Assessment of Technology Infrastructure in Native Communities

Dr. Linda Ann Riley
Dr. Bahram Nassersharif
Dr. John Mullen

College of Engineering
Box 30001
New Mexico State University
Las Cruces, NM 88003

Prepared for
Economic Development Administration
U.S. Department of Commerce
Washington, D.C. 20230

About the logo

The logo for this project was designed by Dr. Bahram Nassersharif with input from Drs. Riley and Mullen. The logo represents technology infrastructure in Native communities depicting telecommunications and digital circuits in a pueblo or village setting supported by both human engineered infrastructure (the triangles) and natural infrastructure (earth, water, and skies depicted in the colors filling the triangles).

ACKNOWLEDGEMENTS

●●●●●●●

Pat Spears, President, Intertribal Council on Utility Policy

John Tahsuda, Deputy Attorney General, Oneida Tribe of New York

Emily Ipalook Wilson, Special Assistant to Administrator, Samuel Simmonds Memorial Hospital, Arctic Slope Native Association

Expert Interviewees

Victor Chavez, Manager Regional & Small Business Partnering Department, Sandia National Laboratories

Harold Felipe, Information Systems Manager, Sky City Casino

Mathew Foster, Economic Development Planner, Pueblo of Sandia

Bernadine Garcia, Tribal Economic Development Planner, Acoma Pueblo

Petuuche Gilbert, Realty Officer, Tribal Councilman, Acoma Pueblo

Desmond Jones, Central Office Engineer, Navajo Communications Company

Rex Kontz, Acting Manager Engineering and Technical Services Division, Navajo Tribal Utility Authority (NTUA)

Joyce Merrill, Vice President, Indian Pueblo Cultural Center, Indian Pueblo, Marketing, Inc.

Angela R. Padilla, Assistant Vice President, NationsBank, Community Investment Group

Eric Vigil, Rural Business -- Cooperative Service Specialist, U.S. Department of Agriculture, Rural Development

Scott Zuiderveen, Assistant Vice President, NationsBank, Commercial Banking

Survey Respondents

Asa'carsarmiut Tribe

Assiniboine and Sioux Tribes, Fort Peck Indian Reservation

Cabazon Band of Cahuilla Mission Indians

Chalkyitsik Village

Cheyenne-Arapaho Tribes of Oklahoma

Confederated Tribes of the Umatilla Reservation

Crow Tribe of Montana

Evansville Village

Hopland Band of Pomo Indians

Hughes Village

Igiugig Village

Inupiat Community of the Arctic Slope

Lovelock Paiute Tribe of the Lovelock Indian Colony

Makah Indian Tribe

Manokotak Village

Menominee Indian Tribe of Wisconsin

Minnesota Chippewa Tribe, Mille Lacs Band

Minnesota Chippewa Tribe, White Earth Band

Native Village of Barrow Inupiat Traditional Government

Native Village of Chistochina

Native Village of Eyak

Native Village of Gambell

Native Village of Kipnuk

Native Village of Nightmute

Native Village of Noatak

Native Village of Ruby

Native Village of Shishmaref

Native Village of Tanana

Native Village of Tuntutuliak

Navajo Nation of Arizona, New Mexico & Utah

Ninilchik Village

Oglala Sioux Tribe of the Pine Ridge Reservation

Ponca Tribe of Indians of Oklahoma

Ponca Tribe of Nebraska

Pueblo of Acoma

Quinault Tribe

Red Lake Band of Chippewa Indians

Seneca Nation of New York

Soboba Band of Luiseno Mission Indians

South Naknek Village

Stillaguamish Tribe of Washington

Tohono O'odham Nation of Arizona

Tonto Apache Tribe of Arizona

Tunica-Biloxi Indian Tribe of Louisiana

Tuolumne Band of Me-Wuk Indians

Turtle Mountain Band of Chippewa Indians of North Dakota

EXECUTIVE SUMMARY

●●●●●●

Introduction

On August 6, 1998, President Clinton directed the Department of Commerce, in conjunction with the Department of Interior and Native American tribes, to undertake a technology infrastructure study of American Indian and Alaska Native communities. The study was to fulfill three fundamental goals:

1. Assess the current state of technology infrastructure in Native communities;

2. Identify and describe the challenges and barriers to technology infrastructure development in Native communities; and

3. Propose solutions for overcoming these challenges and barriers.

After conducting a nationwide review of proposals, the Commerce Department's Economic Development Administration contracted with the College of Engineering at New Mexico State University (NMSU) to conduct the study between January and June of 1999. This report presents the findings of that research.

Scope of Study

This project defined the concept of "technology infrastructure" very broadly to include all forms of infrastructure that routinely affect economic development. While many people automatically associate the term with telecommunications, it is clear that telecommunications infrastructure alone cannot improve the economic conditions in Native communities without a sound network of roads, utilities, and similar infrastructure. Likewise, technology infrastructure development cannot proceed unless Native communities have a certain minimal capacity in the form of a skilled labor force, capability to undertake technology and strategic planning, and resources to finance infrastructure investment.

The study included Native communities throughout the lower 48 states and Alaska.

The Current State of Technology Infrastructure in Native Communities

By just about any measure used, individuals living in Native communities or villages typically have less income, receive less education, and suffer from higher unemployment and poverty

rates than individuals in non-Native communities. Native communities also lag far behind non-Native communities in "basic" infrastructure such as roads, utilities, and housing. The gap between Native and non-Native communities is even greater in "advanced" technology infrastructure such as Internet access, cellular telephone service, and cable TV. Many Native communities have made important gains in some types of basic technology infrastructure. However, these gains are more than offset by the rapid growth in the importance of, and demand for, advanced technology infrastructure.

For example, results from the survey associated with this project show:

- Only 39% of rural households in Native communities have telephones compared to 94% for non-Native rural communities.

- Approximately 26% of tribes report that they do not have 911 service.

- 44% of tribes have no local radio stations, and for those tribes with radio stations, these stations are rarely tribally owned.

- In rural areas, (population areas with less than 2,500 individuals), 12% of Native households lack electricity and 23% lack gas.

- Of rural Native households, only 22% have cable television, 9% have personal computers, and of those, only 8% have Internet access.

- 61% of tribes report not having a single manufacturing facility in their community.

- Only 17% of the responding tribes have a technology infrastructure plan, 44% have an economic development plan and 35% have a strategic plan in place.

- Nearly 90% of Native schools and libraries have both computers and Internet access.

Tribes overwhelmingly identified their top investment priorities as housing, roads, waste water technology and medical facilities while expressing the opinion that basic levels of technology infrastructure must be in place to lay the foundation for more advanced levels.

Today, many Native communities find themselves in a vicious circle. The weak economic base of these communities makes it difficult to support infrastructure investment. And in turn, the poor state of infrastructure undermines their ability to undertake and attract successful economic development initiatives.

Barriers to Development of Technology Infrastructure in Native Communities

Native, government and private sector participants in our research identified many barriers that interfere with tribal efforts to develop and maintain technology infrastructure in Native communities. The most important of these include:

- The generally weak economic base of these Native communities that prevents them from investing in either physical infrastructure or worker training necessary to support technology infrastructure;

- Geographical remoteness that raises the cost of providing technology infrastructure;

- Distrust on the part of some Native Americans of specific new technologies and of federal assistance;

- Lack of an integrated, interagency Native American investment strategy;

- Federal policy that fails to reflect the severity of the technology gaps faced by Native Americans,

- Insufficient information dissemination regarding federal programs available to the tribes; and

- Insufficient planning in Native communities.

In general, while there are many programs already in place intended to improve the current state of technology infrastructure in Native communities, these programs could be better coordinated into an overall Native American investment strategy.

Recommendations for Closing the Technology Infrastructure Gap between Native and non-Native Communities

Based on our research and extensive discussion with project contributors, we recommend that the federal government provide assistance and encourage private investment for developing Native technology infrastructure. This can be accomplished by:

- Developing a long-term, consistent federal investment strategy for Native technology infrastructure that also encourages the development of public and private partnerships. The federal government should continue to serve as a catalyst to spur private investment such as the Administration's New Markets Initiative. This strategy

should identify specific investments needed, assign responsibility for those investments to specific agencies and partners, and estimate budgetary needs and timelines to complete the necessary investments;

- Increasing funding, developing incentive programs, and facilitating strategic partnerships for development of Native technology infrastructure. The most badly needed investments are for physical infrastructure, planning assistance, and workforce development;

- Improving the efficiency with which existing Native infrastructure programs are delivered. As part of this recommendation, we suggest a series of interagency working groups. The charge of these groups would be to: target specific types of infrastructure initiatives; identify program strengths, weaknesses and gaps, and; maximize synergy between different agency programs funding similar Native infrastructure areas; and

- Recognizing the sovereignty of tribes to plan, develop, and manage their own technology infrastructure. Most important, the federal government should give tribes greater authority to grant utility right of ways and to purchase land needed for effective technology infrastructure development.

Consistent with these broad, cross-cutting policy suggestions, we recommend that the federal government support improvements in specific infrastructure areas by:

- Assisting Native communities to upgrade their basic utilities—providing funding, establishing programs, and involving private sector participants in technology transfer to tribes, as well as simplifying federal review of their development efforts;

- Assisting Native communities to upgrade their educational facilities and programs for workforce development and managerial training. Most notably, greater support is needed for distance education programs and computer facilities in Native schools and the networks needed to connect them to the rest of the world;

- Increasing funding for, and coordination of, federal programs to help Native communities install and maintain telecommunications infrastructure;

- Setting standards, facilitating partnerships and creating programs needed to encourage the development of telemedicine programs; and

- Increasing program and technical support for, and highlighting successful private initiatives in, Native American economic development activities.

Methodology

To arrive at these findings, NMSU researchers:

1. Conducted interviews with Native technology experts, tribal planners, utilities managers, federal and private technology infrastructure program managers, and technology transfer experts from the national laboratories;

2. Undertook a technology infrastructure survey targeted at all federally recognized tribes;

3. Convened a Native Technology Infrastructure Summit of nationally recognized Native experts to discuss, analyze, and propose solutions for technology infrastructure development in Native communities; and

4. Reviewed prior scientific, governmental and other literature related to Native technology infrastructure development.

For more information on this study, please contact:

Dr. Linda Ann Riley (505) 646-2475;
    E-mail: linriley@nmsu.edu

Dr. Bahram Nassersharif (505) 646-3502;
    E-mail: bn@nmsu.edu

Dr. John Mullen (505) 646-2958;
    E-mail:jomullen@nmsu.edu

College of Engineering, Box 30001
New Mexico State University
Las Cruces, New Mexico 88003

Project Website: http://alpha.nmsu.edu/~tech
Project E-mail: tech@alpha.nmsu.edu

CONTENTS

●●●●●●

LIST OF TABLES

●●●●●●

INTRODUCTION

●●●●●●

1-1. Overview

..."*To continue our focus on infra-structure technology needs and business development in American Indian and Alaska Native communities, I direct the following actions.*

First, I direct the Secretary of Commerce, in collaboration with the Department of the Interior and tribal governments, to report back to me within 9 months on the state of infrastructure technology needs in Indian communities, including distance learning facilities, telecommunications capabilities, and manufacturing facilities. This report should identify the infrastructure technology needs in Indian country and set forth proposals that would help address these needs."*...*

WILLIAM J. CLINTON
August 6, 1998

On August 6th, 1998, at a conference entitled "Building Economic Self-Determination on Indian Lands," President Clinton announced a multifaceted plan for improving economic conditions in American Indian and Alaska Native communities. As one element of this plan, the President directed the Department of Commerce to undertake a technology infrastructure study with collaboration from the Department of the Interior and tribal governments.

This report presents the findings from that study, undertaken between January and June of 1999. The report documents the current state of technology infrastructure in Native communities, then identifies and describes barriers to improving that technology infrastructure. Finally, it makes suggestions for funding, policy, and strategic alternatives to overcome these barriers.

1-2. Why Study Native Communities?

Government statistics and academic studies have consistently documented significant disparities in economic performance and technology between Native and non-Native communities in the U.S. By just about any measure used, on average, individuals living in Native communities or villages have less income, receive less education, and suffer from higher unemployment and poverty rates than individuals in other types of U.S. communities. The gap between Native and non-Native communities is even greater in "advanced" technology infrastructure such as Internet access, cellular telephone service, and cable TV.

What makes these statistics even more significant is that instead of improving over time, there is evidence in a number of cases of worsening trends. Today, many Native communities find themselves in a vicious circle where their weak economic base makes it difficult to support infrastructure investment, and the poor state of their infrastructure undermines successful economic development.

Regardless of the type of development strategies or masterplans adopted by Native communities, a necessary prerequisite for improving the economic well-being of these communities is a certain level of technology infrastructure.

1-3.   What is Technology Infrastructure?

Most people understand intuitively what infrastructure is. It is the roads, telephone lines, sewers, and similar large capital investments needed to keep towns and cities functioning. Usually, but not always, the size of these investments and the shared character of their benefits necessitates significant public involvement, both in terms of funding and setting standards for quality and access. In recent years, economists, urban planners, and others have gradually expanded the definition of infrastructure to include "softer" support areas such as education and health maintenance systems. While not "bricks and mortar," it is clear that these areas represent important public investments necessary to support a healthy economy and functioning communities. They are human and institutional capital investments, rather than investments in physical capital.

Most people have a more difficult time defining what *technology infrastructure* is, and it is not readily apparent why Native technology infrastructure is any different than other kinds of technology infrastructure. Technology infrastructure simply refers to those fundamental investments in physical, human, and institutional capital needed to support continued technological progress in our communities. Usually, this has been explained in terms of economic development. The most common example provided is investment in advanced telecommunications infrastructure, such as fiber optic cables and microwave relays needed to conduct modern business.

> *Technology infrastructure simply refers to those fundamental investments in physical, human, and institutional capital needed to support continued technological progress in our communities.*

However, technology infrastructure is much more than this. It includes investments necessary to upgrade the skills of workers to develop and use new technology as it becomes available. It also includes institutional changes needed to support technological advance. Examples include investments in systems for registering Internet addresses and the setting of standards for digital transmissions. Technology infrastructure is also not limited to purely economic applications. It can include cultural institutions, recreation, health and welfare, and any other aspect of daily life. An example would be the development and deployment of systems for digitally cataloging and displaying museum collections.

1-4. Why are Technology Infrastructure Needs Different in Native Communities?

Understanding what technology infrastructure is still does not tell us why technology infrastructure needs may be different in Native communities than elsewhere. There are at least two reasons why Native technology infrastructure may be different.

Poor state of existing infrastructure

First, the poor state of existing infrastructure in most Native communities means there is less of a foundation to build on than in other communities. A number of Native communities, for instance, have poor telephone service and low rates of telephone penetration. In such communities, continued technological progress requires either that telecommunications access is first improved, or that future technologies not be heavily dependent on existing systems.

Different technological needs

Second, Native communities may have different technological needs than other communities. Technology demands in urban areas for instance, may be very different than those in rural areas; and people in poor communities may have very different expectations of new technologies than individuals in wealthier areas.

Likewise, the technological demands of a community are partly determined by cultural factors. The experts contributing to this study steadfastly insisted that new technologies adopted in their communities should respect their languages, religions, oral traditions, methods of governance, and attitudes toward privacy and community.

Because the technology infrastructure needs in any community depend on its existing state of technology and technological goals, it is not surprising that there is tremendous variety in how different Native communities define technology infrastructure. In every interview we conducted, in our survey, and at the beginning of the Native Technology Infrastructure Summit, we asked Native contributors to the project to define"technology infrastructure." We received nearly as many responses as there were participants.

For some, technology infrastructure meant installing T1 lines; for others it meant modernizing basic utilities. Some Native respondents defined technology infrastructure in terms of specific outcomes such as, "connectivity within the community" and "interconnectivity to the rest of the world." Other contributors stressed the need for technology infrastructure to improve economic capacity and skills within the community.

Those tribes with active industrial enterprises and economic development strategies located in, or close to urban areas viewed technology infrastructure as gaining higher computer penetration levels in homes or businesses. Another technology infrastructure goal for these tribes was to integrate Internet capabilities into tribal planning models. This included building a Native skill base to develop and apply geographical information system (GIS) planning.

Alternatively, for other tribes in rural communities encompassing large land areas, technology infrastructure meant getting basic utilities such as electricity and plumbing into homes. For the Alaska Native communities and villages, establishing road access, availability of health care through telemedicine mechanisms and bridging distance and time gaps to take advantage of education programs through the Internet were major definers of technology infrastructure. These Alaskan villages, many of which are geographically isolated, viewed technology infrastructure as a means to close space, time and expertise gaps.

Clearly, the way that tribes define technology infrastructure, the specific barriers to development they face, as well as the technologies and economic development strategies appropriate to their situation vary significantly from one community to another. Therefore, in discussing the challenges and barriers to technology infrastructure development, it is important to

> *Technology infrastructure should provide the framework that facilitates effective resource management while supporting a tribe's specific cultural preservation, education, economic development and community health goals.*
>
> *Respondent to the project survey*

> *There exists no single technology solution or strategy equally applicable for every American Indian and Alaska Native community.*

remember that there exists no single technology solution or strategy equally applicable for every American Indian and Alaska Native community.

1-5.   Elements of the Project Plan

Prior studies have identified a series of barriers that inhibit technology infrastructure development in Native communities including: 1) the prohibitive costs of building the technology infrastructure; 2) the lack of training on how to use the technologies; 3) attaining the education on how, and what to select as the technologies to meet specific tribal development needs; 4) federal law/policy which makes it difficult for Native communities to access funding and programs; 5) right-of-way issues; and 6) tribal, state and federal approval processes [1, 6, 8, 10]. Our research builds on these earlier studies, but goes further by highlighting current programs and initiatives, and proposing new solutions directed to overcome technology infrastructure gaps between Native and non-Native communities.

The NMSU research team employed a number of different methodologies to assess the current state of technology infrastructure in Native communities and generate solutions for the identified technology gaps. These methodologies included:

- Convening a panel of 17 national experts at a Native Technology Infrastructure Summit. These individuals represented a range of expertise in Native technology infrastructure areas including telecommunications, utilities, medical/health, education/training and economic development. The names of these experts are found in Appendix B.

- Conducting a series of expert interviews and focus group interviews with:

  - telecommunication technology managers, tribal planners, tribal utilities managers, economic development planners and Native technology transfer managers from the Department of Energy National Laboratories;

  - tribal representatives and consultants attending Native American related Federal Communications Commission, (FCC) hearings and technology infrastructure conferences; and

- representatives from the Departments of the Interior (DOI), Commerce and Agriculture as well as Native owned and operated computer networking firms and financial institutions funding Native infrastructure projects.

- Completing a literature search and background study of technology infrastructure studies undertaken to date involving Native communities.

- Conducting a national technology infrastructure survey of all federally recognized tribes allowing each tribe to offer input on the issues of technology gaps, challenges and technology implementation barriers in their communities.

- Creating a website documenting the progress, findings and various resources related to this project. A great deal of expanded information pertaining to the expert contributions, tribal databases and survey results is found at the website. The project website is: *http://alpha.nmsu.edu/~tech* and the project e-mail address is: tech@alpha.nmsu.edu. At the conclusion of the project funded by EDA, responsibility for maintaining and supporting the Website was assumed by New Mexico State University. A sitemap of the Website is included as Appendix D.

- Compiling the final report in electronic and paper form summarizing the background literature, input from the panel of experts, and recommendations for strategic alternatives serving to close the technology gaps in Native communities. This report is also available in PDF file format at the website.

