H. Hamilton, Director,
The Woodrow Wilson International Center for Scholars

9:10 AM **Opening Remarks**
Eddie N. Williams, President,
Joint Center for Political and Economic Studies

9:20 AM **Congressional Perspective**
The Honorable Charles B. Rangel
U. S. House of Representatives

9:30 AM **Societal Transformations Across Diverse Communities**
Dr. Irving Wladawsky-Berger, Co-Chair
President's Information Technology Advisory Committee

10:00 AM Coffee Break

10:15 AM **Promoting Access and Opportunity for All**
Moderator:
Dr. John Alderete, Former President,
Society for the Advancement of Chicanos and Native Americans in Science

Panelists:
Bruce Lincoln, Senior Educational Technlogist, Institute for Learning Technologies, Columbia University

Diane Mourning,
Executive Director, and
Max Gayton, Student,
Five Points Media Center

Karen Buller, President and CEO,
National Indian Telecommunications Institute

11:05 AM Q&A

11:45 AM Break

12:00 Noon **Introduction to Keynote**
Dr. John P. Miller
Director, Center for Computational Biology, Montana State University

Keynote Luncheon Speaker
Larry Irving, Former Assistant Secretary for Communication and Information,
U.S. Department of Commerce

1:30 PM **Challenges and Solutions to Access for All**
Moderator:
Dr. George Campbell, Jr.,
President and CEO, NACME
(National Action Council for Minorities in Engineering, Inc.)

Panelists:
B. Keith Fulton, Director
Technology Programs and Policy,
National Urban League

Dr. Paula Y. Bagasao, Director,
Information Technology Research,
Tomas Rivera Policy Center

James Casey,
Telecommunications Attorney,
Morrison and Foerster

2:10 PM Q&A

3:00 PM **Close**
Eddie N. Williams

Resolving the Digital Divide: Information, Access and Opportunity

At the turn of a new century, information technology is transforming the way the world lives, works, and learns. In this new "information age," continued advances in information technologies such as microprocessors, software, and communication technologies, will increase the power of computing systems and make information tools increasingly affordable. The President's Information Technology Advisory Committee (PITAC) states in its report[1] to the President, *Information Technology Research: Investing in Our Future*, that "as we approach the Millennium, it is clear that the "information infrastructure"—the interconnected networks of computers, devices, and software—may have a greater impact on worldwide social and economic structures than all networks that have preceded them."

But the PITAC notes in its report that "the use of information technology—in particular the growing popularity of the Internet and the emergence of global commerce—has introduced a series of important and complex policy issues."[2] One such issue is equity of access to the information age, including access to technology tools, the ability to use and create the tools to better one's quality of life, and the ability to create meaningful content for one's community. One of the Nation's challenges is to extend the possibilities of the information age to all Americans. As the PITAC states, "in an increasingly competitive global economy, our Nation cannot afford to squander our human resources by providing opportunities only to those Americans who are favored by geographic or economic circumstance...information technology tools and applications can provide opportunities that transcend barriers of race, gender, disability, age, income and location."[3]

Our Nation cannot afford a persistent racial divide in the information age. A talented workforce, an educated population, and sophisticated creators and users of information technology are of paramount importance if the information technology revolution is to succeed and if the challenges and opportunities of the information age are to be met. At this point, it is clear that a "digital divide" exists in our country. Fortunately, efforts to end this divide are now underway. The PITAC believes that it critical to examine both the causes and possible solutions

to this digital divide; and, as a follow-on to their report to the President, the committee and its partners are holding a series of conferences on this crucial topic, with a goal of developing a national action plan to ensure that all Americans have access to information technology.

The first conference in this series: *Resolving the Digital Divide: Information, Access and Opportunity*, was sponsored by the Joint Center for Political and Economic Studies in association with the PITAC and the Woodrow Wilson International Center for Scholars (WWICS), and was held on October 19, 1999 at WWICS in Washington, DC. This conference was designed to examine the digital divide among African Americans, Native Americans, and Hispanics whose populations are experiencing the most severe information technology disparities in the U.S. As Congressman Charles Rangel (D-NY) aptly noted at the conference "race and economics both play a role in contributing to the digital divide."