1-6.   Scope of the Project

As defined in the President's directive, the scope of this project involves the approximately 740,000 American Indians, Eskimos and Aleuts of Alaska, (collectively called Native Americans) living in Native communities. Native communities are those areas classified as: 1) reservation or trust areas; 2) Tribal Jurisdiction Statistical Areas; 3) Tribal Designated Statistical Areas; and 4) Alaska Native Village Statistical Areas.

1-7.   Plan for the Report

As a first step to finding solutions, Chapter 2 of this report presents the current state of technology infrastructure in Native communities. Chapter 3 discusses the barriers and challenges to

technology infrastructure development. Finally, Chapter 4 proposes solutions in the form of policy reforms, changes to federal laws or regulations, private/public partnerships, and new or expanded funding initiatives.

THE CURRENT STATE OF TECHNOLOGY INFRASTRUCTURE IN NATIVE COMMUNITIES
●●●●●●

2-1.   Where Are We Now?

Before we can assess the technology infrastructure needs of Native Americans or make suggestions for improving federal policy or private investment strategies, it is necessary to present a picture of where we are today. In this chapter, we describe the existing state of technology infrastructure in Native communities and discuss how this state is affected by geographic, demographic, and economic factors.

One of the greatest challenges in assessing the state of technology infrastructure in Native communities is the lack of current, statistically valid data. The last comprehensive survey of infrastructure reported across the total population of Native Americans and Alaska Natives was the 1990 Census. Although the Bureau of the Census has conducted updates of housing using "the American Housing Survey" since 1990, the sample size for Native Americans is too small to be statistically valid. Consequently, the American Housing Survey includes Native Americans in the aggregated group called "other minority" [24]. In addition, the Census relies on a process of self-identification as "Native American" and generally reports statistics on the basis of the total Native American population in contrast to Native Americans living in Native communities.

Other agencies such as the National Telecommunication and Information Administration (NTIA), the FCC, Bureau of Indian Affairs (BIA), Department of Health and Human Services (HHS) and Department of Housing and Urban Development (HUD) have also explored infrastructure in Native communities using surveys, case studies, formal hearings and expert interviews [3, 10, 13, 14, 25]. In particular, the Commerce Department's NTIA has worked to bring Native issues to the attention of key policymakers as part of its work on universal service policies to assist low income and rural areas. In

addition, through its *Falling Through the Net* reports, NTIA has examined the "digital divide" among America's households. However, all of the various agency studies have typically have focused on smaller subsets of the Native population living in certain regions or participating in selected programs.

To get a more comprehensive and updated picture of the current state of Native technology infrastructure, we have complemented the 1990 Census data with our own survey conducted for this project. This survey was mailed to approximately 550 federally recognized tribes with follow-up phone calls made to tribes in targeted subgroups to assure representation from all types of Native communities.

Because of the short duration of this project, surveys were still being received from tribes as the final report went to press. Nonetheless, the survey results presented in this chapter are based on responses that are representative of the population of all contacted tribes. Forty-eight tribal responses are included in this analysis representing 289,400 of the 740,000, or approximately 40% of all Native Americans living in Native communities. Appendix A presents a detailed discussion of the survey methodology, response rate, and a copy of the survey instrument. The project website provides periodic updates of the survey analysis as addition tribal responses are added to the database.

2-2. The Demand for Technology Infrastructure in Native Communities

According to the 1990 Census, there were about two million Native Americans, (American Indians and Alaska Natives), living in the United States. Table 2.1 lists the ten most populous tribes in the U.S. These tribes account for a little more than half of the total population of American Indians and includes individuals living in both Native and non-Native communities. Consistent with the Presidential directive that motivated this study, we have focused on those 38% of Native Americans that live in designated Native communities. The breakdown of Native community type and the percentage of Native Americans living in these communities is presented in Table 2.2.

Reservations and trust lands constitute the largest category of Native communities. Table 2.3 lists the ten most populous reservations in the United States. Note that the Navajo

TABLE 2.1: Ten Most Populous American Indian Tribes

Tribe	Number
Cherokee	308,000
Navajo	219,000
Chippewa	104,000
Sioux	103,000
Choctaw	82,000
Pueblo Indians	53,000
Apache	50,000
Iroquois	49,000
Lumbee	48,000
Creek	44,000

Source: Adapted from Paisano, et al. [5], Figure 2.

TABLE 2.2: Native American Communities

Type of Area	Population	Percent
Reservation and Trust Lands	437,431	22.3%
Tribal Jurisdiction Statistical Areas	200,789	10.2%
Tribal Designated Statistical Areas	53,644	2.7%
Alaska Native Village Statistical Areas	47,244	2.4%
Other Non-Native Communities	1,220,126	62.3%

Source: Adapted from Paisano, et al. [5], Figure 11.

Reservation is an order of magnitude larger than the next largest reservation, Pine Ridge. American Indians living on the Navajo Reservation constitute approximately 34% of all Indians living on reservation or trust lands and 20% of all Indians living in Native communities. Therefore, the effect of the Navajo population on weighted aggregate statistics, (such as the Census), is dramatic.

In addition to reservations and trust lands, approximately 254,000 Native Americans live in Native non-reservation communities consisting of Tribal Jurisdiction Statistical Areas and Tribal Designated Statistical Areas.

TABLE 2.3: Population of the Ten Largest Reservation or Trust Lands Native Communities

American Indian Reservations and Trust Lands	Native Population	% of all Native Population Living on Reservation or Trust Lands
Navajo Reservation and Trust Lands - Arizona, New Mexico, Utah	143,405	32.8%
Pine Ridge - Nebraska, South Dakota	11,182	2.6%
Fort Apache - Arizona	9,825	2.2%
Gila River - Arizona	9,116	2.1%
Papago - Arizona	8,480	1.9%
Rosebud - South Dakota	8,043	1.8%
San Carlos - Arizona	7,110	1.6%
Zuni Pueblo - Arizona, New Mexico	7,073	1.7%
Hopi - Arizona	7,061	1.6%
Blackfeet - Montana	7,025	1.6%
Total of the Ten Largest Reservation or Trust Lands	218,320	50%

Source: Adapted from U.S Bureau of the Census [16].

Most of the remaining residents of Native communities live in Alaska Native Regional Corporations. Table 2.4 lists the ten most populous Alaska Native Regional Corporations. About half of these Regional Corporations have populations comparable to the top ten reservations, although none are anywhere near as large as the Navajo Reservation. The Regional Corporations are often spread over great distances and vary in the degree to which each forms a cohesive community.

Clearly, Native Americans are distributed widely in terms of community type and geographical location (even acknowledging the large Navajo population). It is important to keep this diversity in mind when characterizing Native technology infrastructure needs.

Native communities are overwhelmingly rural. For the 48 tribes responding to our survey, the average community size is just over 6,000 individuals and ranges from very small Alaskan villages to the Navajo Nation. The great distances and rugged terrain of these communities often pose a significant challenge

Chapter 2: The Current State of Technology Infrastructure in Native Communities

TABLE 2.4: Alaska Native Regional Corporations

Regional Corporation	Population
Cook Inlet	18,600
Calista	16,800
Sealaska	11,600
Doyon	10,800
Bering Straits	6,150
NANA	5,200
Bristol Bay	4,640
Arctic Slope	4,340
Koniag	2,130
Aleut	2,120

Source: Adapted from Paisano, et al. [5].

when laying transmission lines, roads, and similar infrastructure networks. The small populations of these communities often makes them unattractive markets for private utilities.

Population Trends

Native Americans are also one of the fastest growing population groups in the U.S. Between April 1, 1990 and July 1, 1998, the U.S. resident population grew by 8.7%, while the American Indian and Alaska Native resident population grew by 14.3% [15]. By 2009, the American Indian and Alaska Native population is expected to reach 2.6 million, more than a third higher than in 1990. Driven by this population growth, the number of Native American households is projected to be 890,000 in 2009, an increase of 150,000 over today's figure [11]. This rapid population growth and new household formation is a major concern for infrastructure planning, and several of the experts interviewed for this project noted that funding of Native American infrastructure has failed to keep pace with this growth.

Further compounding the infrastructure needs of Native Americans, especially with regard to schools, education, and training, is the age distribution. Overall, the Native American population is young. As of July 1, 1998, approximately 38% of

the American Indian, Eskimo, and Aluet resident population was under the age of 20, compared to 28.7% for the U.S. resident population [9].

As a group, Native Americans also tend to be economically distressed. Moreover, the impoverished state of these communities has not improved dramatically in recent years. While the growing popularity of gaming operations among tribes has drawn considerable public attention, gaming has not been a major force in economic development for Native Americans overall [7]. Our experts identified fewer than a dozen Native communities where gaming has had major economic benefits.

The Economy

Unemployment rates among Native Americans remain among the highest in the nation. For the communities in our survey, reported unemployment rates averaged 42% and reported per capita income averaged $10,296.[*] By contrast, the most recent government data available shows that the U.S. national unemployment rate was only 4.5% in 1998 and average income was approximately $24,000 in 1996 [26, 28]. According to the 1990 Census, the poverty rate for Native Americans was 31% compared to 13% for all Americans [27]

Consistent with the depressed economic state of most Native communities, educational attainment is typically very low. According to our survey, just 47% of Native Americans living in the responding communities graduated high school.[†] For 1997, the comparable national average was over 82% [17, 18]. As shown in Table 2.5, the number of Native Americans pursuing college degrees at all levels has steadily increased, however during 1996, fewer than one percent of Native Americans received bachelor degrees.

---

*.   Per capita income weighted by population. Due to the significant influence of the Navajo tribe, this figure is much lower than a similar unweighted figure. However, even without allowing for the dominance of the Navajo community, the average income of $14,022 is still extremely low.

†.   Weighted by population.

TABLE 2.5: College Enrollment, American Indians by Selected Characteristics: 1980 to 1996 (in thousands)

Year/Characteristic	1980	1990	1996, est.
Male	37.8	47.6	55.7
Female	46.1	66.1	78.2
Public Institution	74.2	100.2	116.3
Private Institution	9.7	13.6	17.7
American Indian Total	83.9	113.7	134.0

Source: U.S. Bureau of the Census, adapted from [27].

2-1. The Supply of Technology Infrastructure in Native Communities

For the purposes of our study we divide technology infrastructure into two main categories: basic and advanced. Basic technology infrastructure includes those services that are considered essential for everyday economic activities and to maintain an average standard of living. This includes telephones, roads, water and sewer systems, basic educational facilities and the like. Advanced technology infrastructure includes services that might be considered optional or unnecessary for conducting business and living comfortably by a significant segment of the population.

Figure 2.1 presents a model for analyzing and understanding the state of progression from basic to advanced technology infrastructure in Native communities.

We should note that while there is a progression from basic to advanced, this hierarchy is neither absolute nor strictly linear. In most cases, Native communities should have basic technology infrastructure in place before moving to advanced technology infrastructure. At the same time, some Native communities pursue advanced technologies precisely because they can help offset weaknesses in basic infrastructure. As an example, many Alaskan villages wish to invest in advanced telecommunications infrastructure to compensate for poor road networks. Their hope is that Internet connections will allow the communities to send their children to school, train their workers, have access to good doctors, and join in cultural exchanges.

	Basic Infrastructure	Advanced Infrastructure
Communications (Video)	Television	Cable television, satellite television, Internet
Communications (Audio)	Telephones	Cellular telephones, digital telephones, geographical information systems, Internet
Education	Community, local schools, home schooling	Distance learning, virtual classrooms
Health	Community based clinics	Telemedicine, teleexamining rooms
Energy	Electricity, gas, oil	Solar, fuel cells
Shelter	Traditional housing, mobile, manufactured houses	"Smart" houses

FIGURE 2.1: Hierarchical Model of Technology Infrastructure in Native Communities

The exact division between basic and advanced technology infrastructure is imprecise. Nonetheless, we make the distinction for two reasons. First, Native communities cannot be expected to develop advanced technologies if their basic technology infrastructure is vastly inferior. Second, the issues, processes, and systems associated with developing basic and advanced technology infrastructure are quite different.

As an example, installing telephones in Native communities is primarily an issue of funding, whereas installing advanced telecommunications requires a substantial leap in the level of economic activity and skills in the community to support the infrastructure.

Telephones

By any conventional measure, Native communities lag far behind the rest of the country in basic technology infrastructure. The most frequently-cited measure of this is telephone penetration rates. According to the 1990 Census of Population, just 53% of Native households on reservation and trust lands had telephones [21], compared to the current rate of 94% for all American homes. Table 2.6 shows the telephone penetration rates for the ten "least connected" reservations.

For 1999, the average penetration rate for telephones in households across all tribes responding to the survey in rural areas is just 39%. Since approximately 20% of all Native

TABLE 2.6: Ten Lowest Telephone Penetration Rates for Reservations in 1990

Reservations and Trust Lands	Penetration Rate (Percent of Homes with a Telephone)
San Carlos Reservation, AZ	16.1%
Navajo Reservation and Trust Lands, AZ-NM-UT	18.4%
Gila River Reservation, AZ	22.2%
Mississippi Choctaw Reservation and Trust Lands, MS	33.6%
Fort Apache Reservation, AZ	35.5%
Northern Cheyenne Reservation and Trust Lands, MT-SD	39.0%
Pine Ridge Reservation and Trust Lands, NE-SD	41.4%
Mescalero Apache Reservation, NM	41.6%
Devils Lake Sioux Reservation, ND	42.6%
Standing Rock Reservation, ND-SD	43.2%
All reservations and trust lands	**53.4%**

Source: For reservations with 500 or more households: U.S. Bureau of the Census, adapted from [21].

Americans living in Native communities are living on the Navajo Reservation, these figures are heavily influenced by the low (22%) penetration rate on the Navajo Reservation. If the Navajo Reservation is removed from the calculations, the percentage of households in Native communities with telephones jumps to 71%. Table 2.7 shows the telephone penetration figures for tribes responding to the survey.

According to our survey, only 6% of tribes have their own

TABLE 2.7: Percentages of Homes, Businesses, Schools and Health Care Providers with Telephones

Basic Telephone	% Native American homes with Basic Telephone		% of Businesses with	% of Schools and Libraries with	% of Health Care with
	Areas with 2,500 pop. or more	Rural			
Responding Tribes excluding Navajo	68%	71%	96%	97%	92%
Responding Tribes including Navajo	41%	39%	96%	99%	99%

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

telephone exchange. We also found that average household telephone installation costs for responding tribes was $78. The typical household monthly service costs were $100 for telephone basic service and $126 for long distance service within the community. The average waiting time for service installation was 8.3 days.

As of 1990, the overwhelming majority of Native households received their water from off-site utilities. This is especially true for reservation lands located in the Western U.S., where households had the least complete plumbing and kitchen facilities. See Table 2.8. As of the 1990 Census, approximately 20% of all Native housing units on reservations lacked complete plumbing facilities.

Water and Sewer

Based on our survey, it is not totally clear how much conditions have improved by 1999 (because we did not ask exactly the same question as used in the Census). Overall, 88% of tribes reported that they had some water and sewer provision on their lands, with tribes being at least partial owners of two-thirds of these facilities. Virtually all schools and health care facilities, and 96% of businesses now have water supplied to them. However, approximately 40% of rural households still have inadequate water provision.

Table 2.9 summarizes sewerage data for reservations with the worst sewer systems in 1990. At that time, fewer than half of all Native households used public sewage treatment facilities, and approximately 18% of Native households disposed of their sewage by some means other than public sewer, septic tank or cesspool. Again, the Navajo Reservation had the least developed infrastructure, with 49% of all households lacking complete plumbing, 44% of households lacking complete kitchens, and 46% of households disposing of their sewage by other means.

From the survey conducted for this project as well as expert interviews conducted with tribal utilities managers, the 1999 numbers for the Navajo tribe were not much better than the 1990 numbers. However other tribes showed some real progress overall. By 1999, our survey respondents indicated that virtually all schools and medical facilities, and 86% of all businesses, had sewerage infrastructure.

TABLE 2.8: Reservation Recap - Plumbing and Equipment

	Water from public system or private company	Water from individual well	Water from some other source	Percent lacking complete kitchen facilities	Percent lacking complete plumbing facilities - total
Navajo Reservation and Trust Lands, AZ-NM-UT	64.2%	22.3%	13.4%	44.3%	49.1%
Hopi Reservation and Trust Lands, AZ	76.5%	7.7%	15.8%	30.6%	46.7%
Papago Reservation, AZ	77.6%	21.1%	1.3%	24.8%	32.0%
San Carlos Reservation, AZ	92.7%	2.0%	5.3%	16.6%	21.6%
Pine Ridge Reservation and Trust Lands, NE-SD	55.8%	39.6%	4.6%	18.2%	20.9%
Gila River Reservation, AZ	97.6%	2.4%	0.0%	15.2%	18.0%
Salt River Reservation, AZ	93.5%	2.9%	3.6%	13.3%	17.9%
Fort Apache Reservation, AZ	91.6%	2.2%	6.2%	13.1%	14.5%
Cattaraugus Reservation, NY	7.8%	80.1%	12.2%	9.6%	13.4%
Acoma Pueblo and Trust Lands, NM	88.0%	8.7%	3.3%	7.4%	12.5%
All reservations and trust lands	**70.3%**	**22.8%**	**7.0%**	**17.5%**	**20.2%**

Source: Adapted from U.S Bureau of the Census [14] and [20].

Electricity, Gas, and Other Basic Infrastructure

Electricity and gas (including oil and propane) are among the areas of most complete infrastructure development in Native communities. Virtually all tribes responding to our survey have gas and electricity available to schools, libraries, and health care facilities. However, tribes still report that in rural areas, 12% of Native households lack electricity and 23% lack gas. Only a quarter of the surveyed tribes generate their own electricity.

As part of our survey, we also asked tribes to report on areas not commonly covered by the Census and other data providers. While most tribes have some access to emergency medical transportation, 26% of the tribes have no 911 service. Surprisingly, 44% of tribes have no local commercial radio stations and for those tribes with radio stations, these stations are rarely tribally owned. Moreover, while commercial radio stations are rare, it's important to note that public radio and television stations are becoming more prevalent. Over the past

TABLE 2.9: Reservation Recap - Waste Water

	Disposing of sewage by public sewer	Disposing of sewage by septic tank or cesspool	Disposing of sewage by other means
Navajo Reservation and Trust Lands, AZ-NM-UT	36.4%	18.1%	45.5%
Hopi Reservation and Trust Lands, AZ	46.5%	10.5%	43.0%
Papago Reservation, AZ	36.0%	32.5%	31.5%
Pine Ridge Reservation and Trust Lands, NE-SD	55.8%	39.6%	21.2%
Salt River Reservation, AZ	19.0%	67.6%	13.4%
San Carlos Reservation, AZ	74.0%	12.7%	13.3%
Cattaraugus Reservation, NY	7.3%	81.0%	11.7%
Cheyenne River Reservation, SD	71.8%	17.3%	10.9%
Fort Apache Reservation, AZ	75.2%	14.5%	10.3%
Gila River Reservation, AZ	46.9%	43.8%	9.4%
All reservations and trust lands	**48.2%**	**33.4%**	**18.4%**

Source: Adapted from U.S Bureau of the Census [14].

TABLE 2.10: Percentage of Tribes with Various Infrastructure Services and Breakdown of Ownership

Community Services	Fully Owned by the Tribe	Partially Owned by the Tribe	Not Owned by the Tribe	No Service Available
Local newspaper	26%	2%	47%	26%
Broadcast radio	9%	0%	53%	38%
Emergency transport	25%	8%	63%	4%
911 service	15%	7%	52%	26%

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

two decades, NTIA's Public Telecommunications Facilities Program has helped to fund the creation of forty public radio and television facilities in Native communities throughout the country. Low power television and public radio, if funded adequately and managed properly, can play important roles in conveying public information, information on health subjects, economic development, distance learning and cultural

preservation. For example, KNBA-FM in Anchorage, which is controlled by Alaska Natives, is dedicated specifically to the education and information needs of their community.