The Digital Divide

Panelists from the *Resolving the Digital Divide: Information, Access and Opportunity* conference agreed that there is a digital divide based on demographics, including geographic area, income, race, age, education, and household type. Research from their own organizations as well as from the Department of Commerce *Falling Through the Net*[4] report demonstrate that while the Internet is one of the cornerstones of the information age, the rural poor, rural and central city minorities, young households, and single-parent female households are the least connected to the Internet of all Americans. Only 16 percent of low-income schools have functional Internet connectivity.

White Americans are far more likely to have computers in their homes than African Americans, Hispanics, or Native Americans. Americans with a college education are ten times more likely to have a computer in the household than those with a high school education. As income levels increase, all racial groups are more likely to have computers in the home, although Whites are still more likely than African Americans or Hispanics to have personal computers. From 1994 to 1997 there was an increase in the disparity between Blacks and Hispanics, who now lag even further behind Whites and Asians in their levels of PC-ownership and online access.

Further, African Americans, Hispanics, and Native Americans do not comprise a significant portion of the information-based workforce. These groups constitute one-fourth of the total U.S. workforce, thirty percent of the college-age population, and a third of the birth rate. Yet members of these minorities collectively comprise only 6.7 percent of the U.S. computer and information science labor force (all degree levels), 5.9 percent of the engineering workforce, 1.7 percent of the U.S. computer science faculty, and 4.9 percent of the engineering faculty.[5] These statistics are particularly important because jobs in information technology pay significantly higher salaries than jobs in non-information technology fields. Currently, it is estimated that sixty percent of all jobs will require information technology skills.

Conference panelists were a diverse group of African American, Native American, and Hispanic expert policymakers and practitioners who were asked to discuss both findings and recommendations based on their experiences in working to resolve the digital divide. The panelists ranged from a 14 year-old CNN Student Bureau reporter working at the Five Points Media Center in Colorado to a senior educational technologist at Columbia University. *Panel I: Promoting Access and Opportunity for All* panelists were: Moderator, Dr. John Alderete, Former President, Society for the Advancement of Chicanos and Native Americans in Science; Diane Mourning, Executive Director, Five Points Media Center; Karen Buller, President and CEO, National Indian Telecommunications Institute; Max Gaytan, Student, Five Points Media Center; and Bruce Lincoln, Senior Educational Technologist, Institute for Learning Technologies, Columbia University. *Panel II: Challenges and Solutions to Access for All* panelists were: Moderator, Dr. George Campbell, President and CEO, NACME; Dr. Paula Bagasao, Director, Information Technology Research, Tomas Rivera Policy Institute; James Casey, Telecommunications Attorney, Morrison & Foerster; and B. Keith Fulton, Director, Technology Programs and Policy, National Urban League.

Keynotes Speakers were: Larry Irving, former Assistant Secretary for Communications and Information, U.S. Department of Commerce; Charles Rangel, U.S. House of Representatives; and Irving Wladawsky-Berger, Co-Chair, President's Information Technology Advisory Committee. Closing remarks were made by Eddie Williams, President, Joint Center for Political and Economic Studies, and Dr. Raj Reddy, Co-Chair, PITAC.

Resolving the Divide: The Findings

Information technology is associated with the current economic upswing in the U.S. The information revolution has increased jobs, productivity and the ability of Americans to raise our standard of living. Information technology is viewed as a transforming phenomenon that is likely to help empower and democratize its users. Yet, this positive reality is possible only if all of our society is able to use information tools to better our lives. Research on the social and economic ramifications of information technology on all of our society as well as national efforts to solve the disparities in access to the tools of the information age are critical. It is essential that industry, government, and the non-profit world work together to erase the digital divide.