Likewise, nearly a third of reservations report having no local newspaper, and newspapers which are available to the tribe are predominately non-tribally owned and distributed. Table 2.10 shows the percentage of tribes with various infrastructure services.

Summary for Basic Infrastructure

Finally, we asked tribes to give an assessment of their current basic technology infrastructure. The rating was on a scale of 1 to 5, as follows:

1. No infrastructure in place;

2. Poor infrastructure in place: bare minimum;

3. Fair infrastructure in place: adequate for most purposes;

4. Good infrastructure in place: adequate for all but the most extreme purposes;

5. Excellent infrastructure in place: could not be better.

The results are summarized in Table 2.11.

TABLE 2.11: Summary of Basic Infrastructure in Place for Tribes

Levels of Infrastructure in Place	Average of all respondents
Water	3.1
Roads	2.7
Electricity	3.6
Telephones	3.6
Waste water facilities	2.5
Law enforcement	2.5
Education/training	2.7
Medical/health	3.1

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

Note that no area of infrastructure was rated as "good." Electricity and telephones were rated the highest. This is especially interesting given the frequent importance that outside

analysts have placed on improving telephone penetration. Waste water facilities and law enforcement services were assessed as the most problematic forms of infrastructure, with roads and educational systems also being considered less than fair.

2-2. Advanced Technology Infrastructure

Advanced technology infrastructure includes equipment and services needed to pursue business and improve the quality of life using more sophisticated technology. What is included in this category depends in part on the existing technological status of the tribe and economic status of the region under study. For our purposes, advanced technology infrastructure includes cellular phone systems, cable and satellite TV services, distance learning and telemedicine facilities, Internet access, pagers, and even personal computers. For many Americans, some of these items are viewed as necessities. For most Native Americans however, they are still luxuries, or at least uncommon enough that they have not become a central requirement for conducting business.

The advanced nature of these forms of infrastructure is also suggested by the lack of reliable data for evaluating their penetration into Native communities. Most of these items were not covered in the 1990 Census, and while more recent surveys have been conducted by the Census Bureau and other researchers, these have rarely been targeted at Native communities.

As part of our survey, we asked respondents to indicate whether their tribe had access to cellular phone or pager service, as well as cable and satellite TV. As shown in Table 2.12, all of these services have made significant inroads in Native communities. In the vast majority of cases, tribes rely on outside service providers. Indeed, the only area where tribes appear to have any significant ownership presence is in cable TV.

Still, the fact that these services are available in a Native community does not mean they have a high penetration rate at the level of individual households and businesses. As part of our survey, we also asked tribes to estimate penetration rates for cable TV, personal computers, and Internet access. These results are shown in Table 2.13.

TABLE 2.12: Percentage of Tribes with Various Advanced Infrastructure Services and Breakdown of Ownership

Community Services	Fully Owned by the Tribe	Partially Owned by the Tribe	Not Owned by the Tribe	No Service Available
Cellular telephone service	0%	2%	71%	27%
Pager service	0%	0%	63%	37%
Cable television	13%	4%	62%	21%
Direct broadcast satellite television	2%	2%	79%	17%

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

TABLE 2.13: Percentages of Homes, Businesses, Schools, and Health Care Providers with Cable, Computers and Internet, Unweighted for Native American Community Size

Technology	% of Native American homes		% of Businesses with	% of Schools and Libraries with	% of Health Care with
	Areas with 2,500 pop. or more	Rural			
Cable television	50%	34%	24%	46%	29%
Computer	15%	14%	73%	90%	88%
Internet access	10%	8%	43%	82%	62%

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

In general, cable TV, personal computers, and Internet service have made only minimal penetration into Native households, especially in those rural areas where most Native Americans live. While approximately half of Native businesses have both computers and Internet access, we need to remember that there are relatively few Native businesses. The majority of access to all three forms of infrastructure appears to be via institutional facilities such as schools, libraries, and health clinics. Surprisingly, nearly 90% of Native schools and libraries have both computers and Internet access. While we do not know the actual state of the equipment and services in place, we believe that the high level of connectivity in these institutions can be attributed to, in part, the Clinton Administration's policy of connecting all classrooms, libraries, and health clinics to the Internet by the year 2000, and the eligibility of BIA schools to participate in the E-Rate Program created by the Telecommunications Act of 1996.

When asked to rate reservation-wide Internet infrastructure quality on a scale of 1 to 5 where 1 meant no infrastructure in place at all and 5 meant excellent infrastructure in place, survey respondents rated it at 2.3, which is just above "poor, the bare minimum." On a scale of 1 to 5, the quality of distance learning facilities was rated at 2.2, again barely passable.

It is difficult to speak of "economic development infrastructure" as a unique category of investment. After all, all types of infrastructure contribute to economic development. Nonetheless, there are certain broad-based contributors to technologically sophisticated economic development that are not easily captured in discussions of other infrastructure types. First, economic development depends in large part on the stock and quality of private capital in place. Second, economic development can be assisted by careful planning to develop strategies for overcoming economic weaknesses and exploiting economic strengths of the community. These planning activities are especially important in technology-led economic development, where large fixed investments and long-term commitment are needed.

Economic Development Capacity

By nearly any measure, Native communities today lack the resources and capacity they need to promote economic development. In terms of private capital, very few tribal communities have any form of manufacturing. According to our own survey, fully 61% of tribes report not having a single manufacturing facility in their community. Of those tribes that do have manufacturing, 44% of these facilities are tribally owned, in whole or in part.

Likewise, our survey indicates that just 65% of tribes have any type of resident construction company. Only 39% of tribes have any sort of industrial park. Of these, nearly two-thirds are tribally owned, in whole or in part. On a scale of 1 to 5, where 1 means no infrastructure in place and 5 means infrastructure fully in place, our survey respondents ranked the quality of industrial parks as 1.6. This is by far, the lowest ranking our survey respondents gave any form of infrastructure—falling below the bare minimum (a ranking of 2).

Equally disturbing, the majority of Native communities responding to our survey have no plan on how to proceed. As shown in Table 2.14, only 42% of tribes have a land use plan. Economic development and strategic planning is even less

common, and several experts told us that their plans were severely out of date. Even more dramatic was the number of tribes without telecommunications, technology infrastructure, and training plans. All of these plans are essential for making investments in advanced technology infrastructure.

TABLE 2.14: Plans and Programs in Place

Does your tribe have any of the following plans or programs in place?	% responding yes	% responding no
Technology infrastructure plan	17%	83%
Telecommunications plan	17%	83%
Strategic plan	35%	65%
Economic development plan	44%	56%
Technology training plan	13%	87%
Land use plan	42%	58%

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

A number of tribal representatives indicated during the expert interviews that there was a fundamental inability on the part of some tribes to attract economic development projects. Many of the experts interviewed expressed frustration that more funding, tax incentive, and partnership programs are not available to help tribes attract economic activity to their communities. However, the lack of strategic planning in place raises serious questions about the ability of tribes to utilize such assistance effectively if it was offered.

Today, it is not even clear what tribal priorities are regarding technology infrastructure investments. Do tribes, for instance, believe they should seek parity in basic technology infrastructure first? Or, alternatively, do they see investment in advanced telecommunications infrastructure as a way of overcoming weaknesses in other types of infrastructure such as roads and basic telephone? As a first step toward answering such questions, we asked tribal managers to rank their investment priorities for us. Specifically, we asked them, "If you had $1 million dollars to spend on infrastructure development for your tribe, how and where would you allocate

the money?" Table 2.15 summarizes their responses. We have averaged their responses to arrive at a single investment figure across the responding tribes. Each row in the table indicates the share of a hypothetical $1 million budget these survey respondents would allocate to each type of infrastructure.

TABLE 2.15: Allocation of One Million Dollars on Tribal Infrastructure

Ranking	Infrastructure Area	Allocation in Dollars
1	Housing	$185,903
2	Roads	$120,447
3	Waste water technology	$103,591
4	Medical health facilities	$102,227
5	Education	$96,175
6	Water	$87,786
7	Other	$66,959
8	Internet	$54,480
9	Law enforcement	$52,474
10	Distance learning	$40,529
11	Utilities	$33,602
12	Electricity	$32,166
13	911 Services	$15,529
14	Telephones	$8,131
	Total	$1,000,000

Source: Source: New Mexico State University Survey, 1999. Based on 48 responses.

The message from this table is unmistakable. The survey respondents place overwhelming priority on meeting basic needs for shelter, sewage disposal, and transportation before they invest in advanced technology infrastructure. Still, individual tribes have different priorities based on the state of their existing infrastructure and goals. Certainly, our survey results do not substitute for real planning.

Another interpretation of this table is that categories may also include technology-based spending; for instance, health and medicine probably includes some spending for telemedicine. The fact that tribes want better basic technology infrastructure also does not mean they want parity with non-Native areas. An indicator of this is their attitude toward telephones and 911 service. While somewhat absent on tribal lands, these are still viewed as low priorities compared to other needs. Still, the basic conclusion is clear; repeatedly, experts told us that they believed this basic infrastructure had to be in place before significant economic development investments could be undertaken.

CHALLENGES AND BARRIERS TO TECHNOLOGY INFRASTRUCTURE DEVELOPMENT IN NATIVE COMMUNITIES

●●●●●●

3-1. Common Challenges Faced by Native Communities

Today's Native communities are extremely diverse and are located in a variety of geographical settings. As a result, they have widely varying levels of technology infrastructure and face diverse challenges to upgrading that infrastructure. Yet nearly all of these Native communities face one or more of the following challenges in developing their technological infrastructure:

- Lack of a strong economic base that inhibits private investment and skills development;
- Geographical remoteness and terrain which raises the cost of providing technology infrastructure;
- Native distrust of new technologies and federal assistance;
- Lack of a comprehensive, integrated, interagency Native American technology infrastructure investment strategy;
- Federal policy that fails to consider the severity of the technology gap faced by Native American;
- Inadequate information on the part of Native Americans regarding opportunities and assistance available; and
- Insufficient strategic planning by tribes.

Let's consider each of these in more detail.

Lack of a Strong Economic Base

Without question, the greatest obstacle that most tribes face to developing technology infrastructure is that they start from a severely disadvantaged economic position. Very few tribes have strong local industry or service sectors developed through tribal or private investment initiatives. While some tribes have access to gaming revenues, they are the distinct minority, and only a handful of these are successful enough to fund serious economic development activities. For most Native communities, a weak

●
●
●
●

economic base and poor infrastructure are mutually reinforcing. Without good jobs, Native Americans generate neither the income nor the taxes needed to build and maintain modern technology infrastructure. Conversely, the poor state of infrastructure makes it extremely difficult to establish new economic activities that create jobs.

The pervasive nature of this problem is exemplified by the low telephone penetration rates seen in many Native communities. We reported in Chapter 2 for instance, that just 22% of Navajo households have telephones, (according to the research undertaken for this project.) Navajo utility experts assure us that many more households have access to phone lines than is suggested by this figure. The issue is affordability, especially when considering the high connection charges to receive first service. Even where telephones are available, many low-income families simply cannot afford to maintain their service. On the Navajo reservation, where individuals earn an average income of just $6,352 per year, 35% of new telephone connections are eventually disconnected.

Given the difficulties they have generating new capital, many Native communities badly need federal assistance and private investment to break free from this vicious circle of poverty and poor infrastructure. In our survey results, inadequate funding was the single most frequently listed barrier to technology infrastructure development. Lack of funding was identified by 75% of respondents as one of their three top infrastructure concerns.

In several instances, Native contributors to our research expressed the opinion that the federal government provides costly aid packages to foreign governments while neglecting investment on Native lands. Several of our experts also noted that existing funding formulas have failed to account for rapid population growth on Native lands. Consequently, programs designed to expand infrastructure on tribal lands have actually lost ground. For many tribes, funding intended for upgrading and extending existing infrastructure has been insufficient even to maintain utility systems that are severely past their useful life. This is especially the case for waste water, sewage, and waste disposal systems.

> *"Nonpayment of fees is a major issue that Navajo Communication Company faces. This is particularly the case for long distance charges. Approximately fifty percent unemployment exists on the Navajo Reservation. Therefore the question of having a phone or not is an issue of luxury versus necessity."*
>
> *Desmond Jones*
> *Central Office Engineer*
> *Navajo Communications Company*

At the same time this lack of capital makes it difficult for tribes to invest in their own infrastructure, the weak state of their economies makes Native communities poor locations and markets for private firms. External private telephone companies, manufacturing entities, and service establishments have all tended to avoid investing in Native communities relative to other, more profitable, markets. Commercial companies argue that doing business on the reservation requires charging higher rates to reflect the risk and cost of operating in more remote and economically distressed locations.

In addition to the immediate effects of underemployment, the generally low level of commercial activity in tribal communities undermines skills development necessary for technological progress. Many tribes have a strong desire to own and operate commercial enterprises; however in many cases they lack the necessary technical expertise, training, and education to undertake this effort.

For individuals wishing to remain on tribal lands, the lack of economic opportunity creates a disincentive to receive an education. For those tribal members that do pursue high school and college studies, it is usually a major economic sacrifice to return to, or remain on tribal lands once trained. Our survey results show that, of the responding tribes, only 47% of their members had finished high school. Several tribal technology managers we interviewed believed they could not hire new specialists because the pay levels necessary to attract these individuals were higher than the salaries earned by tribal leaders.

The result is that Native communities have a tremendous shortage of skilled workers in those occupations central to planning, installing, and maintaining technologically sophisticated infrastructure. Even when such workers are present, Native communities usually lack diversity in their skills base. This shortage of a skilled and diversified workforce also creates an economic leakage from Native communities, since tribes must hire outside expertise. Many of our Native experts expressed frustration at continually having to rely on non-Native consultants and contractors.

Geographic Remoteness

In many cases, the weak economic base of Native communities is exacerbated by their remote location. In fact, geographical remoteness can be both an incentive and a barrier to technology

infrastructure development. On the one hand, technology infrastructure can be a critical tool to overcoming the isolation and economic disadvantages imposed by remote locations. At the same time, it can be extremely expensive to provide services to remote locations. Not only is it expensive to lay roads, pipes, and cables across remote areas, but it often requires an extensive efforts to acquire rights-of-way. These costs can be especially severe where tribal lands are discontiguous. Tribes also find that neighboring counties often fail to provide public infrastructure in areas adjoining their lands. Consequently, even if a tribe is successful at developing its own infrastructure, connecting to the rest of the world can be challenging.

Another impediment to providing telecommunications services is the rugged terrain of many Native lands. Regardless of the technology deployed, the very nature of the terrain, (and in the case of Alaska, climate), in these unserved areas makes construction and maintenance of facilities costly and difficult.

As with other communities, Native Americans often disagree regarding the benefits and risks of new technologies. In several cases, the technology experts contributing to our study believed that their tribal leaders have failed to recognize the full benefits of adopting new technologies. However, these experts also agreed that new technologies often raise very real and difficult cultural issues unique to tribes. For instance, electronic communication based on writing may undermine cultural values based in an oral tradition. Similarly, many people interviewed believed that widespread public access to Native languages, religion, and art over the Internet poses a threat to the integrity of cultural intellectual property.

This also has a very real economic component. In recent years, for instance, it has become increasingly common to see fraudulent Indian art appearing on the Internet, a problem of great concern to our experts. To date, there are few government programs designed to develop culturally sensitive educational curricula or protect Native intellectual property rights.

This apprehension regarding new technology is often complicated by the distrust some Native Americans have for the federal government and private assistance providers. As a result, tribes often discount the value of externally provided information about new technologies.

> *"There are few roads on the Navajo Reservation. There is really no source of funding for the roads since the tribe does not have the funding mechanisms for roads. And because of the non-tax status of the Indian reservation, there are also no funds available for public works."*
>
> *Rex Kontz, Acting Manager, Engineering and Technical Services Navajo Tribal Utilities Authority*

Distrust of New Technologies and Federal Assistance

Similarly, our experts expressed concern that tribes have repeatedly been taken advantage of by outsiders. One expert, for instance, complained that a local telecommunications equipment representative tended to sell his tribe whatever equipment was in inventory with little regard for the tribe's unique needs. Other experts suggested that while negotiations were ongoing with a telecommunications provider, the provider was extremely attentive to the tribe's needs. However, once the contract was signed, the provider would not respond to tribal requests for assistance and T-1 line orders. We have not completely investigated these or other specific cases reported to us, so it is possible there is some reasonable explanation in these instances. Frankly, this is less important than the fact that such stories continue to document tremendous frustration by Native Americans in their dealings with non-Native businesses.

Lack of a Comprehensive, Integrated, Interagency, Native American Investment Strategy

With the absence of a comprehensive and integrated interagency strategy, the full potential of tribal technology infrastructure development is not realized. At times, this results in missed opportunities to achieve greater efficiency. To be sure, this has started to change in the 1990s, and there is greater coordination among agencies today than even a few years ago. Still, the Native experts participating in our study raised several specific examples where further integration is needed.

For example, USDA's Rural Development Programs, (RUS), BIA, and EDA all fund economic development projects on tribal lands. Each program however, has a slightly different focus, regulations, application process, and eligibility requirements. If these programs were coordinated with a single referral point and a single integrated federal strategy, synergistic benefits from both a financial and economic perspective might be realized. A similar example is provided by federal policy toward investing in Native Internet access. The IHS, BIA, RUS, Department of Education, NASA, DOD and indirectly the FCC through the E-Rate program, are all funding "connectivity" for tribes, but with limited interagency coordination. However, the FCC currently is in the process of gathering data and developing strategies to improve coordination.

In some cases, the lack of federal policy coordination is manifested as inconsistencies or redundancies related to program requirements. To give an example, several experts noted that both the Indian Health Service (IHS) and the BIA require separate Y2K compliance reports even though much of

the same information is included in each report, albeit in different formats. This problem is not unique to Native communities. However, the burden Native communities bear is greater because of their limited resources.

In other cases, poor coordination of investment is manifested as gaps in program coverage. For example, the national laboratories and the Small Business Administration (SBA), have a variety of collaborative services to assist in business infrastructure development and technology transfer. However, the labs cannot normally provide these same services to tribes because they are considered a form of government and not a small business. Consequently, even though tribal governments are typically one of the most important economic entities in Native communities, they are ineligible for this innovative program.

There are some signs this may be changing. Recently, both Sandia and Los Alamos National Laboratories have obtained special help from the SBA in designating tribally owned enterprises as small businesses to make them eligible for assistance. This has allowed Laguna Industries (of the Laguna Pueblo) to receive technical and business consulting assistance needed to complete a defense contract worth millions of dollars of revenue to the tribe. A similar reclassification of tribal enterprises allowed the Northern Pueblos of New Mexico to receive technical assistance to set up an advanced telecommunications and Internet system. Unfortunately, these success stories remain exceptions to the rule, and obtaining special redesignation for each tribal unit is a complicated and time-consuming process.

Too often, federal policies intended to help Native Americans develop their technology infrastructure have failed to understand the severity of the technology gap they face. Some federal agencies, for instance, now require electronic submission of grant and funding applications (e.g., the National Science Foundation). This effectively excludes tribes with poor, or non-existent Internet access. Even when paper submission of forms is still allowed, some tribes believe that federal agencies give preference to those application forms submitted electronically.

Federal Policy that Fails to Consider the Severity of Native American Technology Gaps

The same problem results when federal or private investment programs require that tribes have basic levels of infrastructure in place to be eligible to compete for a program. For example, to qualify for Universal Service Funds, applicants must have 911 service. However, as we saw from our earlier survey results, many tribes do not have 911 service. Although the FCC is willing to consider exceptions to this requirement, no tribe knew of this policy. And even before 911 service can be instituted, rural addressing systems and road access must be available to facilitate this service. For some tribes, these basic levels of infrastructure are still not developed.

Inadequate Information

In numerous instances, we found that Native Americans were unaware of programs and policies designed to help them. In some cases, this results from the fact that these policies are subject to frequent change. Nearly always, this lack of information was symptomatic of the technology infrastructure gaps these communities face. To give an obvious example, the majority of public and private assistance providers today are shifting their information dissemination activities to the World Wide Web. In principle, this has a tremendous potential to increase and speed the dissemination of important information to tribes, many of which have slow mail delivery service. However, in the absence of good Internet access in Native communities, this policy may systematically place Native Americans at an information disadvantage. This highlights the importance of providing meaningful community access to the Internet at schools, libraries, rural health facilities and federal offices.

Lack of Planning

Developing effective technology infrastructure requires planning. As documented in Chapter 2, very few tribes have strategic plans, economic development plans, or technology plans in place. The Native experts assisting in our study repeatedly identified inadequate tribal strategic planning as a barrier to technology infrastructure development, describing in detail how their communities have neither the skills nor systems in place to undertake such planning efforts

They also argued there are few sources of funding to hire new people or to acquire computers, geographical information systems software, and other resources that non-Native communities take for granted. As one expert explained, planners in his tribal office work almost exclusively preparing grant applications--not planning.

Typically, many federal assistance programs depend on the performance of the applicant to ensure the success of a proposed economic development project. For example, EDA may fund an infrastructure project such as an industrial park on the basis of an economic strategic plan. Once the project is built, however, it is the applicant that must plan and take the steps necessary to assure success for the project. Because of the nature of federal programs and funding, mixing infrastructure development funds with planning or assessment funds is uncommon. Equally distressing, when informed that the EDA has programs in place to fund strategic planning, none of our experts were aware that such programs existed, even though several of their communities had received various types of EDA funding in the past. In large part, this may stem from the fact that EDA's planning program funds are severely limited and consequently EDA cannot realistically expect to fund new applicants. However, the current trend is for new grant applications to contain some requirement for performance measures. In addition, the federal government currently has a few on-going demonstration projects with Native communities that require feasibility assessments, coupled with intensive technical assistance.

> *"The people of the tribe need training on developing local area networks, building Web pages and other technologies. Currently, the tribe pays for outside computer consultants to provide such services. In addition, there's a very strong need to be able to use GIS software for planning purposes. The BIA provides GIS databases but there is no local expertise to use this service"*
>
> ***Bernadine Garcia***
> ***Tribal Planner***
> ***Acoma Pueblo***

3-2. Obstacles to Specific Types of Technology Infrastructure

To a greater or lesser degree, the barriers described previously apply across the board to many different kinds of technology infrastructure. In most cases, tribes face a number of these barriers and their effect on investment in traditional infrastructure such as roads, water, and electricity is fairly straightforward. Understanding these barriers helps us to understand why Native communities tend to lag so far behind other communities with respect to infrastructure development.

Unfortunately, as we enter a new economic era requiring more advanced types of infrastructure, the economic position of Native communities is likely to erode further without dramatic federal, private and tribal action. First of all, advanced telecommunications-oriented infrastructure relies on traditional infrastructure to be effective. Quite simply, the ability to deploy these modern systems depends critically on good roads, structures, and educational and training facilities. Second, these

newer systems impose their own challenges and barriers that are likely to compound the problems faced by all distressed communities, and Native communities in particular. Let us now consider several specific categories of advanced technology infrastructure.

3-3. Obstacles to Telecommunications

Modern telecommunication services have the potential to help Native communities by freeing them from geographic isolation; opening up new overseas markets by means of E-commerce; providing access to Native cultural resources held elsewhere; and by allowing Native communities throughout the U.S. to share their experiences in using different economic development strategies. However, some tribes today have only the most rudimentary telecommunications infrastructure. More importantly, these Native communities are falling further behind. While utility companies in communities across the U.S. are installing fiber optic cable at a frantic rate, some Native communities continue to struggle to get basic telephone access.

This point is clearly illustrated in the continuing series of reports published by the NTIA. The *Falling Through the Net* reports document that over time, the growth in telecommunications and Internet access has occurred more rapidly at higher income levels and varies among demographic groups and geographic areas. The divide between certain groups of Americans increased between 1994 and 1997, resulting in a widening gap between those at the upper and lower income levels. Rural areas lagged behind urban and central cities with respect to rates for online access. Though the sample size for Native Americans is too small to be statistically valid, these conclusions generally support our survey research suggesting that Native communities continue to lag far behind the national and rural telephone penetration rates. NTIA plans to release an updated study in July, 1999 that will go beyond the state of household connectivity and examine where Americans are gaining access and what they are doing on-line.

Virtually all of the barriers described earlier in this chapter deter investment in telecommunications infrastructure in Native communities. For private firms, Native communities are seen as small markets with high entry and service costs, and significant

business risk. Even where private telecommunications firms wish to serve Native communities, they must overcome several significant barriers.

Almost without exception, our experts identified the need to acquire rights-of-way as a major impediment to developing technology infrastructure, especially in telecommunications. Unlike other areas, most tribal lands do not have established utility corridors. Furthermore, the trust status of tribal lands often means that private utilities seeking rights-of-way must apply to both the BIA and tribal government for approval, a complex and time-consuming process requiring a large number of certifications and assessments. As an example of this, Figure 3.1 shows the flowchart associated with the Navajo Communications Company process for gaining a right-of-way. This process can take anywhere from three to five years for a telecommunications line.

Utilities operating in different regions may face a slightly different process. However, right-of-way acquisition for small line extension or cable reinforcement may routinely take from 60 days to 12 months. Right-of-way acquisitions to provide service in an unserved area can take two to three years and cost hundreds of thousands of dollars. In nearly every case, the difficulty in establishing rights-of-way deters private investment by decreasing the profitability of providing services in Native communities.

> *"The land value for right-of-way is a major issue. For example, the railroad pays the tribe only $1 a year for crossing through tribal land. The court case in 1910 provided a onetime $10,000 payment for the railroad easement. As a result of these past experiences, the tribe is very reluctant to provide private right of away access."*
>
> *Petuuche Gilbert,*
> *Tribal Councilman*
> *Acoma Pueblo*

The requirement for federal approval of rights-of-way across tribal lands is imposed by statutes dating from 1948. Authority for approving rights-of-way is delegated by the Secretary of the Interior to the Bureau of Indian Affairs. Current law provides that no right-of-way shall be made without the consent of the proper tribal officials. There are other considerations that the Secretary must review prior to approving a right-of-way. One of the more significant considerations is the National Environmental Policy Act (NEPA) of 1969. This statute requires that any federal action include an assessment of the potential environmental impacts. There are numerous other statues that are also applicable including threatened and endangered species, clean water and air, and historic preservation. These functions are not a requirement of the BIA but are congressional mandates. Failure of the BIA to comply with these mandates is a violation of federal law.
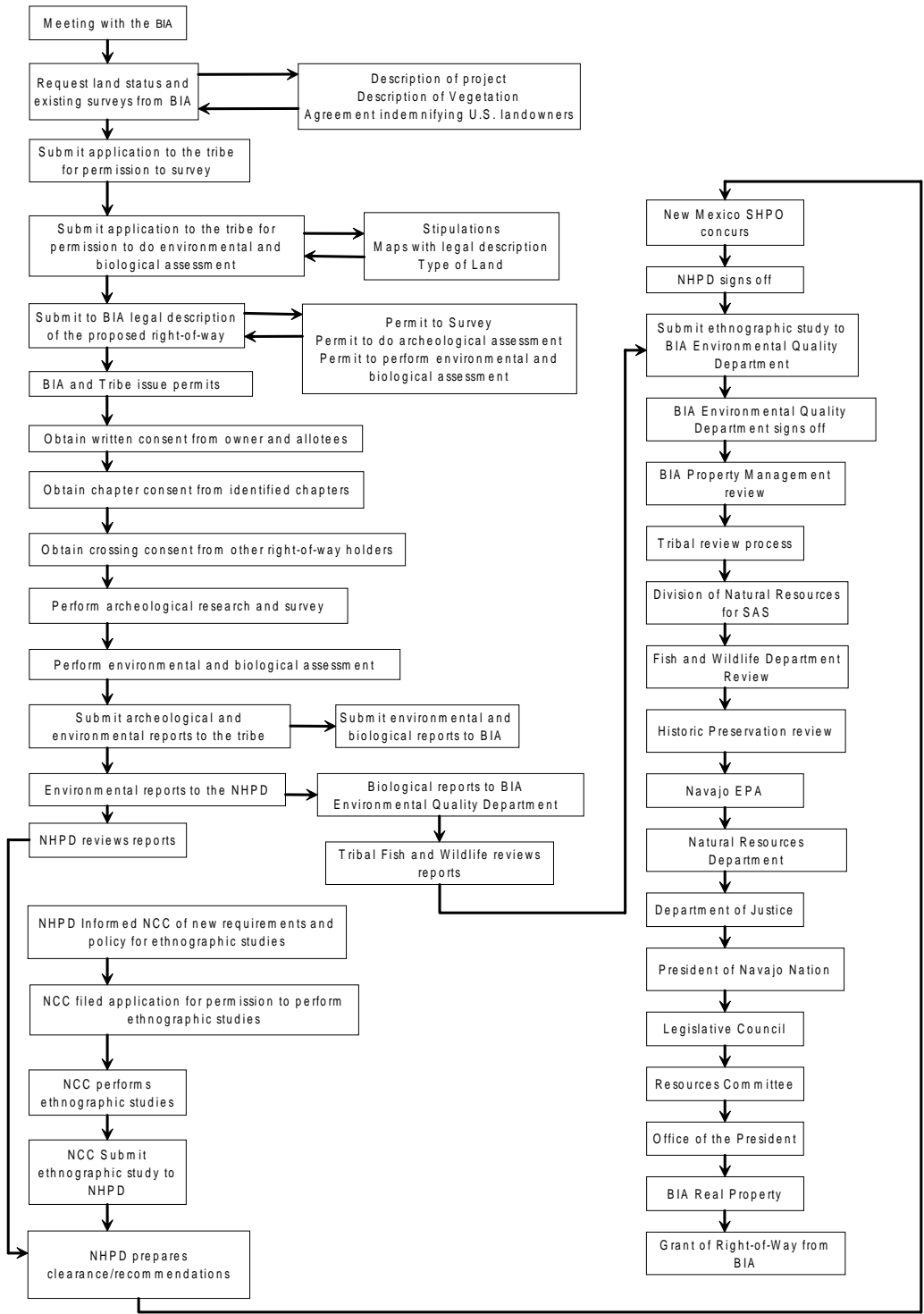
FIGURE 3.1: Typical right-of-way flow-chart for NCC

Nonetheless, our experts generally felt that BIA involvement in granting right-of-way requests represents an infringement of their tribal sovereignty. A few people interviewed even suggested that the federal government has, at times, granted rights-of-way across tribal lands without informed consent from the tribes in question. In some cases, tribes also had sovereignty disputes with state governments stemming from historical easement agreements concerning railroad rights-of-way. We cannot speak to the validity or circumstances of specific claims. However, it is clear that any policy diluting tribal control over land use undermines tribal efforts to establish their own utilities and to negotiate favorable contracts with service providers. Furthermore, to the extent that federal and state governments raise tax revenues or charge fees to utilities or service providers on Native lands, it makes it more difficult for tribes to fund their services, because they cannot charge their own fees without raising costs.

Many tribes have a strong desire to own and operate their own telecommunications infrastructure. Unfortunately, some tribes face additional barriers to investing in telecommunications infrastructure. First, most tribes don't have the capital or the skills to undertake such development. Second, private utilities have been reluctant to sell capacity to tribes in the fear that they will lease the excess capacity to competitors. Also, current Universal Service rules limit support when an exchange is purchased from large telecommunications carriers. Third, the manner in which local access transfer areas (LATA) have been designated was viewed by the experts contributing to this study as another impediment to building a telecommunications infrastructure.

One program positively impacting the tribal telephone penetration rates and tribal ownership of telecommunications companies is the Rural Utility Service, (RUS) of the USDA. This program has provided financing to five tribally-owned telecommunications companies. In areas served by those companies, telephone penetration rates averaged 28% before RUS involvement, and have risen to 78% after involvement. In addition, 60 non-tribal firms financed by RUS provide service to over 27,000 Native Americans. Unfortunately, much more assistance is still needed.

Given the remote location of many tribes, some see microwave and other wireless communication methods as especially attractive because they can reduce the need for investment in telecommunications lines. Unfortunately, the large distances, low population density and rugged terrain involved also make wireless options expensive. Furthermore, current technology makes some wireless technologies a narrow band service in a broadband world. In addition, few tribes can compete in government auctions of broadband spectrum. Even if tribes pooled their resources, Native contributors to this report felt that the FCC rules preclude the partitioning of licenses. However, the FCC responds that it does allow for the partitioning of licenses under certain conditions. The point may be moot, because there is little available spectrum that has not already been auctioned off. From a cultural perspective, the placement of microwave towers and other wireless structures on tribal lands may be in direct conflict with a tribe's belief system regarding the sacredness of their skies and land.

Just as private firms operating in Native communities struggle to acquire rights-of-way, tribes often struggle to acquire new lands. This is especially important where tribes wish to connect remote areas by purchasing parcels to fill in their discontiguous land holdings. Our experts suggested that there is no consistent federal land acquisition policy. Furthermore, it was mentioned that the BIA processing of land acquisition applications is often a slow and complex process. Again, Native groups resent the involvement of the federal government in approving their land acquisitions–something they view as a matter of tribal sovereignty.

While it is true Indian tribes struggle to acquire new lands, it is not because the BIA does not have a procedure in place to assist the tribes. There are prescribed regulations that govern the process by which an Indian tribe may make an application to the Secretary of the Interior to take title to land in trust on behalf of the tribe. However, these acquisitions are not exempt from controversy. State and local government have concerns regarding the potential impacts on their government because of removal of the lands from the tax roles.

3-4. Obstacles to Distance Learning

Universities and colleges around the nation are building programs to support distance education. However, our experts and survey respondents repeatedly cited the following barriers to delivering distance education to tribal schools and community centers:

- insufficient access to advanced technologies such as computers and the Internet;

- lack of tribal ownership of these services and insufficient funding for tribes to construct their own infrastructure; and

- shortage of education and training programs that are culturally relevant, and acceptable to tribal leadership.

The FCC, RUS, and NTIA all have important distance education funding initiatives in Native communities (described more fully in the next chapter). However, it is clear that the demand for these programs greatly exceeds what they can provide given existing budget constraints. This underscores the need for greater private sector involvement in this area.

3-5. Obstacles to Telemedicine

In its most basic form, telemedicine uses advanced telecommunications infrastructure to provide access to a doctor or a diagnostician located at a distance from the patient. Telemedicine practices have helped many tribes and Native Alaska communities overcome the great geographic distances that separate them from immediate, high quality health care. As the technology exists today, telemedicine is most useful for interpreting X-rays, electro-cardiograms (EKGs), and similar diagnostic tests. The value of the approach is more limited where a tactile interaction between patient and doctor is required. Telemedicine is often not available for those remotely located Native communities that need it most.

Some of the barriers that must be overcome to increase the availability of telemedicine are not unique to Native communities. Because the technology is new, there is still uncertainty regarding which technology will become the standard for telemedicine delivery. This deters investment by communities fearful that their technology will quickly become

obsolete. The current lack of standards is also critical because incompatible hardware and software across the network can bring the system down.

There is debate regarding licensing standards for physicians practicing telemedicine. As a result, a physician licensed in one state may be prohibited from providing treatment to patients in other states.

Furthermore, programs such as Medicare and Medicaid set up their payment schedules and rates on the basis of "laying of hands" by the health care provider. With telemedicine, portions of the patient's treatment encounter and treatment never involve a doctor actually touching a patient. Consequently, some of these treatments are not reimbursable by Medicare or medical insurance. Other costs that may not be reimbursable include video teleconferencing, time of computer technicians, and uplink charges.

Other telemedicine barriers are more specific to Native (and other distressed) communities. Most important, Native communities cannot easily afford the costly, highly specialized investments required for telemedicine, including reliable two-way video capability and specialized "tele-examining rooms." The FCC's Universal Service Fund and E-Rate Program are designed to subsidize these types of costs, including infrastructure development necessary for establishing "connectivity." Unfortunately, participants in our study identified several weaknesses in these programs as they pertain to funding telemedicine facilities on tribal lands.

First, the rules and eligibility requirements governing the E-Rate program for schools and hospitals are generally very complex. Second, the published benchmark rates for establishing universal service funding are calculated with models that do not necessarily consider rural Native communities. In some cases, this makes the potential level of support too low to be of benefit to Native communities.

A third telemedicine barrier raised by Native contributors is that infrastructure provided under the E-Rate program cannot be used for purposes other than telemedicine. As an example, equipment and Internet services paid for with E-Rate funds cannot be used for community distance education when the telemedicine facility is not being used for its main purpose unless the distance education provider is also an eligible E-Rate

recipient. Only when this is the case, with an approved cost allocation model, can the E-Rate supported telemedicine lines be used for other purposes. Any revenue that a clinic or hospital might receive for providing services using E-Rate supported telemedicine lines is prohibited. However, this policy is applicable to all communities not just Native ones. The reason for this policy is to enforce acceptable and appropriate use of Internet services. Still, this is perceived as a major economic barrier in remote locations such as Alaskan villages, where hospitals and health clinics are often expected to serve as providers of other types of community services.

Our experts also recognized the need for patient security if telemedicine lines were used for dual purposes. In principle, data encryption is one way to allow dual use of the Internet connection and also protect patient privacy. However, there is currently no common, accepted encryption system for transferring data and maintaining patient records.

Telemedicine requires that individuals be trained both in the technology of hardware and software, and in health care. At present, especially in remote areas, developing staff with these skills is difficult. First, there are few local programs for training in these specialized fields; and second, it is difficult to attract individuals possessing these dual skills to remote geographical locations where salaries are far lower than in major urban telemedicine centers.

Another barrier to fully implementing a telemedicine mechanism involves the relationship between local exchange carriers and long-distance carriers. Especially in Alaska, local carriers do not stand to profit from telemedicine, which is based on a long-distance connection. This is due to the nature of community contractual agreements with local carriers and the gateway services they provide.

Finally, telemedicine technicians working in remote Native areas, (most notably Alaska) may need to speak Native languages and present the telemedicine technology to the patient in a culturally acceptable way. It may also be necessary to work with tribal or village leaders to create ethnomedical profiles, ethnic profiles, and programs in telemedicine cultural sensitivity. To reduce the demands on telemedicine practitioners, current demonstration projects have developed

health care CDs in Native languages and computers with Native keyboard sets for typing. All of these initiatives require additional funding from public and private sources.

3-6. Lagging Technology Infrastructure Investment as an Obstacle to Manufacturing and Economic Development

We started this chapter by arguing that the most serious obstacle to technology infrastructure development in Native communities is the fragile state of the economy. However, the real point is that *infrastructure and economic development are mutually supportive and interdependent*. Poor economic capacity is both a cause and a result of weak infrastructure development. There is little doubt that poor roads, electrical distribution systems, housing and schools hurt the competitiveness of Native communities today. Lagging technology infrastructure development on tribal lands can only place Native communities at an even greater economic disadvantage in the future. Without affordable access to the Internet, distance learning and similar technologies, Native Americans will find it difficult to obtain the capital and skills they need to compete effectively. They will find it increasingly difficult to track new market developments as a greater proportion of commerce is carried out on-line and with greater speed. And finally, without a reliable basic infrastructure system of roads, electricity and utilities, the development, growth and success of Native or private enterprises on tribal lands will not occur.