Barriers to Access

Infrastructure—Hispanics, Native Americans, and African Americans in both rural and urban areas are likely to have a low overall rate of connectivity, and poor infrastructure is one of the major causes. Information technology infrastructures vary across and within communities and public access points. Often the schools, libraries, and community organizations have poor infrastructure in all these areas, which makes it particularly cost-prohibitive and difficult to obtain the necessary infrastructure for using information technology tools.[6]

Education— In order to more fully benefit from information technology tools, reading, writing, math, and critical thinking skills are essential but are often lacking among potential users/creators in underrepresented groups. In addition, educational pedagogy must undergo a change to adapt both to the way students learn most effectively and to approaches to using technology to better education.[7] "We need new paradigms of education and must expect new and innovative programs to deal with the losses that occur throughout the educational pipeline."[8]

Economics—Unfortunately, the tools of the information age are at present primarily helping those already favored by economic circumstance. Those in the lowest income brackets are not likely to have access to information technology tools at home or at work. In the communities most in need, neither the schools, libraries, nor community centers have sufficient access to the best information

technology tools. The greatest disparities exist between the richest and poorest schools and the library systems in affluent versus poor neighborhoods.[9]

Content—Communities and individuals are the most likely to use information tools that they see as culturally relevant. It is important that Native Americans, African Americans, and Hispanics seek the use of information technology tools to preserve and further define their cultures or seek a means of communication among themselves and with others.[10] Also, the panelists stressed that it is often essential for communities to use their own languages when using information technology tools.

Ease of use—The technology that spurs the information age is constantly improving. Yet, access will continually depend on the types, costs, and ease of use of these tools. Many schools, libraries, and community technology centers find that they have inadequate human technical capacity to serve their needs. Individuals find computer maintenance and the necessary updates costly and difficult. Obstacles to buying computers include the affordability of outdated equipment, which often does not function with the latest software; insufficient information about what computer "brands" are the best for the buyer's needs; the difficulty of operation; and the expensive of buying and updating the best hardware, software, and Internet connectivity.

Information Technology is a Tool

Information technology is a "communication and knowledge tool to support the building blocks of a community such as education, governance, economic viability, health, environment and law."[11] Information technology is a tool for addressing needs and not an end in and of itself. Two examples of community uses of information technology are below.

Replication of excellent programs is key to solving the digital divide. For example, the National Indian Telecommunications Institute is dedicated to using the power of electronic technologies to provide American Indian, Native Hawaiian, and Alaskan Native communities with extensive educational tools, equal opportunity, and a strong voice in self-determination. The Five Points Media Center attempts to bring together an ethnically diverse community of Hispanics, African Americans, and Asians around the media. This gives the community a

voice and recognizes the importance of involving the community by having an advisory board of community members.

Community Technology Centers, Libraries and Schools Have an Important Role to Play

While public access points do not eliminate the need for information technology tools in the home, they are an excellent source for bringing underserved groups closer to information tools. Access points include public libraries, community technology centers, and schools, all of which have unique features and a unique clientele. Each access point also has its unique problems and set of concerns.

Public/Private Partnerships Are Essential in Eliminating the Digital Divide

The digital divide can only be resolved if there are sustainable public/private partnerships. Industry, government, philanthropic organizations, and community-based organizations are all necessary and important components in efforts to bring technology access to every American in the information age. Panelists recommend that all partners stay fully engaged until the completion of a project. Instead of giving each partner distinct tasks, it is better to use the expertise of each group throughout the process. All of the panelists were engaged in programs that built on partnerships between several groups.