RECOMMENDATIONS FOR CLOSING THE TECHNOLOGY INFRASTRUCTURE GAP IN NATIVE COMMUNITIES

●●●●●●

4-1. Synopsis

Today, virtually all American Indian and Alaska Native communities lack the technology infrastructure common to other American communities. While some tribal communities have made important gains in specific areas, the gaps in technology infrastructure are widening as a result of the rapid emergence of new technologies and related infrastructure requirements. Without significant action, tribal economies in the future will be even less able to compete successfully in the economic mainstream of America than they are today.

The most fundamental barriers to technology infrastructure development identified in this report have existed for decades, if not longer, and cannot be eliminated with quick fixes and simple solutions. Real solutions must look beyond what any single administration or private partnership can hope to achieve. These solutions will require long-term strategic planning with tribal and community-based participation. This is essential to ensure that these strategies will reflect the wide variety of tribal needs and goals, and support sustainable tribal development. Given the present barriers to capital formation in Native communities and the depressed state of many tribal economies, much of the capital tribes need for technology infrastructure investment is likely to come from sources—especially the private sector—located outside these communities. It is essential therefore, to secure the participation and cooperation of private utilities and service providers as part of the development and implementation of these strategies. Likewise, state and county governments, particularly in rural areas, should be encouraged to work cooperatively with tribal governments to ensure that the infrastructure of tribal and non-tribal communities are complete and seamless across political boundaries.

In particular, the federal government can facilitate technology infrastructure improvements in several key ways. First, there must be a consistent federal investment strategy for tribal communities, with an emphasis on encouraging private investment necessary to provide the fundamental services needed to support information technologies. Among these are: power and phone lines, fiber optics, and communications satellite coverage. Second, resources must be provided to enable tribes to develop the infrastructure essential to economic and business development. Third, the federal government must improve the efficiency of its own program delivery to tribal communities, expand the types of programs available to tribes, and better communicate program availability to tribes. Finally, the government must work to support tribally-directed economic growth by strengthening tribal sovereignty.

4-2. Develop a Long-Term, Consistent Federal Investment Strategy for Native Technology Infrastructure

In order to effect sustained economic growth and development in Native communities, the federal government must take the lead in instituting a coordinated investment strategy to enhance the technology infrastructure in tribal communities. This is not to suggest that federal agencies do not work with each other. To give just one example of federal agency collaboration, the BIA and the FCC have worked closely with one another to encourage greater utilization of the E-Rate Program by Native K-12 schools. However, cooperation by two or three agencies on selected initiatives does not constitute a comprehensive, integrated investment strategy.

In 1998, the Clinton-Gore Administration made a significant, if preliminary step in the right direction when representatives of major federal agencies, in consultation with the Domestic Policy Council, issued the Joint Report to the President, "Economic Development in Indian Country." This report provided a partial list of federal economic development programs operating in Native communities (some of which provide support for infrastructure development), as well as several recommendations for change.

The next step is to develop an investment strategy building on this Joint Report that identifies specific infrastructure goals and investments necessary to meet the report recommendations as

well as encouraging and involving private sector involvement. The strategy should also include budget estimates and clarify which agencies have responsibility for each investment. Finally, it must include time lines for achieving important milestones and methods for measuring performance.

To maximize the potential for success, this interagency strategic planning effort must be replicated on an intra-agency basis. Each agency should establish an Indian policy or tribal liaison office similar to those in place at the Departments of Justice, Interior, and EPA, and as recently committed to by the Department of Commerce. These offices should be placed at a sufficiently high level of the organization to participate fully in the development and coordination of tribal policy. Individual agencies may choose a political appointee as director, but the office should include career employees to ensure long-term continuity. We recommend that careful attention be given to the structure and function of the office to guarantee that its role is appropriately reflected to serve a policy function. The role of this office should not be limited to referral services or that of an information clearinghouse. Each agency also needs field representatives with expertise in Native issues that can serve as initial points of contact for tribal governments and coordinate collaboration on a regional basis.

A few federal agencies have already made progress in this direction. A good example is HUD's Office of Native American Programs (ONAP), which is dedicated solely to serving and implementing Native American programs such as the Native American Housing Assistance and Self-Determination Act (NAHASDA) of 1996, the Indian Community Development Block Grant Program, the Section 184 Indian Housing Loan Guarantee Program and the Title VI Tribal Housing Activities Loan Guarantee Program. There are currently 178 full time equivalent staff positions in ONAP and each ONAP employee is an expert on Indian housing and/or community development matters. These employees also help to coordinate policy across different offices/divisions within the agency and with other agencies.

4-3. Increase Funding to Break the Vicious Circle of Poverty and Weak Infrastructure

Significant increases in public and private investment are required to break free of the current situation in which poor infrastructure and poverty conspire to depress economic activity in Native communities. Resources most badly needed include capital investment, planning assistance, workforce development and training, and information and data provision.

Native communities need to make substantial investments to upgrade their technology infrastructure to standards that non-Native communities would consider minimally acceptable. These needs are greatest in basic infrastructure areas such as water and waste water systems. In our survey, tribes overwhelmingly ranked inadequate funding as the single greatest obstacle to making those investments. In the fiscal austerity of the 1980s, federal aid supporting Native infrastructure investment programs declined significantly. The Clinton-Gore Administration has taken important steps to reverse this trend by increasing aid to selected existing programs and new initiatives. It is difficult to determine the funding actually available to Native communities under these programs, because they are available to all distressed communities. However, it is clear that resources are available. To give a few important examples:

Capital Investment

- Since 1993, the RUS has provided millions of dollars in loans and grants for building distance education infrastructure in rural areas and a number of tribes are making progress in the area of distance learning using satellite technology.

- NTIA's Telecommunications and Information Infrastructure Assistance Program (TIIAP) provides grants on a competitive basis to non-profit entities, including tribal governments. Since 1993, eighteen tribal projects have been funded, and in several cases, these projects have brought Internet access to the community for the first time. These projects are providing important models for how Native communities can use technology in innovative ways to improve the quality of life. The White Mountain Apache Tribe of Arizona is using TIIAP to build a community-wide network to improve economic development and educational opportunities on the reservation. And, the Oglala Sioux Tribe in Pine Ridge, South Dakota, is using TIIAP to develop a

digital wireless home health care service network that will use a paging system to coordinate responses from health services and emergency services to high-risk patients.

- The Air Force Small Business Office has launched a joint effort with the Native American Development Corporation of Montana and Wyoming to increase the number of Native American firms awarded Air Force contracts. In June, 1999, the Air Force awarded a contract to Chugach Management Services Inc., a Native-owned, Alaskan corporation for outsourcing the base civil engineering function at MacDill AFB in Florida. The contract is for ten years with an estimated value of $549 million.

- Many HUD programs allow for the purchase of computers and computer related equipment and software as eligible expenses. In 1998, HUD funded a number of tribal programs and initiatives associated with economic development, technology training and employment apprenticeships in tribal industries. This is all in addition to the $600 million in Indian Housing Block Grants (IHBG) awarded in 1998.

- The Department of Treasury's Community Development Financial Institution (CDFI) program provides several million dollars per year to capitalize loan funds that communities may use to fund local business ventures.

- In FY 1998, SBA approved $76.5 million worth of loans to Native-owned small businesses, triple the number of loans made in 1993. SBA, working in cooperation with BIA, has also established 18 tribal business information centers to assist tribal entrepreneurs with technical and information services.

These programs, while significant, pale in comparison to what is needed. Clearly, the federal government cannot meet these needs alone. Greater private involvement is an absolute necessity. Recognizing this, current Administration strategy seeks to increase the role of the private sector. Microsoft Corporation, for instance has helped NASA to support programs of the American Indian Science and Technology Education Consortium (AISTEC) to prepare American Indian students for careers in science, engineering, and mathematics. Likewise, as an example, the Air Force has entered into a number of Mentor-Protege agreements in which tribally owned or affiliated businesses receive assistance from larger, more established businesses.

Unfortunately, the high cost and small markets associated with investment in Native communities continue to deter widespread private sector involvement. The public-private partnerships that have emerged, while valued and often very successful, have been modest. For the future, the Administration has far more ambitious plans to expand private sector involvement in Native communities. Most notable among these is the President's New Market Initiative included in his FY2000 budget. This initiative consists of a series of tax credits and incentives designed to spur private investment in distressed communities worth an estimated $15 billion. These incentives would be available to Native communities.

The increased scale and private sector involvement of this initiative are certainly steps in the right direction. Still, it is equally important to maintain and expand public sector programs for those critical areas where private sector participation fails to materialize.

Careful planning increases the efficiency and effectiveness of public and private technology infrastructure investment. Tribal governments need increased funding and technical assistance to undertake such planning and to develop strategies for encouraging greater private investment. Recently, tribes have been given access to previously unavailable planning resources. Most notably, they have been granted eligibility under the Empowerment Zone Program/Enterprise Community (EZ/EC) program jointly run by USDA and HUD, and the Pine Ridge reservation has been designated an Empowerment Zone. In total, 18 tribes were selected to participate in the Round II EZ/ECs program. Among other benefits, this makes the community eligible for planning assistance of the sort needed (and requires them to undertake that planning effort). NASA has also furthered planning efforts among tribes by providing GIS training to tribes in Northern California.

Future assistance for planning should include funding for technology infrastructure needs assessments. These needs assessments must reflect the unique conditions facing each tribal community. However, they should also utilize standardized methodologies that allow funding agencies to develop more reliable estimates of national investment needs in Native communities. Recognizing that plans are "living documents" that require continual updating, and that planning consists of implementation as well as document preparation,

Planning Assistance

some portion of the funding should be made available on a continuing basis. An example of this is EDA's Planning Program, which provides ongoing funding to more than 60 tribal planning efforts for the purposes of preparing and implementing plans, as well as building economic development capacity.

Workforce Development and Training

Unless Native communities upgrade the skills of their residents, they will continue to have difficulty making informed investments in, and maintaining technology infrastructure. As a result, these Native communities will continue to lose significant amounts of revenue to outside contractors, and in the process, lose control over their technological futures.

Some Federal agencies, such as the Department of Labor, through the Job Training Partnership Act (JTPA) and its successor, the Workforce Investment Act (WIA), have programs in place which are already increasing the employability of individuals in the Native American community through educational and occupational training. For instance, under the JTPA Title IV-A program for Program Year 1998, the Department of Labor invested $54 million in 183 Native American grantees to increase workforce development and training in the Indian community. Through the Welfare-to-Work Program created in 1997, the Department is also spending $15 million annually in FY 1998 and 1999 on the Indian and Native American Welfare-to-Work Program (INA WtW).   For Fiscal Year 1998, the Department invested $15 million in 86 grantees to help move Long-Term/Temporary Assistance for Needy Families recipients from dependence on public assistance into positions where they can become self- sufficient and better provide for themselves and their families. These two programs (INA WtW and JTPA/WIA) together help over 40,000 Native American participants (adults and youth) annually upgrade their skills and obtain better jobs in their communities.

These programs are useful, although it is not clear how much of the training provided serves to increase the kinds of technology competency of individuals required to support major infrastructure improvements in the community. Training programs need to do more than focus just on employability. One excellent mechanism already in place to take a lead role in this effort is the network of Tribal Colleges. Toward this end, the federal government should support the long-term development of vocational technology curricula in Tribal Colleges and other

colleges that can create a supply of future technology workers for tribes. Until economic activity and wages in Native communities increase overall, tribes also should have access to funding programs to support higher salaries or other benefits to attract and keep skilled workers in tribal communities.

Strategic planning by both federal and tribal government officials is hampered by the lack of baseline data and information. While tribal governments are located throughout the U.S. and are subject to a wide range of economic conditions, most of the existing economic data is highly aggregated, detracting from the overall utility of the information for specific tribes. Moreover, most existing economic data is restricted to employment and education measures. The data are simply not available to analyze properly those factors that contribute to high unemployment, lack of skills, or other critical weaknesses in the local economy. Without a proper understanding of these weaknesses, it is difficult to design effective strategies to remedy those weaknesses.

Research, Outreach and Data

Tribes have recognized the importance of current and reliable data for their communities and have sought to develop their own data sources. The Intertribal GIS Council, for instance, is using TIIAP funds to develop an electronic database of tribal land and geography to help the tribes make important policy decisions concerning natural and cultural resources. Still, each federal agency working with tribes should dedicate a specific and publicly identifiable portion of its annual budget for assessing native technology infrastructure needs in their area of expertise/responsibility. These investments in data collection and maintenance should be developed in the context of the agency and interagency strategic planning processes described previously.

4-4. Improve the Efficiency of Existing Federal Infrastructure Programs for American Indians and Alaska Natives

The federal government needs to improve the efficiency with which it delivers its own programs for Native Americans. In all fairness, several of the agencies that work closely with Native Americans on infrastructure issues have made tremendous progress, despite the fact that many of the issues agencies have had to tackle are extremely complex. Consider the case of Universal Service provision to Native communities. Prior to

1998, Universal Service Funds were administered exclusively by the states. This was a problem, because states do not negotiate directly with tribes, which are considered sovereign governments. This caused tribes considerable frustration in trying to gain access to Universal Service Funds. In 1998 President Clinton signed legislation into law that allows tribal entities not subject to state jurisdiction, to apply directly to the FCC to qualify for Universal Service support. FCC representatives concede that rules governing this program still remain in a state of flux, especially as applicable to tribes. Nonetheless, there has clearly been significant improvement and the FCC is continuing to make improvements based on extensive tribal input.

We need to make sure this progress continues across all the agencies working with Native communities. To promote interagency cooperation at the highest policy levels, President Clinton has created the Domestic Policy Council Working Group on Native Americans. This is useful, but has very wide responsibilities. The model needs to be extended down to the operational level of the agencies involved. It also needs to be allowed to focus more closely on specific infrastructure issues.

To promote tribal access to federal technology programs and to improve the efficiency and effectiveness with which these programs are delivered in tribal communities, we propose to create several interagency working groups. Each working group will address a specific infrastructure area such as telecommunications, educational facilities, and so on. Each will also serve to coordinate program activities between the agencies participating on the working group.

The 1998 Joint Report to the President recommended an inventory of federal Indian programs and the creation of a referral center within BIA to handle questions about Native economic development programs. This is a good first step. The interagency working groups we are recommending would take the next step by having each agency in each working group create an electronic inventory of its procedures, eligibility requirements, funding levels, etc. Each agency should also outline its strongest assets and capabilities. The working groups could then identify areas of inconsistency and duplication among federal programs, as well as specific steps to remedy these inconsistencies. Each working group would also systematically identify opportunities for greater private sector

involvement and interagency cooperation to assist Native communities in developing their technology infrastructure, making the best possible use of each agency's unique resources. Logically, this should be a prerequisite to new investment.

4-5. Strengthen Tribal Sovereignty to Develop and Manage their Own Technology Infrastructure

Tribal economic development cannot be separated from sovereignty issues. Without clear and unencumbered authority to negotiate contracts, develop their lands, and make similar economic decisions, Native Americans are placed at a serious competitive disadvantage and cannot hope to attract private sector investment. To strengthen tribal sovereignty, the federal government needs to adhere to certain principles. Specifically, it should:

- Ensure that all government agencies are fully aware of, and understand the principle of tribal sovereignty and institute processes to ensure adherence to federal Indian laws and policies.

- Include tribal representation in meetings with state, county, and local governments regarding agency initiatives and the development of programs and policies related to information technology, communications, and community development.

- Remove any procedural or other obstacles which would limit tribal participation in agency programs or activities, particularly with regard to infrastructure development.

- Engage in meaningful tribal consultation when agency actions, decisions, or proposals affect tribal communities.

- Sponsor research to ensure that federal and tribal policy-makers have adequate information to make reasoned decisions concerning the infrastructure and economic needs of tribal communities.

- Develop and disseminate information which will foster a greater understanding of the political, social, and economic status of tribes within government, the private sector, and the general public.

The current Administration has made real and important progress in strengthening tribal sovereignty. Both by Executive Memorandum and Executive Order, President Clinton has directed federal employees and agencies to respect and support

tribal sovereignty and recognize tribal governments, including religious freedom. Of course, supporting sovereignty means more than making promises. The Clinton-Gore Administration has fought efforts by states to impose new taxes on tribes and put real resources into strengthening tribes as independent communities.

The federal government could further strengthen tribal sovereignty by turning greater authority for infrastructure development over to tribes. Current policies require tribal governments to obtain inordinate degrees of federal approval for granting rights-of-way, purchasing land, and undertaking other actions that are relatively simple elsewhere. Giving tribes greater authority would make it easier for them to reap the benefits of infrastructure investment and give them added incentives to make those investments. It would also make it easier for tribes to secure private sector involvement and negotiate contracts. Rather than concerning itself with the day-to-day decisions involving tribes, the federal government should empower tribes to exercise their sovereignty more effectively by providing them with technical assistance, planning, and workforce development as described above. Much of this assistance could be delivered through the existing network of Tribal Colleges that are members of AIHEC and regional universities.

The recommendations above are general and apply across all types of technology infrastructure. In the course of our research, we have also identified a series of recommendations needed to promote the development of specific types of technology infrastructure.

4-6.   Infrastructure-Specific Recommendations

4-6.1.   Utilities, Water, and Waste Water Facilities

The federal government must work aggressively to help Native communities improve their basic utilities as a foundation for advanced technology infrastructure. Again,

there are many existing programs in this area. One such program is USDA's Rural Housing Service 504 loan and grant program, which can be used to finance Native utility hook-ups.

In addition, the federal government should:

- Reassess utility infrastructure needs on a program-by-program basis, making assessments based on future needs, (including population growth) rather than historical funding levels. Set specific targets and fund these programs fully to meet those targets.

- Streamline or eliminate the right-of-way clearance process.

- Streamline or eliminate the tribal land acquisition clearance processes.

- Revise existing policies to give tribes greater jurisdiction over utilities and roads on tribal lands.

- Develop and fund training programs for community planners and utility managers in the Tribal Colleges. These programs should include curricula on contract negotiation, strategic planning, needs assessment, conducting feasibility studies, as well as basic financial modeling.

- Assist tribes to develop alternative and renewable energy sources.

- Develop programs through the national laboratories that support transfer of utility and construction technology to Native communities. An example would be Sandia National Laboratory's program to install fuel cells as a power source in remote Alaska Native Villages.

4-6.2. Education Programs and Facilities

Education represents one of the biggest single success stories for federal policy to help Native Americans in recent years. Toward this end, several different agencies now fund education programs and projects of critical value to Native Americans. In addition to the E-Rate Program and NTIA efforts described earlier:

- The Department of Education has a number of programs in place which can serve as models for replication by other agencies or private entities. For example, under a Technology Innovation Challenge Grant, the Native American Technology Consortium will train almost 3,000

teachers serving 45,000 students on the Navajo Reservation in the innovative use of educational technology. Another Department of Education program, The Star Schools program, is providing $2 million to the Mountain Plains Distance Learning Partnership involving tribes in Colorado, Montana, Wyoming and Utah. This partnership is developing an electronic, virtual campus, employing two-way audio and visual interactive connection using fully scalable, high speed digital ATM microwave transmission and receiving classrooms.

- The National Science Foundation (NSF) has invested for over a decade in the development of high performance computing infrastructure in Tribal Colleges.

- NASA, in partnership with Microsoft Corporation, is funding programs of the American Indian Science and Technology Education Consortium (AISTEC) to prepare American Indian students for careers in science engineering, and mathematics.

- BIA's Office of Indian Education Programs (OIEP) has formed partnerships with the National Museum of the American Indian and companies such as Microsoft, Intel and 3Com to provide culturally relevant educational programs such as virtual museums and cultural preservation projects that can be shared with communities throughout the world.

- NTIA's Public Telecommunications Facilities Program has funded the planning and construction of a distance learning network providing each of the 30 American Indian Higher Education Consortium (AIHEC) member schools with a satellite receive terminal and related video classrooms. An additional nine AIHEC colleges have VSAT earth station capability that allows them to transmit culturally relevant educational programming to all the AIHEC member schools.

To sustain and build on these existing efforts, the federal government should:

- Enhance and strengthen coordination between federal programs to fund Internet connections in Native schools.

- Increase overall funding levels for Internet connections to tribal schools, possibly along the lines of the National Science Foundation's Connections Program for Educational Institutions.

- Continue to fund Tribal College and regional university distance education programs as well as expanding support for private partnerships specifically address building tribal economic capacity.

- Assign the Department of Education the task of assessing educational and training needs for Native Americans to work with, and manage key technologies.

- Expand funding for culturally sensitive technology curricula for Native communities. Funding should include teacher training/scholarships.

- Encourage internship/apprenticeship programs between the private sector and Tribal Colleges to provide on-the-job training to Native Americans in industrial fields. Develop technical training curricula.

- Create incentives for new college graduates to return to work in Native communities, including wage subsidies if necessary.

4-6.3. Telecommunications Infrastructure

To ensure Native communities do not fall further behind in critical new technologies, the federal government must create a comprehensive and coherent investment strategy for telecommunications infrastructure which involves participants from tribes as well as the private sector.

In 1993, the Clinton Administration recognized the importance of telecommunications and information technologies as a foundation for the nation's economic prosperity. The Administration set forth a vision for the development of a National Information Infrastructure (NII) based on pro-competitive policies that would promote vigorous private-sector investment and reduce the cost of technology and service for all communities. Tribes were encouraged to embrace this vision so that their communities would be able to enjoy the benefits of the NII, including enhanced education, economic development, health care, public safety and delivery of government services.

The Administration's Efforts in Building Telecommunications Infrastructure

In 1996, President Clinton signed into law the Telecommunications Act of 1996 -- a major cornerstone of the Administration's NII effort. The Act expanded the definition of universal service by creating the E-Rate Program to provide discounts for telecommunications equipment and connections for all schools, libraries and health clinics.

Even though there are a number of complexities associated with the administration and eligibility for E-Rate discounts, many tribal schools and libraries in particular have benefited from the program. Overall, 26% of BIA schools or approximately 56 schools participated in the E-Rate discount program in 1998. These schools received on average a discount of nearly 80%.

Yet, even with such progress, tribes still have a long way to go before they can fully participate in the new information economy. We know that the state of connectivity in Native communities generally is poor. But, in order to identify effective solutions to this problem, a critical step is defining the need and identifying areas for solutions.

Recommendations in Implementing the Telecommunications Act of 1996

The Telecommunications Act of 1996 provides for comparable rates and services between rural and urban areas, "just, reasonable and affordable," to all Americans and requires carriers to serve previously unserved communities. The deregulations implementing that law are still being developed. The FCC should ensure that the promise of the Act is a reality for Native Americans and should: 1) provide for enhanced "Lifeline" and "Link-Up" support to tribal ares not subject to state jurisdiction; 2) provide relief from the two year wait for Universal Service Funds for new carriers providing service to tribal communities; 3) remove the per line cap on Universal Service Funds for acquired exchanges; and 4) institute meaningful carrier of last resort procedures for tribal communities.

In addition, the federal government should:

- Increase funding for Native telecommunications infrastructure by developing tax incentives to promote private investment.

- Within the training programs for tribal utility managers recommended above, develop specialized curricula for telecommunications managers.

- Revise HUD policies, or better communicate existing policies regarding the program support for wiring houses for telephones. Investigate the costs and possible funding mechanisms for providing full connections from houses to the telephone network.

- Reserve portions of the broadband spectrum for Native use.

- Develop 911 emergency programs coupled with a Native community rural addressing program.

- Revise and develop more consistent federal policies regarding LATA boundaries.

- Revise USF benchmark calculation models and FCC policies with respect to policy effects on tribally owned and operated telephone enterprises.

- Simplify E-Rate eligibility criteria to include Native communities more fully. Review regulations related to multiple use of infrastructure funded under E-Rate telemedicine programs.

- Create private/public partnerships with BIA in administration and negotiation of BIA school Internet projects. Examples of partnerships might include NSF, Department of Education, private foundations, etc.

- Implement programs to better define the revenue and investment needs of telecommunications constituent groups involved in Native communities from a provider viewpoint, i.e., LECs, long distance carriers, Internet service providers, etc.

- Develop level-of-service criteria for local exchange carriers that would allow Native American communities to take advantage of alternate providers in a franchise area when the primary provider cannot or will not provide timely and adequate service.

4-6.4. Telemedicine Facilities and Programs

Telemedicine represents an important strategy whereby Native communities utilize new technologies to overcome their isolation and weaknesses in the existing transportation and health care networks. The federal government should support telemedicine programs of Native communities by:

- Working with the medical community, insurers, and other related parties to accelerate the development of legal and technology standards for telemedicine. This should include making more of the costs associated with telemedicine eligible for traditional insurance payments.

- Providing greater funding for telemedicine facilities, including tele-examining rooms. Presently RUS lends for these initiatives.

- Assisting Native telemedicine programs to piggyback on other networking projects (e.g., schools, libraries, DOI, military, Forest Service, Coast Guard, National Park Service, etc.).

- Creating medical training/skills programs for telemedicine, delivered through culturally appropriate mechanisms.

- Working to review E-Rate rules that currently inhibit multiple uses of infrastructure. Explore possibilities of having Department of Defense (DoD) and National Laboratories provide necessary encryption technology.

4-6.5. Economic Development

Over the longer run, increasing businesses, expanding business activity, job training, and encouraging entrepreneurial initiatives are the only means to increase the resources and skills that tribal communities need to build local capacity and ensure economic viability. One of the best ways to promote economic development within tribes and tribal communities is through the fostering of an entrepreneurial culture. Entrepreneurship and small businesses have always been the backbone of a strong American economy. And these are the keys to job creation and our continued leadership in the global economy of the 21st century. Several new sources of economic development support have emerged in recent years that can promote entrepreneurship in Native communities.

- Indian tribes are participating in two of the five EZs, including the Oglala Sioux Tribe on the Pine Ridge Reservation in South Dakota and the Desert Communities EZs in California with three participating Indian tribes. Of the 20 ECs, eight include tribal entities. Under these programs, the federal government provides tax benefits for businesses, flexible grants to carry out comprehensive revitalization strategies, and the ability to apply for waivers from federal programs enabling local communities to better address their particular needs.

- Although a very small program, CDFI has invested several million dollars annually in a number of Native American-owned investment funds serving Native American communities. For example, the Fund made a $1 million grant to First American Credit Union, which provides basic financial services to Native Americans in Arizona, parts of New Mexico, and Utah. The CDFI Fund is also conducting

a study on barriers to lending and investment, and will make recommendations for ways to expand access to capital in Native communities.

If fully funded, the New Markets Initiative might also channel significant capital into Native communities.

In addition, there are a number of successful private/tribal partnerships aimed at building tribal economic development capacity. As an example, Intel Corporation has partnered with tribal governments and Tribal Colleges in New Mexico to offer a two-year associates program to address the company's challenge of locating a skilled electronics workforce. Similarly, IBM has joined forces with several Tribal Colleges to develop, prepare and retain workers in the computer industry.

The federal government should continue to support such efforts by:

- Increasing funding for Native economic development, including funds for strategic planning and capacity building.

- Implementing fully the clearinghouse for federal agency economic development initiatives currently under development at BIA. The program should include follow-up as well as initial referral services.

- Revising SBA definitions that prohibit tribal enterprises from receiving small business assistance.

- Conducting independent quality audits of previous federal infrastructure development and deployment projects undertaken in Native communities as compared with projects undertaken in non-Native communities. These audits will serve to upgrade Native infrastructure project standards to comparable levels as projects undertaken in non-Native communities.

- Establishing an internship/exchange program to provide Native economic developers experience working off the reservation (or conversely to bring in outside expertise) on a temporary basis.

- Continuing to support and emphasize programs which build private-sector partnerships for economic development training, Native-owned contracting and job training.

4-7. Conclusion

Modern technology infrastructure provides wonderful opportunities for Native communities to strengthen their economies, educate their children, improve their standard of living, overcome geographic isolation, and sustain their cultural heritage. However, barriers such as geographic isolation, access to education, limited infrastructure, and other disadvantages continue to exclude tribes from the economic mainstream of this nation. We now have a chance to ensure that tribes are not excluded from the Information Age. The lack of infrastructure is a major remaining barrier to tribal economic growth. Today the opportunity and the means to remove this barrier are at hand.

The Native, government and private contributors to this study have helped identify many suggestions to remove the barriers to tribal infrastructure development. What is needed now is a coherent and sustained commitment to improving the situation. This will require significant public and private investments in both physical structures and people.

The existing state of infrastructure development in Native communities as well as the federal and private policies serving to impede certain types of development has taken a long time to evolve. Without question, change is occurring. However, all contributors to this research agree–immediate and committed federal help in funding, and facilitating private sector partnerships can make a difference.

REFERENCES

● ● ● ● ● ● ●

[1] Office of Technology Assessment U.S. Congress, "Tele-communications Technology and Native Americans: Opportunities and Challenges," (Washington, DC: U. S. Government Printing Office, 1995).

[2] Daley, William M., Aida Alvarez, and Bruce Babbitt, "Economic Development in Indian Country," (Washington, D.C.: U.S. Department of Commerce, U.S. Department of the Interior, U.S. Small Business Administration, 1998).

[3] Bureau of Indian Affairs, "Answers to Frequently-Asked Questions," *http://www.doi.gov/bia/aito-day/q_and_a.html*, (U.S. Department of the Interior, April 2, 1998).

[4] Bureau of Indian Affairs, "Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs," *http://www.doi.gov/bia/aito-day/q_and_a.html*, (U. S. Department of the Interior, December 21, 1998).

[5] Paisano, Edna L. et. al. *We the First Americans*. U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census. September 1993.

[6] Duffy, Diane and Jerry Stubben, "An Assessment of Native American Economic Development: Putting Culture and Sovereignty Back in the Models," Studies in Comparative International Development 32, no. 4 (1998): 52-78.

[7] Anonymous, "Intergovernmental Compacts in Native American Law: Models for Expanded Usage," Harvard Law Review 112, no. 4 (1999): 922-939.

[8]   Governor Mary Thomas, "Response to Federal Communications Commission Questionnaire," (Gila River Indian Community, 1999).

[9]   U.S. Census Bureau, "Resident Population Estimates of the United States by Sex, Race, and Hispanic Origin," *http://www.census.gov/population/estimates/nation/intfile3-1.txt*. (Washington, D.C., Population Estimates Program, Population Division, December 28, 1998).

[10]   "One-Stop Mortgage Centers: Building Local Capacity to Promote Homeownership in Indian Communities," Interagency Draft Report, Washington, D.C., March 29, 1999.

[11]   U.S. Census Bureau, "Table 4. Projected Number of Households by Type, Race and Hispanic Origin," *http://www.census.gov/population/projections/nation/hh-fam/table4n.txt*. (Washington, D.C., U. S. Bureau of the Census, May 1996).

[12]   Tiller, Veronica E., Tiller's Guide to Indian Country (Albuquerque, NM: BowArrow Publishing Co., 1996).

[13]   McConnaughey, James W. and Wendy Lader, "Falling Through the Net II," *http://www.ntia.doc.gov/ntia-home/net2/falling.html*. (Washington, DC, National Telecommunications and Information Administration, 1997).

[14]   U.S. Census Bureau, "Housing of American Indians on Reservations: Structural Characteristics," SB/95-10, April, 1995. Washington, D.C., U. S. Department of Commerce, 1995.

[15]   U.S. Census Bureau, "Population Projections of the United States by Age, Sex, Race, and Hispanic Origin: 1995 to 2050," P25-1130, *http://www.census.gov/prod/1/pop/p25-1130/*. (Washington, D.C., U. S. Bureau of the Census, February 1996).

[16] U.S. Census Bureau, "Table 53: Population Living on Selected Reservations and Trust Lands and American Indian Tribes with 10,000 or More American Indians: 1990," The Official Statistics: Statistical Abstract of the United States, 1998.

[17] U.S. Census Bureau, "Table 303: College Enrollment, by Selected Characteristics: 1980 to 1996," The Official Statistics: Statistical Abstract of the United States (1998).

[18] U.S. Census Bureau, "Table 328: Degrees Earned, by Level and Race/Ethnicity: 1981 to 1995," The Official Statistics: Statistical Abstract of the United States (1998).

[19] National Congress of American Indians. (Myrtle Beach, CA, October 17-23 1998).

[20] U.S. Census Bureau, "Housing of American Indians on Reservations: Plumbing," SB/95-9, April, 1995. Washington, D.C., U. S. Department of Commerce, 1995.

[21] U.S. Census Bureau, "Housing of American Indians on Reservations: Equipment and Fuels," SB/95-11, April, 1995. Washington, D.C., U. S. Department of Commerce, 1995.

[22] Racine-Myers, C., American Indian Higher Education Consortium, *http://www.fdl.cc.mn.us/pages/aihec/*, Alexandria, VA, 1999.

[23] Sturgis, Amy, "Tale of Tears," *Reason*, *http://www.reason.com/9903/fe.as.tale.html*, March, 1999.

[24] U.S. Census Bureau, "American Housing Survey," 1995. Washington, D.C., U. S. Department of Commerce, 1995.

[25] Division of Program Statistics et al., "Regional Differences in Indian Health," *http://www.tucson.ihs.gov/PublicInfo/Archives/Publications/Trends/Trends96/96RDpv.pdf*, Washington, D.C., 1996.

[26] Bureau of Labor Statistics, "Regional and State Employment and Unemployment (Monthly)," *http://stats.bls.gov/news.release/laus.nws.htm*. Washington, D.C., U. S. Department of Labor, May 1999).

[27] U.S. Census Bureau, "Statistical Abstract of the United States," *http://www.census.gov/statab/www/*. (Washington, D.C., U. S. Department of Commerce, April, 1995).

[28] Bureau of Economic Analysis, "1997 State per Capita Personal Income and State Personal Income," BEA 98-10, *http://www.bea.doc.gov/bea/newsrel/spi497.htm*. (Washington, D.C., U. S. Department of Commerce, April, 1998).

BIBLIOGRAPHY

●●●●●●

U.S. Supreme Court, "Morton v. Mancari," 417 U.S. 535, June 17, 1974.

O'Brien, Sharon, *American Indian tribal governments*, vol. 192 of, *Civilization of the American Indian* (Norman, OK: University of Oklahoma Press, 1989).

Pommersheim, Frank, "Tribal-State Relations: Hope for the Future," *South Dakota Law Review* 36 (1991): 239, 245.

The National Center for American Indian Enterprise Development, "Assessment of Infrastructure Needs in Arizona Indian Reservations," the Arizona Department of Commerce, 1999.

Paisano, Edna L., "The American Indian, Eskimo, and Aleut Population," in *Population Profile of the United States: 1995*, U.S. Bureau of the Census, Current Population Reports (Washington, DC: U.S. Government Printing Office, 1995).

Bybee, Shannon, "Responsible gaming: The bottom line," *The bottom line* 13, no. 6 (1998): 8-10.

Cray, Dan, "Navajo vs. Navajo," *Time* 152, no. 4 (1998): 4.

Jahrig, Shannon H., "Business on the Reservation," *Montana Business Quarterly* 35, no. 3 (1997): 15-16.

Grunewald, Rob, "Cranberries and New Factories Create Jobs for Red Lake Tribe," *Fedgazette* 11, no. 1 (1999): 10.

Directorate of Civil Works, "Planning Programs and Activities: Planning Assistance to States Program," *http://www.usace.army.mil/inet/functions/cw/*, U.S. Army Corps of Engineers, 1999.

Office of Research and Development, "Hoopa Valley Indian Reservation Transportation Plan 1996-2001," *http://ceres.ca.gov/planning/hoopa/transportation.html*, December 5, 1996. Hoopa, CA, Hoopa Valley Tribe, 1996.

Warm Springs Extension, "Home Economics Education," *http://www.orst.edu/dept/wsext/homec.htm*, Oregon State University, 1998.

Office of the Assistant Secretary for Planning and Evaluation, "Catalog of Federal Domestic Assistance, Program Target: Native American Organizations," *http://aspe.os.dhhs.gov/cfda/iben40.htm*, Washington, DC, U.S. Department of Health and Human Services, 1999.

U.S. Census Bureau, "Counties ranked by American Indian population in 1997," *http://www.census.gov/population/estimates/county/rank/cori97.txt*, April, 1995. Washington, D.C., U. S. Department of Commerce, 1997.

U.S. Census Bureau, "Communications and Information Technology," in *Statistical Abstract of the United States* (Washington, D.C.: U. S. Department of Commerce, 1998), 569-586.

U.S. Census Bureau, "Census 2000 American Indian and Alaska Native Programs," *http://www.census.gov/geo/www/aian/aian.html*, Washington, D.C., U. S. Department of Commerce, 1999.

U.S. Census Bureau, "American Indian Heritage Month: November 1-30," *http://www.census.gov/Press-Release/cb98ff13.html*, Washington, D.C., U. S. Department of Commerce, 1998.

U.S. Census Bureau, "Foreign-Born Population Reaches 25.8 Million, According to Census Bureau," *http://www.census.gov/Press-Release/cb98-57.html*, Washington, D.C., U. S. Department of Commerce, 1998.

U.S. Census Bureau, "Education," in *Statistical Abstract of the United States* (Washington, D.C.: U. S. Department of Commerce, 1998), 158-205.

Dalaker, Joseph and Mary Naifeh, "Poverty in the United States: 1997," P60-201, *http://www.census.gov/prod/www/abs/poverty.html*, Washington, DC, U.S. Bureau of the Census, 1998.

Faber, Carol S., "Geographical Mobility: March 1996 to March 1997 (Update)," P20-510, *http://www.census.gov/prod/www/abs/mobility.html*, Washington, DC, U.S. Bureau of the Census, 1998.

Faber, Carol S., "Geographical Mobility: March 1996 to March 1997 (Update): Detailed Tables for Current Population Report P20-510," P20-510u, *http://www.census.gov/prod/www/abs/mobility.html*, Washington, DC, U.S. Bureau of the Census, 1998.

Savage, Howard A., "Home-Ownership Affordability," in *Population Profile of the United States: 1997*, Current Population Reports, (Washington, DC: U.S. Government Printing Office, 1998), 54-55.

U.S. Census Bureau, "Minority- & Women- Owned Business Enterprises -- 1992," *http://www.census.gov/csd/mwb/1992/*, Washington, D.C., U. S. Bureau of the Census, 1996.

U.S. Census Bureau, "Table 34: Resident Population by Race, Hispanic Origin, and State: 1997," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998).

U.S. Census Bureau, "Table 54: Social and Economic Characteristics of the American Indian Population: 1990," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998).

U.S. Census Bureau, "Table 327: First Professional Degrees Earned in Selected Professions: 1990 to 1995," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998): 202.

U.S. Census Bureau, "Table 919: Telephone Systems: 1985 to 1996," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998): 575.

U.S. Census Bureau, "Table 920: Telephone Communication - Operating Revenue and Expenses: 1990 to 1996," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998): 575.

U.S. Census Bureau, "Table 921: Cellular Telephone Industry: 1990 to 1997," *The Official Statistics: Statistical Abstract of the United States* *http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm* (1998): 576.