Resolving the Divide: The Recommendations

Resolving the Digital Divide Demands A National Initiative

It is certain that we need clearly articulated national goals and public/private partnerships to solve the digital divide. One program discussed at the conference, entitled the "Transcontinental Cyberspace Railroad" is based on the need to diffuse technology and give underserved communities the technology tools necessary to transcend their present socioeconomic condition. "People who are most disadvantaged socially need the most developed information technology."[12] Underserved communities should benefit from cutting edge technologies in public libraries, community technology centers and homes. Outdated hardware and software are not appropriate for the needs of these communities. It is recommended that the "Transcontinental Cyberspace Railroad" model be used to create the widespread use of a national technology diffusion initiative designed to target underserved areas and to accelerate their technological development through the organization of technology markets.

A national strategy will help ensure coordinated efforts and widely dispersed benefits. While many distinct efforts are presently underway, panelists cautioned that piecemeal efforts will do little to alleviate the complex and massive digital divide problem.

Community Relevance and Community Involvement is Essential for Solving the Divide

Community relevance and community involvement are key to the success of initiatives to resolve the digital divide. Panelists strongly recommend that communities be involved in strategies to increase use of information technology tools and that the tools be used to solve existing community problems. It is imperative that solutions are culturally relevant and acceptable to the community involved. Panelists noted that in many instances community members have not been asked what would be important to them. Ongoing advisory committees of community members are strongly recommended if community issues and the digital divide are to be solved. In addition, organizations with

existing client bases are the most viable source for creating public access to information technology.

For example, Internet connectivity in the Native American community is important so that individuals can define themselves as authors to preserve their culture and counter misconceptions about important issues pertaining to belief systems, daily life, and socioeconomic status. In addition, using the Internet for business and communication allows Native Americans to stay on their own landbase. In the Native American community there is particular concern about information about Native peoples online—cultural content is often appropriated and inaccurate.

Underrepresented groups must also transform belief systems in order to adopt and use technology to obtain economic parity and solve community problems. Information technology can serve as a tool for wealth-creation in minority communities. From minority individuals to institutions, the minority community must make using and creating information technology tools a priority.

Rethink Educational Approaches

A constructivist approach[13] to teaching and learning is recommended. Using technology to educate is much more important than educating students about technology. Also, curricula must be made culturally relevant. Content is extremely important to communities—content should be relevant, culturally acceptable, and of interest to the community.

Panelists recommended that corporate contributions be used to help create policies to revolutionize K-12 education and teachers' colleges. Current corporate gift giving has had minimal impact and there is little consistency between different organizations.

In higher education, there should be a major national initiative to increase access in the engineering and computer and information technology fields. During the conference it was estimated that the incremental cost of creating parity in the representation of African Americans, Hispanics, and Native Americans in the engineering workforce would be about $350 million annually (that is, to produce 17,000 more minority engineers annually). The cost of not doing this is far greater. Joint Ventures estimates the cost of the workforce gap in

Silicon Valley alone is about $3.5 billion annually in lost productivity, excessive turnover, premium salaries, and the like.

Continue and Expand Government Programs and Provide Additional Funding to Resolve the Digital Divide

Panelists recommended continuing current government programs and increasing government investments targeting programs to resolve the digital divide. The Department of Education's funding for Community Technology Centers—which expand access to information technology and related learning services for residents of distressed urban and rural communities— should be continued and augmented. The Community Technology Center program provides funding for center start-up and expansion.

The Universal Service Fund, more commonly known as e-rate[14] is an effort to help end the digital divide. E-rate is a FCC program to provide all K-12 schools and public libraries up to $2.25 billion a year in discounts for telecommunications services. Broader public awareness of the e-rate program is recommended.

Also, continuation and expansion of programs of the National Telecommunications and Information Administration (NTIA) is recommended. NTIA, an agency of the U.S. Department of Commerce, is the Executive Branch's principal voice on domestic and international telecommunications and information technology issues. NTIA spurs innovation, encourages competition, helps create jobs, and provides consumers with more choices and better quality telecommunications products and services at lower prices. One of NTIA's grant programs, Technology Opportunity Program (TOP, formerly known as TIIAP), has been particularly helpful in lessening the effects of the digital divide. TOP promotes the widespread use of advanced telecommunications and information technologies in the public and non-profit sectors and provides matching demonstration grants to state and local governments, health care providers, school districts, libraries, social service organizations, public safety services, and other non-profit entities to help them develop information infrastructures and services that are accessible to all citizens in rural as well as urban areas.