U.S. Census Bureau, "Table 922: Wireless Bureau Stations Authorized, by Class: 1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 576.

U.S. Census Bureau, "Table 923: Radio and Television Broadcasting Services—Finances: 1990 to 1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 576.

U.S. Census Bureau, "Table 924: Copyright Registration, by Subject matter: 1990 to 1997," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 577.

U.S. Census Bureau, "Table 925: Public Television Programming: 1984 to 1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 577.

U.S. Census Bureau, "Table 926: Public Broadcasting Systems—Income, by Source; 1990-1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 577.

U.S. Census Bureau, "Table 927: Cable Television—Systems and Subscribers: 1970 to 1997," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 578.

U.S. Census Bureau, "Table 928: Cable and Pay TV—Summary: 1980 to 1997," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 578.

U.S. Census Bureau, "Table 929: Cable and Pay TV—Revenue and Expenses: 1990 to 1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 578.

U.S. Census Bureau, "Table 930: Microcomputer Software Sales: 1995 to 1996," *The Official Statistics: Statistical Abstract of the United States* http://www.census.gov/prod/3/98pubs/98statab/cc98stab.htm (1998): 579.

The Center for Economic Development Research and Assistance, "A Marketing Research Study of Potential Target Markets for ATIIN, Inc.: Volume 1 - Tribes with Gaming Operations," December 12, 1995. Las Cruces, NM, College of Business Administration and Economics, New Mexico State University, 1995.

"National Native American Small Business Conference" (San Diego, CA, 1997).

"Tribal Healthcare 2000: Telecommunications and Telmedicine Conference and Trade Show" (San Diego, CA, 1997).

Hansen, Paulette, Madonna Peltier Yawakie, and Mel Yawakie, "Proceeding Excerpts July 1998" (paper presented at the National American Indian Telecommunication Workshop, Radisson Hotel, Albuquerque, NM, July 28 – 30, 1998 1998).

Minnesota AISES Professional Chapter Website, http://bioc02.uthscsa.edu/~yawakie/.

Yawakie, Madonna Peltier and Paulette Hansen, "Improving Tribal Telecommunication Service Levels and Telehealth," *http://aises.uthscsa.edu/~yawakie/SDP.html*, San Diego, CA, 1999.

Chandler, Ken, "Rural Utilities Service Check-list of How to Start a Utility with Government Financing" (paper presented at the Improving Tribal Telecommunication Service Levels and Telehealth, San Diego, CA, 1999).

Buchanan, Hank, "Rural Telephone Finance Cooperative" (paper presented at the Improving Tribal Telecommunication Service Levels and Telehealth, San Diego, CA, 1999).

Hall, Gabriel, "Identification of Business Partners & Financial Structures" (paper presented at the Improving Tribal Telecommunication Service Levels and Telehealth, San Diego, CA, 1999).

Rouleau, Michael A., "Testimony of Michael A. Rouleau, Vice President, Marketing for Enterprise Networking, US West Communications before the U.S. Senate Committee on Indian Affairs on Native American Business Development," April 21, 1999.

Stevens, A. J., "Overcoming Obstacles to Telephone Service to Indians on Reservations," Chandler, AZ, Presentation made to FCC by Citizens Communications and Navajo Communications Company, 1999.

Wiese, Charles G., *Overcoming the Obstacles to Telephone Service for Indians on Reservations* (Comments of General Manager of the Tohono O'Odham Utility Authority to the FCC: Comments of General Manager of the Tohono O'Odham Utility Authority to the FCC), Comments.

Woster, Terry, "Storm Warning: Don't rely on cellular phone to save you," *Argus Leader*, Wednesday, Nov. 26, 1997 1997.

Deloria, Vine, Jr. and Clifford M. Lytle, *American Indians, American Justice* (Austin, Texas: University of Texas Press, 1983).

Appendix A

SURVEY METHODOLOGY
●●●●●●

The purpose of administering the survey associated with this study was to assess the current state of technology infrastructure in Native communities. As with any survey, the primary concern is projectability of the results. To this end, a stratified random sampling design was used. The following summarizes the preliminary model and compares it to the group returning surveys.

A-1. A Preliminary Model of Federally Recognized Native American Communities

Surveys were sent to all tribal communities including reservations, trust lands, tribal jurisdictional areas, rancherias, colonies, and Alaskan villages that are under the jurisdiction of federally recognized Native American tribes, nations, bands, corporations, or other entities. The primary concern was that all Native communities be represented.

The primary source of Native American tribes was Indian Entities Recognized and Eligible to Receive Services from the United States Bureau of Indian Affairs [4]. The primary source of information about Native American communities was Tiller's Guide to Indian Country [12]. For the most part, the two sources are in close agreement. The general exceptions are in Alaska and California, probably due to the fact that many entities have been recognized in those two states in the three years since Tiller's Guide was published.

In most cases, each community represents a single entity, and vice-versa. There were approximately ten exceptions. If several locations were governed as a single unit, they were considered parts of a single community, but if each location has its own government, it was considered separate, even if confederated. The model contained 559 distinct Native American communities.

●
●
●
●
●

A.1.1. Stratification of the Preliminary Model

The community model was stratified along four dimensions: 1) total community population; 2) type of land ownership; 3) configuration of land; and 4) total land area.

Total community population includes both Native American and non-Native American residents. This reflects the size of an infrastructure problem in terms of number of potential users on lands under the jurisdiction of the entity in question. In most cases, this number is stated in Tiller's Guide. Total community population was estimated for those communities without census values in Tiller's Guide on a case-by-case basis. Estimated total community population was broken into four stratum, as shown in Table A.1. Note that although stratum 1 consists of only 22 communities, it accounts for 78 percent of the population in all eligible communities. Conversely, although stratum 4 accounts for over 40% of the communities in the study, it includes less than 1% of the population.

Total Community Population

TABLE A.1: Native American Communities and Population by Population Strata

| Stratum | Range | Communities | | Estimated | |
		Total	Resp	Total Pop.	Percent
1	10,000 or more	22	4	1,678,657	78.4
2	1,000 to 9,999	108	15	355,309	16.6
3	200 to 999	191	11	88,452	4.1
4	0 to 199	238	18	19,552	0.9
	Totals	559	48	2,141,970	100.0

Table Note

Each table displays the total number of communities and the number of communities which responded to (resp.) surveys in each stratum.

Type of Land Ownership

The degree to which a Native American government can install and manage technology infrastructure depends on the degree to which it has jurisdiction over its land area. Therefore the grouping of different types of ownership into stratum was made on the basis of possible difficulty establishing infrastructure. Four stratum were identified.

In stratum 1, the band, tribe, or nation owns land in a special status recognized by the federal government. This includes reservations, trust lands, rancheria, and colonies. In stratum 2 the land is not owned by the Native American government, but

by members in allotments or possibly fee simple. In stratum 3 the Native American government owns the land, but not with a special federal status. These include fee simple and state trusts. Stratum 4 consists of Alaska Native communities. The breakdown of the stratum is shown in Table A.2. Note that while the majority of communities are in stratum 1 or 4, over two-thirds of the population is in stratum 2.

TABLE A.2: Native American Communities and Population by Land Ownership Strata

| Stratum | Ownership | Communities | | Estimated | |
		Total	Resp	Total Pop.	Percent
0	No land	23	1	2,015	0.1
1	Reservation/Trust	204	15	361,363	16.9
2	Member-owned	85	9	1,460,726	68.2
3	No Federal Status	25	3	242,291	11.3
4	Alaskan Village	222	20	75,565	3.5
	Totals	**559**	**48**	**2,141,970**	**100.0**

Land Configuration

Land configuration was stratified into three levels with each successive level representing a higher degree of difficulty or complexity in establishing infrastructure. The first stratum includes communities that consist of a single contiguous area of land. Stratum 2 includes communities that consist of several separated areas of land. Stratum 3 includes communities that contain many separated pieces of land or are situated in more than one state. In the "checkerboard" configuration many plots within the community are owned by non-members. In Table A.3 note that although 85% of communities are contiguous, nearly 80 percent of the total population live on lands that are not.

TABLE A.3: Native American Communities and Population by Land Configuration Strata

| Stratum | Description | Communities | | Estimated | |
		Total	Resp.	Total Pop.	Percent
1	Contiguous	474	39	466,662	21.8
2	Several sections	39	4	898,668	41.9
3	Checkerboard /Multi-state	46	5	776,640	36.3
	Totals:	**559**	**48**	**2,141,970**	**100.0**

When considering total land area as shown in Table A.4, stratum 0 consists of all communities with either no statement of community area or a statement that the community owns no land area. It is proposed that some in this stratum may actually belong in one of the other stratum. Stratum 1 includes communities up to 10,000 acres, the size of a small town. Stratum 2 includes communities between 10,000 and 100,000 acres, the size of a moderately large city or small county. Stratum 3 includes communities between 100,000 and one million acres, the size of a moderately large county. Finally, Stratum 4 includes communities greater than one million acres in size, the size of a moderately large state.

TABLE A.4: Native American Communities and Population by Community Land Area Strata

		Communities			
Stratum	Area (Acres)	Total	Resp	Population	Percent
0	0	58	3	9,767	0.5
1	1 to 9,999	156	8	96,964	4.5
2	1,000 to 99,999	183	13	511,490	23.9
3	100,000 to 999,999	138	18	523,933	24.5
4	1,000,000 or more	24	6	999,816	46.6
	Totals:	559	48	2,141,970	100.0

A-2. Survey Instrument

The project team attempted to send a copy of the survey instrument to every federally recognized Native American tribe. Additionally, the team followed-up with telephone calls to a representative sample of 168 communities. A total of 48 usable responses were received at the time of this report. Responses received after the project deadline will be incorporated into the survey summary posted on the project web page. The survey instrument is reproduced on the following four pages.

Technology Infrastructure Study
Native Communities Focus

Introduction

The purpose of this survey is to assist the federal government in shaping policy and developing funding plans for building technology infrastructure in native communities. Ultimately, the findings from this survey will become a portion of a report submitted to the White House. Responses to this survey will remain confidential, no individual or group will be directly associated with any specific response. Therefore, please feel free to add any comments. Use additional paper if necessary. When finished with the survey, either mail the survey back to the address on the last page, fax to (505) 646-2976, or send as an email attachment to tech@alpha.nmsu.edu   If you have any questions with regard to this survey, please call Marie Madrid at (505) 646-4923 or email your questions to: tech@alpha.nmsu.edu

In this survey, the term "Native American" is used to describe both American Indian and Alaskan Native populations. "Community" refers to the land area under the jurisdiction of your Tribal, National, or other Native American government. Please answer all questions in this survey with respect to your Tribe, Nation, Village or Community**.**

Respondent Name _____

Title _____

Tribe, Nation, Village or Community _____

_____

Department _____

Address _____

Phone Number _____

Email _____

Total community population _____

Native American Population _____

Community size: _____ ☐ Acres ☐ Sq. Miles

Percent of adults with high school diploma _____

Unemployment rate _____

Per capita income _____

Technology Infrastructure Questions

1. For each of the items below, please indicate to the best of your knowledge, what percentage of homes, businesses, schools and health care providers (hospitals, clinics, etc.) within your community possess the following:

	Percentage of Native American Homes with...		Percentage of Businesses with...	Percentage of Schools and Libraries with...	Percentage of Health Care with...
	Areas with 2,500 pop. or more	Rural			
Basic Telephone					
Single Party Telephone					
Electricity					
Utility - Water					
Utility - Sewage					
Gas, Oil or Propane					
Cable Television					
Computer					
Internet Access					

2. There are many different ideas about exactly what the term "technology infrastructure" means. In your opinion, what does "technology infrastructure" in native communities mean to you?

_____

_____

_____

_____

_____

_____

_____

3. Please list the three most important areas of technology infrastructure for your tribe.

1. _____

2. _____

3. _____

4. If you were given one million dollars to spend on building the following infrastructure areas for your tribe, how and where would you allocate the money?

(For example, you might spend $500,000 on distance learning, $250,000 on telecommunications and $250,000 on housing.) Write in your allocations next to each category.

Infrastructure Area	Allocation of $1 million dollars
Water	$_____
Roads	$_____
Electricity	$_____
Housing	$_____
Telephones	$_____
Waste water technology	$_____
Medical/health facilities	$_____
Law enforcement	$_____
911 Emergency services	$_____
Utilities (gas, oil, fuel)	$_____
Distance learning	$_____
Education	$_____
Internet access	$_____
Other_____	$_____
Total	$ 1,000,000

5. What do you see as the five greatest barriers or challenges that your tribe faces in developing a technology infrastructure? And what type of strategy, idea or policy reform might address that challenge or barrier?

Barriers or Challenges to Technology Infrastructure Development	Strategy, idea or policy reform that would address the challenge or barrier
1.	
2.	
3.	
4.	
5.	

6. What types of initiatives or projects are presently underway with your tribe that are contributing to building a technology infrastructure? Can you briefly describe three specific projects? Who is backing or funding the project? (For example, BIA, tribe, USDA, IHS, RUS, USF, EDA, etc.)

Project 1:	Backing or funding
Project 2:	Backing or funding
Project 3:	Backing or funding

7. What types of infrastructure are needed in your tribe to strengthen the following areas?

Area	Types of Needed Infrastructure
Education (K through 12)	
Industrial development - manufacturing	
Cultural preservation	
Business development services, retail, financial	
Economic prosperity	
Quality of life	
Self-determination	
Workforce training	

8. How would you evaluate where (your tribe, community....) is at present for the following areas on a scale of 1 to 5 corresponding to the following measures?   Please circle the number that most closely represents the infrastructure state for your tribe.

1 — No infrastructure in place
2 — Poor infrastructure in place: Bare minimum
3 — Fair infrastructure in place:
    Adequate for most purposes
4 — Good infrastructure in place:
    Adequate for all but the most extreme purposes
5 — Excellent infrastructure in place:
    Could not be better

	No Infrastructure		Excellent Infrastructure		
Distance learning	1	2	3	4	5
Water	1	2	3	4	5
Roads	1	2	3	4	5
Electricity	1	2	3	4	5
Telephones	1	2	3	4	5
Waste water facilities	1	2	3	4	5
Internet access	1	2	3	4	5
Medical/health	1	2	3	4	5
Law enforcement	1	2	3	4	5
Industrial parks	1	2	3	4	5
Education/training	1	2	3	4	5

9. Please indicate which of the following services are available in your community and place an "X" in all of the boxes that describe the type of ownership for each of these services.

	Fully Owned by the Tribe	Partially owned by the Tribe	Not owned by the tribe	No service available
Electricity				
Water/sewage				
Local newspaper				
Broadcast radio				
Telephone				
Cellular telephone service				
Pager service				
Cable television				
Direct broadcast satellite television service				

	Fully Owned by the Tribe	Partially owned by the Tribe	Not owned by the tribe	No service available
Emergency transport				
911 service				
Manufacturing operations				
Industrial parks				
Construction companies				
Other _____				

10. On average, what is the typical installation cost for the following services?

Telephone	$ _____
Cable television	$ _____
Internet access	$ _____

11. On average, what is the typical monthly cost for the following service?

Basic Local Telephone	$ _____
Long-distance Telephone calls within the community.	$ _____
Cable television	$ _____
Internet access	$ _____

12. What is the average waiting time, (in days), for each of the following services?

Telephone	_____ Days
Cable television	_____ Days
Internet access	_____ Days

13. Does your tribe have any of the following plans or programs in place?

Technology infrastructure plan	□ Yes □ No
Telecommunications plan	□ Yes □ No
Strategic plan	□ Yes □ No
Economic development plan	□ Yes □ No
Technology training plan	□ Yes □ No
Land use plan	□ Yes □ No

14. What programs, plans, groups, individuals or agencies would you say are the greatest "facilitators" of building a technology infrastructure for your tribe? (For example, the universal service fund, the rural utilities service, Indian Health Service programs, innovative tribal council, etc.)

_____
_____
_____
_____
_____
_____

15. Is there anything else that you would like to add concerning building a technology infrastructure for your community that hasn't been covered in this survey? (Please add additional paper if necessary.)

_____
_____
_____
_____
_____
_____
_____
_____
_____

Thank you so much for your participation in this survey.

If you desire a copy of the survey results, please check here:

□ Yes, I am requesting a copy of the survey results. Please indicate your mailing address:

□ Use the address on the first page of the survey.

Use this address:

Name:_____ Title_____

Address_____

Return this survey to:
New Mexico State University/Linda Riley
College of Engineering
MSC 4230, Las Cruces, NM 88003

SUMMIT MATERIALS

●●●●●●

B-1. Summit

***Ms. Lesley Kabotie,
Summit Facilitator***

The Technology Infrastructure Summit was convened in Las Cruces, New Mexico on March 25th and 26th, 1999. A distinguished group of Native American experts attended the summit. In an intense two-day workshop format, these participants presented, discussed, debated, and documented challenges and barriers to technology development as well as policy changes that could facilitate technology infrastructure development and deployment in Native communities.

Materials from the workshop are replicated in the following pages. Ms. Lesley Kabotie facilitated the group discussions during the first day of the summit. Dr. Perry Horse facilitated the second day of discussions and the working groups.

B-2. Expert Panel Biographies

George Baldwin

Dr. Baldwin received B.A. degrees in Psychology and Sociology from Northeastern State University in Tahlequah, Oklahoma. He earned his Masters degree in Indian Manpower Economics and his Ph.D. in Sociology from Oklahoma State University. He is presently a Professor and Faculty Planner at California State University Monterey Bay. At CSUMB, he is Director of the Institute for Community Networking, the American Indian and Alaska Native Census Information Center and executive planner for the Social and Behavioral Science Center.

Victor A. Chavez

Mr. Chavez is currently the Manager of the New Ventures, Entrepreneurial, and Regional Economic Development Programs for Sandia National Laboratories. Mr. Chavez holds a Bachelor degree in University Studies with a Concentration in Economics from the University of New Mexico. Mr. Chavez also has a Masters in Public Administration from the University of New Mexico and is currently obtaining an Executive Masters in Business Administration.

Bob Cita

Mr. Cita received his B.S. in Computer Science from the University of Colorado at Boulder. He is currently Director of Information Services with Southeast Alaska Regional Health Consortium (SEARHC). SEARHC is a non-profit Native-administered health corporation providing health care services to Alaska Natives and American Indians.

William DeHaas

Mr. DeHaas is a member of the Otoe-Missouria Tribe of Oklahoma and is presently employed as the Tribal Planner. He is a graduate of the University of Kansas, Lawrence. Mr. DeHaas is presently involved in Strategic Planning, Land Reform, and developing a Class II gaming enterprise.

Robert Gemmell

Mr. Gemmell is the Manager of Information Systems and a member of the Suquamish Tribe on the Port Madison Indian Reservation near Seattle.

Petuuche Gilbert

Mr. Gilbert is the Pueblo of Acoma Realty Officer and a tribal councilman for Acoma Pueblo. He has been involved in tribal economic and community development for over 20 years.

Desmond D. Jones

Mr. Jones is a Central Office Engineer for the Navajo Communications Company. He is from Rock Point, Arizona. He holds a B.S. in Electrical Engineering Technology from Arizona State University.

Rex P. Kontz

Mr. Kontz is an Acting Manager for the Engineering and Technical Services Division of the Navajo Tribal Utility Authority, "an Independent Enterprise of the Navajo Nation." He is presently a member of the Navajo Nation Health Care Design Team, a twenty-member task force that is working to formulate a plan to contract the U.S. Indian Health Care System from the Federal Government on the Navajo Nation.

Tim McGee

Mr. McGee is a native Oklahoman and a member of the Cherokee Nation. He is presently Acting Manager of Information Systems/Network Administrator for the Cherokee Nation of Oklahoma. In 1982, Mr. McGee received a B.S. from Northeastern State University in Chemistry with a Mathematics minor and a B.S. in Biology, with a Zoology emphasis.

Thomas G. Pagano

Mr. Pagano is a founding owner of Johnson, Stone & Pagano, P.S. He is a Certified Public Accountant and a Certified Valuation Analyst with the National Association of Certified Valuation Analysts. He is also a certified estate planner. He received his B.S. in Commerce from the University of Santa Clara in 1973.

Kenneth E. Robbins

Mr. Robbins is the President for the National Center for American Indian Enterprise Development. He has a B.S. degree in Finance from Arizona State University and over 20 years of management and technical assistance experience. Ken is an enrolled member of the Standing Rock Sioux Tribe.

Randy Ross

Mr. Ross is the Executive Director of the Indian Center, Inc. in Lincoln NE. His education includes undergraduate training at the University of South Dakota, Vermilion, SD 1974-76, Black Hills State College, Spearfish, SD 1979-1982 and Oglala Lakota College, Rapid City, SD 1986-1993.

Roy Sahali

Mr. Sahali is the Tribal Connections Project Manager for a joint project by the National Library of Medicine and University of Washington.

Daniel Sanchez

Mr. Sanchez is a former leader for the Pueblo of Acoma tribe, where he served as the tribal secretary. He is a realtor with Centerfire, Inc. and currently a lobbyist for the tribe with state and federal governments.

Pat Spears

Mr. Spears is President of the Intertribal Council on Utility Policy. The Council is actively involved on a national level with highlighting and promoting policy affecting tribal utility concerns.

John Tahsuda III

Mr. Tahsuda is acting general counsel for the Oneida Indian Nation. Mr. Tahsuda received his J.D. with a specialization in International Legal Affairs from Cornell Law School in Ithaca, New York and his B.S., in Business Administration in 1990 from Oklahoma State University.

Emily Ipalook Wilson

Ms. Wilson presently holds the position of special assistant to the administrator of Samuel Simmonds Memorial Hospital. She is involved with the Arctic Slope Native Association and the Tribal Connections Project.

B.2.1. Principal Investigators' Biographies

Linda A. Riley

Dr. Riley presently holds a faculty position in the Department of Industrial Engineering at New Mexico State University. She received her M.S.I.E. and Ph.D., from NMSU in 1997 and 1993, respectively. She also received her M.B.A from Suffolk University in 1982 and her B.S.B.A. in Marketing from Boston University, 1978. Dr. Riley has extensive experience working with Native American tribes in the areas of design and coordination of planning, economic development master planning, and enterprise evaluation.

John Mullen

Dr. Mullen presently holds a faculty position in the Department of Industrial Engineering at New Mexico State University. He received his B.A., in Mathematics from the University of Pennsylvania in 1968, his M.S. in Industrial Engineering from Iowa State University in 1984 and his Ph.D. in Industrial Engineering from Iowa State University in 1994.

Bahram Nassersharif

Dr. Nassersharif is presently Department Head and Professor of Mechanical Engineering in the College of Engineering at New Mexico State University. He received his B.S. in Mathematics from Oregon State University in 1980 and his Ph.D. in Engineering in 1983 also from Oregon State University. He has extensive experience in design, management, implementation, and systems integration of advanced information and high-performance computing and networking technologies.

B.2.2. Summit Facilitators' Biographies

Perry G. Horse

Dr. Horse is a Senior Associate with MDC, Inc., Chapel Hill, NC. He received his B.S. in Commercial Studies from Haskell Institute, Masters in Education from Harvard University and his Ph.D. in Higher Education from the University of Arizona.

Lesley J. Kabotie

Ms. Kabotie, a member of the Crow Tribe, and currently provides consulting services in education and training development, facilitation services and strategic planning through the Alire Group in Denver, Colorado. She is pursuing a Masters Degree in Non-Profit Management at Regis University.

FIGURE B.1: Panel of Experts from left to right (*standing*) Bahram Nassersharif, Pat Spears, Victor Chavez, Daniel Sanchez, Rex Kontz, Roy Sahali, Bob Cita, Desmond Jones, Tim McGee, Randy Ross, Linda A. Riley, (*sitting*) William DeHaas, George Baldwin, Robert Gemmell, Ken Robbins, Emily Ipalook Wilson, Petuuche Gilbert, Thomas Pagano, John P. Mullen. . Absent from the picture is John Tahsuda.

Panel of Experts
Native Technology Infrastructure Summit

Las Cruces, New Mexico
March 25-26, 1999

George Baldwin
Professor of Social and Behavioral Science
California State University-Monterey Bay
100 Campus Center, Bld 17
Seaside, CA 93955
George_Baldwin@monterey.edu
(831) 582-3625 (voice)
(831) 582-3566 (fax)

Victor Chavez
Manager
Regional & Small Business Partnering
Department
Sandia National Laboratories
PO Box 5800, MS 1380
Albuquerque, NM 87185-1380
vachave@sandia.gov
(505) 843-4190
(505) 843-4175

Bob Cita, Director
Southeast Alaska Regional Health Consortium
SEARHC
3245 Hospital Drive
Juneau, AK 99801
bob@searhc.org
(907) 463-4085
(907) 463-4075 (fax)

William DeHaas
Tribal Planner
Otoe-Missouria Tribe
8151 Hwy 177
Red Rock, OK 74651
(580) 723-4466
(580) 723-4273 (fax)

Robert Gemmell
Information Technology Director
Sequamish Tribe of Washington
robertgemmell@hotmail.com
P.O. Box 64
Sequamish, Oregon
(360) 394-5234 (wk)

Petuuche Gilbert
Tribal Councilman
Acoma Pueblo
PO Box 309 Rt. SP30/SP32
Tribal Administration Bld.
Pueblo of Acoma, NM 87034
petuuche@aol.com
(505) 552-6604
(505) 552-6600

Desmond Jones
Central Office Engineer
Navajo Communications Company
PO Box 6000
Window Rock, AZ 86515
ddjones@czn.com
(520) 871-3745
(520) 871-3749 (fax)

Rex Kontz
Acting Manager
Engineering and Technical Services Division
Navajo Tribal Utility Authority (NTUA)
PO Box 170 North Rt. 12
Ft. Defiance, AZ 86504
rpkontz@ntua.com
(520) 729-6275
(520) 729-6241 (fax)

Tim McGee
Acting Manager of Information Systems
Cherokee Nation of Oklahoma
tmcgee@cherokee.org
(918) 456-0671
(918) 456-6485 (fax)

Thomas Pagano
Johnson, Stone & Pagano, P.S.
Certified Public Accountants
1501 Regents Blvd
Suite 100
Fircrest, WA 98466-6060
(253) 566-7070
(253) 566-7100 (fax)

Ken Robbins
President, National Center For American Indian
Economic Development
953 E. Juanita
Mesa, AZ 85204
naiedken@aol.com
(602) 545-1298
(602) 545-4208

Randy Ross
Executive Director
Indian Center, Inc.
1100 Military Road
Lincoln NE 60508
rross@tmn.com
(402) 438-5231

Roy Sahali
Project Manager
Tribal Connections Project
National Network of Libraries of Medicine
University of Washington (NN/LM)
Health Science Library
Box 357155
Seattle, Washington 98195-7155
rs@u.washington.edu
http://www.tribalconnections.org/
(206) 543-9253
(206) 543-8262
(206) 543-2469 (fax)

Daniel Sanchez
Tribal Consultant
Lands and Telecommunications
PO Box 309
Rt. SP30/SP32
Tribal Administration Bld.
Pueblo of Acoma, NM 87034
(505) 552-6604
(505) 552-6600

Pat Spears
President, Intertribal Council on Utility Policy
143 Lakeview Court
Pierre, South Dakota 57501
pspears2@aol.com
(605) 945-1905 (wk)
(605) 224-2520 (fax)

John Tahsuda
Deputy Attorney General
Oneida Tribe of NY
jtahsuda@aol.com
(315) 762-2898
(315) 361-6429 (fax)

Emily Ipalook Wilson
Special Assistant to Administrator
Samuel Simmonds Memorial Hospital
Arctic Slope Native Association
PO Box 1390
Barrow, AK 99723
ewilson@alaska.his.gov
(907) 852-4611
(907) 852-0357 (fax)
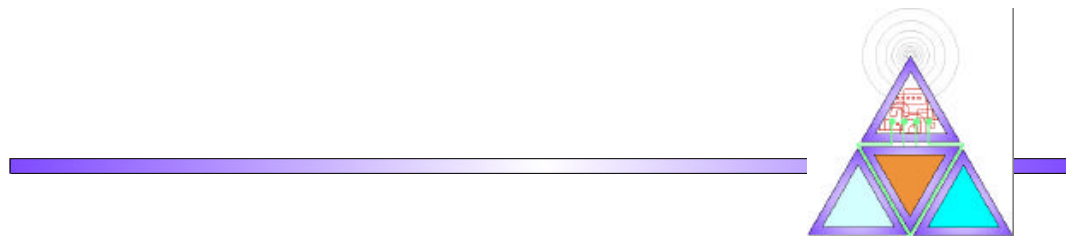
Appendix C

SUMMIT WORKING GROUP SUMMARY REPORTS

●●●●●●

Working groups were a major component of the Native Technology Infrastructure Summit in Las Cruces, New Mexico. Five groups and topical areas were identified based on discussion of priorities during the first morning of the summit. The working groups then met to discuss issues, challenges and barriers, and potential solutions.

The working groups considered the following topics

- Economic Development, Industry, and E-commerce
- Utilities, Roads, Water, and Waste Water
- Education-distance learning, culture and language preservation
- Telecommunications and Internet Access
- Medical Health and Telemedicine

The details of working group discussions are provided at the project web site (see Appendix D). Summaries of the key points highlighted by each working group is presented in this Appendix.

C-1. Economic Development/Industry/E-Commerce

Daniel Sanchez: Tribal Consultant, Acoma Pueblo;

Ken Robbins: President, National Center for American Indian
Economic Development;

Victor Chavez: Manager, Regional and Small Business Partnering,
Sandia National Laboratories;

William DeHaas: Tribal Planner, Otoe-Missouria Tribe;

Patrick Spears: President, Intertribal Council on Utility Policy

Participants

Key Points

- There is a need to encourage the private and public sectors, national laboratories, entrepreneurs, and tribal partnerships in technology business development in telecommunications and energy infrastructure.

- Tribal leadership is in need of technology education on the potential for increased efficiency in tribal services.

- Technology infrastructure is critical for successful economic development.

- Renewable resources involve undeveloped sources of energy for utilities on tribal lands.

- There is no existing organized planning program for telecommunications technology, energy generation, or tribal utility development.

- Water, waste water treatment, roads, and solid waste collection and disposal systems are in need of renovation and expansion to serve tribal populations and support economic development.

C-2. Utilities/Roads/Water/Waste Water

Participants

Bob Gemmel: Information Technology Director, Sequamish Tribe;

John Tahsuda: Deputy Attorney General, Oneida Tribe;

Rex Kontz: Acting Manager, Navajo Tribal Utility Authority

Key Points

- Right-of-way is a significant issue for the tribes. It is complicated by a bureaucratic process involving the tribal government and the BIA. The financial revenue from granting rights-of-way can be a significant economic incentive for the tribes. Negotiation of rights-of-way is complicated by a lack of a market value assessment system.

- The specific tribal needs for utilities, roads, water, and waste water require a significant amount of planning.

- A need exists for Code of Federal Regulations (CFR) revisions. The current CFRs do not adequately address the issues of jurisdiction regarding utility, road, water, and waste water.

- Historical events and agreements have governed much of the right-of-way negotiations for the reservations; e.g., railroad rights-of-way.

- A significant need exists for training and technical assistance.

- A "coordinating point" or clearinghouse for federal agency initiatives (loan programs, etc.) is needed to provide information to the tribes, including an orientation program for federal agencies to explain government-to-government relationships. This would remove duplication and redundancy.

C-3. Education/Distance Learning/Culture and Language Preservation

George Baldwin: Professor, California State University;

Emily Ipalook Wilson: Special Assistant to the Administrator, Arctic Slope Native Association

Participants

- An indigenous culture educational policy and resources for curriculum development (particularly in science and technology) is needed.

- Access and Internet connectivity for distance learning are of crucial importance to Native communities because of their geographical remoteness. Connectivity programs are needed that specifically address the needs of the Native communities.

- Information and media literature for Indian education and Indian programs (i.e., intellectual property rights and cultural appropriateness) are needed.

- Curriculum development programs that are culturally and linguistically appropriate are needed.

- Early childhood and cultural resource programs are needed. Programs that support multimedia display, and cultural repositories are also needed. Very little funding exists for these types of programs and they are very useful for education.

- Overall funding for educational programs is extremely limited in Native communities. Official tribal web sites (where content is controlled by the tribe) are needed.

Key Points

C-4. Telecommunications/Internet Access

Participants

Tim McGee: Acting Manager of Information Systems, Cherokee Nation;

Thomas Pagano, CPA, CVA, Telecommunications Valuation Consultant

Desmond Jones: Central Office Engineer, Navajo Communications Company;

Randy Ross, Executive Director, Indian Center, Inc.

Key Points

- Universal access (and USF) policy must treat the Native communities as equal to all other rural communities.

- A new policy initiative for the BIA schools is needed (similar to the Department of Education's Schools 2000 program). BIA is providing the funding to connect the schools but it needs to be expanded.

- Native libraries need funding for Internet connections. Education and training of the library and information technology staff is very important.

- Provide consultant services through the BIA (or IHS) to help educate the tribes. BIA is helping with schools only but is not helping tribal administration. In the Navajo Nation, the tribe is connected through the IHS network.

- There is overlap between the IHS and BIA Internet connection programs. A more integrated and unified approach would be more effective.

- Most tribes do not have an integrated plan for information infrastructure development. Assistance in strategic planning for information technology is needed.

- Technology can be a threat to traditional values and ways of life. It is important to also understand the culture and philosophies of the Indian nations.

- A disparity of access exists across the country–telecommunication companies do not invest in the tribes. Telephone companies engage in deployment red-lining in Native communities for advanced services.

C-5.   Medical Health/Telemedicine

Bob Cita: Director, Southeast Alaska Regional Health Consortium;

Roy Sahali: Project Manager, Tribal Connections Project

Participants

Key Points

- The physician's role is very different in telemedicine from traditional medicine. Telemedicine can't handle tactile practices of traditional medicine. Best applications for telemedicine include skin rashes and radiology.

- Regulations regarding telemedicine are complex. There is a very tedious application process.

- Eligibility of telemedicine for E-Rates is too narrowly defined.

- There is a need for additional trained technicians and tele-examination rooms in Native communities. Programs for training and education are needed; for example, train-the-trainer models.

- Connection bandwidth is very important in telemedicine. High-end application of telemedicine [e.g., magnetic resonance imaging (MRI) and real-time radiology] cannot be considered at 56K connection speeds.

- Federal funding (including USF) must allow for the creation, building, and maintaining of infrastructure.

- In Alaska, there is a problem with participation by local exchange carriers (LECs). Carriers will not make much money connecting hospitals with clinics over long distances. Telemedicine requires "big pipes," i.e., T-1 between sites.

- Telemedicine network infrastructure could be built by leveraging other networking projects (e.g., schools, libraries, DOI, military, Forest Service, Coast Guard, and National Park Service). Technology transfer from the defense industry can provide the needed encryption system.

- Develop public/private partnerships to provide managed health care via telemedicine. Tribes should determine what services are needed.

Appendix D

WEBSITE

●●●●●●

A Website for the project has been established at the following URL *http://alpha.nmsu.edu/~tech*

This site contains the latest project information and will continue to grow with additional information throughout the life of this EDA project. Figure D.1 shows the main screen on the home page. This final report can be found at the Website in PDF format.

The website also contains additional detailed information that was excluded from the final report for the sake of brevity.
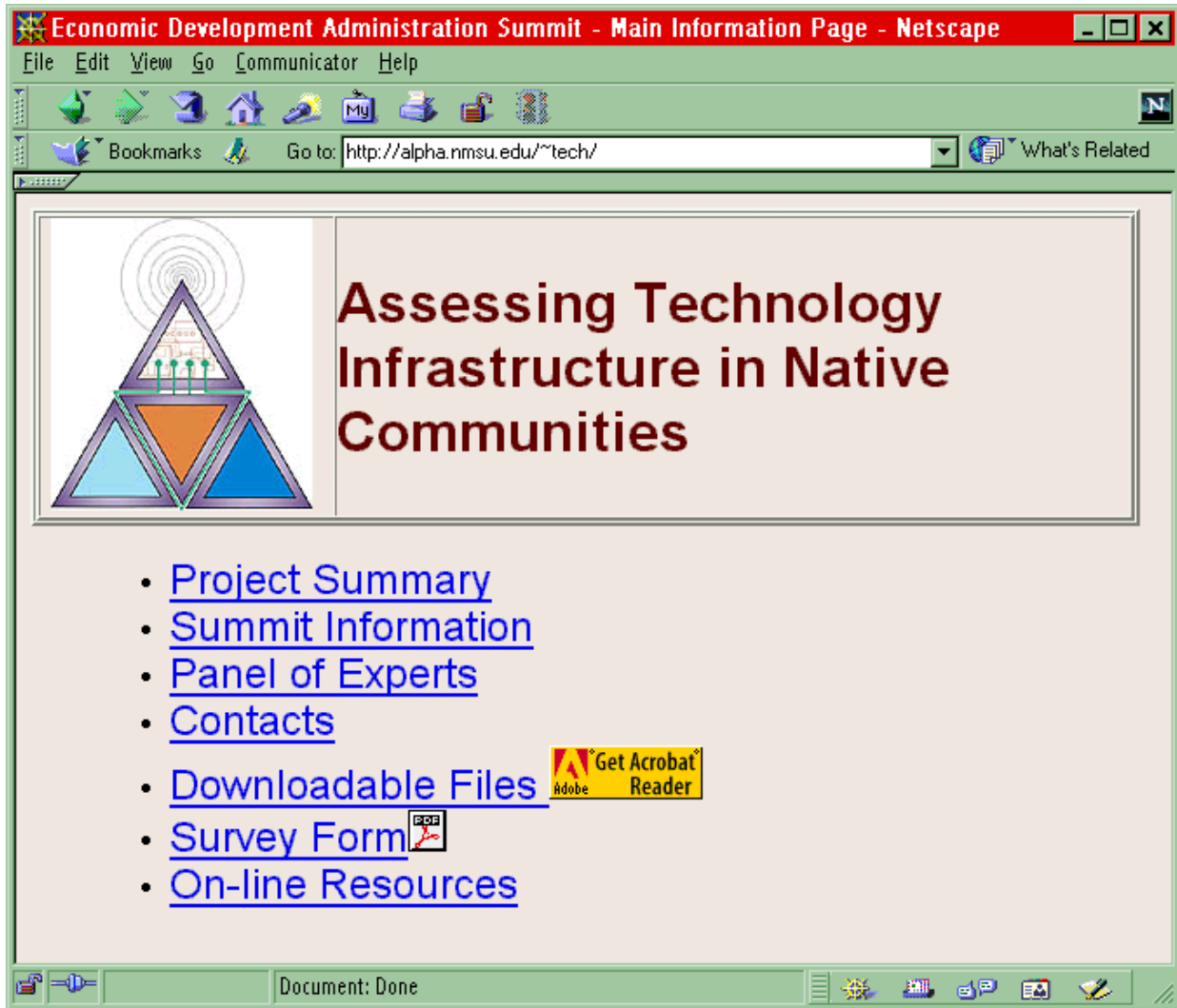
FIGURE D.1: Assessing Technology Infrastructure in Native Communities Website

INDEX

●●●●●●