Technology Challenge grants provide $300 million matching grants over a five years, and are designed for community partnerships to develop creative responses to the Information Age requirements of all students, including those in inner cities and rural areas. Panelists favored continuation of the Technology Challenge grants noting that they should remain as a separate grant program from community block grants.

Lastly, panelists praised the U.S. Department of Housing and Urban Development's (HUD's) partnership with Communities in Schools (CIS) and the Cisco Networking Academy Program, which promotes job and economic opportunities in underserved communities. HUD, along with CIS and Cisco, is targeting the Networking Academy Program to serve youth and their families in public housing, Neighborhood Network sites, Empowerment Zones, and Enterprise Communities. The CIS-Cisco Networking Academy Program-HUD partnership recognizes that community development means that people must have job skills to ensure the community remains economically strong and viable now and in the future.

However, panelists recommended that the grant-making process be made easier, noting that, in some cases, technical assistance should be provided to help make applying for grants a simpler process. In addition, program evaluation and dissemination of findings from funded projects should be made part of grants in order to ensure sustainability and the use of the best practices. As with all digital divide efforts, it is also important that government agencies coordinate efforts and adopt an intergovernmental approach.

Rethink Market Approaches

"Information equality is a matter of strategy. It is not a matter of the market, because we can see that the market is not evenly distributing technology to all people."[15] It is important to realize the occurrence of these market failures and provide the necessary incentives to overcome them. More training, data collection and research will begin to remedy this problem, as will efforts that focus on viable and sustainable economic development. Traditional markets should be opened in underserved communities. At the same time, communities should try to form models for participation in information age businesses that provide services to their communities and capture markets outside of them to ensure sustainability.

More Research, Data Collection and Evaluation Are Necessary to Solve the Digital Divide

In order to combat the problem of the digital divide, continuing research, data collection, and evaluation is important. Research teams should consistently assess community access to technology and engage the community to solve access problems or create better uses for existing access. Inadequate data is a problem in many underserved communities. For instance, the *Native Networking: Telecommunications and Information Technology in Indian Country,* report concludes that "[this] report not only reflects the current state of telecommunications and technology in Indian country; it also clearly demonstrates the need to collect more and better information."[16]

Pilot programs and test-bed studies will help create better programs for solving the digital divide. These programs should include components to educate communities about the value of information technology. Outreach efforts, including dissemination of findings, will help communities realize their goals. Doing more and better research is the only way to differentiate between viable, sustainable programs and unsuccessful programs or initiatives.

Better Technology and More Minority Owned Businesses

Better technology can help increase the use of information technology tools. Wireless products, for example, help overcome some of the infrastructure barriers previously discussed. Minority-owned companies and a growth in the number of minority researchers, and technical and policy-oriented employees will help to overcome content and cultural barriers. For example, Native American ownership has helped to alleviate some of the cultural barriers associated with telephone use in the Native American community.[17] Larry Irving, former Assistant Secretary for Communications and Information, U.S. Department of Commerce, noted that there is not a single African American owned firm in the list of 100 top Internet companies. Minority communities are not producing the necessary number of entrepreneurs. Irving attributes this to both a lack of understanding in the minority community of the importance of entrepreneurship and discrimination against minority non-technical graduates who have not been afforded the opportunity or same level of trust as their white counterparts. Minority-owned business could be helpful in better utilizing technology and in creating new and better technology.

Conclusion

Larry Irving challenges everyone to play his or her part in eliminating the digital divide. The information revolution gives us an opportunity to close the gap between the haves and have-nots in our country. Irving Wladawsky-Berger, Co-chair of the PITAC, states "We're at a fork in the road. One path is the digital divide, the other is a place where all who wish can take advantage of the empowering transformation that is all around us now."[18]

Community-based, innovative thinking can help end the divide. The country cannot afford to have a two-tiered society—one using the information technology tools and the other trapped by antiquated manual practices. Technologists and policy-makers must play a role in helping communities achieve access in order for the information revolution to realize its full potential. Raj Reddy, Co-chair of the PITAC, says that technologists and policy-makers need to understand that creating better access includes the need for: 1) connectivity and broadband access; 2) computers and the latest information technologies for communities and homes; 3) software that is affordable and meets the needs of communities; 4) training and access to information technology consulting; and 5) research that will shed light on what uses of information technology tools are the most attractive to underserved populations.

The PITAC calls upon members of community-based organizations, the Government, philanthropic organizations, and industry to work together to ensure the closing of the digital divide and to establish a national, coordinated initiative to end the digital divide and help make the tools of the information age accessible to all.

Footnotes:

[1] President's Information Technology Advisory Committee Report to the President, *Information Technology Research: Investing in Our Future*, February 1999: 11.

[2] *Ibid:* 55.

[3] *Ibid:* 57.

[4] U.S. Department of Commerce, National Telecommunications and Information Administration, *Falling Through The Net: Defining the Digital Divide*, 1999. Also, see: The Joint Center for Political and Economic Studies, National Opinion Poll Factsheet, Internet Use, 1998 and 1999, prepared by Margaret C. Simms.

[5] Campbell Jr., George, Ronni Denes, and Catherine Morrison, eds. *Access Denied: Race, Ethnicity and the Scientific Enterprise.* New York: Oxford University Press, 1999.

[6] Researchers from the Tomas Rivera Institute, Digital Steppingstones Project found that small and older facilities are among the obstacles to obtaining information technology tools. *http://www.trpi.org/dss*

[7] See: Strommen, Erik F., and Lincoln, Bruce, *Constructivism, Technology, and the Future of the Classroom Learning,* Columbia University, Teachers College, Institute for Learning Technologies, 1999. *http://www.ilt.columbia.edu/text_version/k12/livetext/docs/construct.html* and President's Committee of Advisors on Science and Technology, *Report to the President on the Use of Technology to Strengthen K-12 Education in the United States,* 1997.

[8] Executive Office of the President, Office of Science and Technology Policy, *Meeting America's Needs for the Scientific and Technological Challenges of the Twenty-First Century,* quote from John Alderete, 1999: 44.

[9] Conference panelist, Karen Buller, notes that while the telephone usage penetration rate for Americans overall is 94 percent, for Native Americans it is 40 percent. In less populated areas, putting in an initial phone line can cost between $10,000-$50,000. Long distance rates may be billed for calls only a few miles away due to the multitude of providers.

[10] For example, two of the conference panelists work on culturally specific projects. Karen Buller has helped create Native Cultures Curriculums and Bruce Lincoln works on The Harlem Renaissance Project.

[11] Casey, James, Randy Ross, and Marcia Warren, *Native Networking: Telecommunications and Information Technology in Indian Country.* Benton Foundation report, 1999: 5.

[12] "Resolving the Digital Divide Conference," Statement by Bruce Lincoln, Washington, DC: October 1999.

[13] The constructivist approach is characterized by the independent, in depth exploration of a limited number of topics. Teachers help students to build their own knowledge bases and skill sets.

[14] See: The U.S. Department of Education, Office of Educational Technology, *E-rate Factsheet, http://www.ed.giv/Technology/comm-mit.html.*

[15] "Resolving the Digital Divide Conference," Statement by Paula Bagasao, Washington, DC: October 1999.

[16] Casey, James, Randy Ross, and Marcia Warren: 3.

[17] "Resolving the Digital Divide Conference," Statement by Karen Buller, Washington, DC: October 1999.

[18] *Ibid.,* Statement by Irving Wladawsky-Berger.

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