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ABSTRACT

This report examines the role of the state in ensuring access to advanced telecommunications technologies by all Minnesotans and explores viable policy alternatives. Recommendations fall into four categories: access, affordability and competition, training and skills, and local initiative. Concerning access, the goal is for all Minnesotans to have access to affordable, advanced information infrastructure in 3-5 years. Recommendations for the state include setting standards of service, addressing the needs of hard-to-serve areas, creating incentives and removing barriers for rural service provision, and focusing on rural American Indian communities. The goal for affordability and competition is to protect consumers from monopolies where competition does not occur. Recommendations include eliminating barriers to competition, monitoring competition, and exploring public-private sharing of facilities. Regarding training and skills, the goal is for all Minnesotans to have the information and opportunity to use telecommunications and information technology. Recommendations include providing information on training opportunities, supporting training initiatives, attracting skilled instructors, supporting employee training, and ensuring the production of technology-literate students. Concerning local initiative, communities should have the information and opportunities to use communications technology to spur growth and improve the quality of life. Recommendations include teaching communities to link telecommunications to economic development, encouraging a proactive attitude towards telecommunications development, involving all parties in planning, and funding projects that might otherwise fail. Appendices present population changes, models of services used in rural settings, telecommunications survey maps, and fiber networks in Minnesota. (TD)

CENTER *for*
RURAL POLICY
and DEVELOPMENT

MINNESOTA STATE UNIVERSITY, MANKATO

MINNESOTA RURAL TELECOMMUNICATIONS INITIATIVE

Final Report and Recommendations Rural Telecommunications Policy Panel

Compiled by:
State and Local Policy Program
Hubert H. Humphrey Institute of Public Affairs

Seeking Solutions for Greater Minnesota's Future

Located on the campus of Minnesota State University, Mankato, the Center for Rural Policy and Development is a private, not-for-profit, research organization dedicated to the study of the social, economic and cultural forces that impact rural Minnesota. The Center's mission is:

> **"To provide state government and other policymakers an unbiased evaluation of issues from a rural perspective to benefit Minnesota."**

The Center for Rural Policy and Development respects a diversity of opinion and thought. As such, it solicits and supports research from a variety of rural policy perspectives. The contents and opinions expressed in this report reflect the views of the authors.

To learn more about the Center, its structure and its programs, contact us at:

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Rural Telecommunications Policy Panel
Final Report and Recommendations

February 2000

Center for Rural Policy and Development
Mankato, Minnesota

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Executive Summary

A Vision for Minnesota

We look to a time when all Minnesotans will have the opportunity to fully participate in the benefits of information-age technology.

For everyone to take full advantage of the new telecommunications technologies and information services, Minnesotans will have to have access to a reliable infrastructure with enough speed and capacity to handle all their telecommunications needs.

However, when it comes to a telecommunications policy in Minnesota, policy makers must understand that one size does *not* fit all. A policy that works to encourage competition in urban centers will not work the same way for rural communities, and could even hinder their access to high-speed telecommunications. A telecommunications policy that primarily benefits urban areas and leaves rural areas behind will adversely affect the long-term economic health of the state as a whole.

The Rural Telecommunications Research Panel has spent the last five months examining two questions:

- **What is the role of the state in ensuring access to high-speed advanced telecommunications technologies to all Minnesotans?**
- **What are some viable policy alternatives that the state can explore?**

The recommendations of this report fall into four categories: access, affordability and competition, training and skills, and local initiative.

Access

Goal: All Minnesotans should have access to affordable, "always-on," advanced information infrastructure for use with broadband applications in three to five years.

- **The state should define a standard level of service and the necessary standards for providing high-speed, broadband service.**
- **The standard should be able to float with changes in technology.**
- **The state should create a board immediately to identify hard-to-serve areas of the state and develop a strategy to address the needs of those areas.**
- **Create incentives, including a state Universal Service Fund, and remove barriers for telecommunications companies that want to build infrastructure and provide services in rural communities.**
- **Focus on the telecommunications needs of the rural Indian communities.**

Affordability and Competition

Goal: Competitive forces should help to generate affordable services and technological innovation, and in areas where competition may not occur, consumers should be protected from the effects of monopoly, particularly in the form of excessive costs or inferior services.

- **Barriers to competition should be eliminated throughout the state.**
- **The state should monitor competition by establishing a benchmark to assess the level of competition in markets throughout the state.**

- Explore creative approaches to public-private sharing of facilities.
- The state should not inhibit the integration of public and private uses along the same transmission lines.

Training and Skills

Goal: All Minnesotans should have the information and opportunities necessary to use telecommunications and information technology for business and workforce development, education, and community training.

- Broaden definition of "educational purposes" to include workforce development, business applications and community training.
- Develop a one-stop, statewide system to make information on training opportunities easily accessible to everyone.
- Support and publicize existing and emerging demonstration and applications training initiatives for community and business outreach.
- Develop programs to attract and retain skilled people to serve as instructors.
- Create incentives for employers to provide training to employees.
- Ensure that the K-12 and college systems within the state produce technology-literate students.

Local Initiative

Goal: Communities should have access to the information and opportunities needed to adopt successful models for community and economic development using communications technology to spur growth and improve quality of life.

- Help communities learn how to link telecommunications and information services to their community life and economic development.
- Encourage local leadership to have a long-term, proactive attitude toward telecommunications development.
- Encourage as many parties as possible to be included in the planning process.
- Public-private partnerships, including institutions and foundations, can offer support in the form of funding and information to fill gaps that might otherwise prevent projects from going forward.

Table of Contents

Acknowledgements

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A Vision for Minnesota

We look to a time when all Minnesotans will have the opportunity to fully participate in the benefits of information-age technology.

Introduction

One of the biggest issues currently facing policy makers, business people, educators, individual citizens and every other sector of society today is how to best harness the enormous potential of telecommunications and information services. Generally thought of only as "the Internet" or "the Web," telecommunications and information services actually span a spectrum of technologies, hardware, software and applications that are changing the way we think about using and sharing information. For everyone to take full advantage of these new technologies, Minnesotans must have access to a reliable infrastructure with enough speed and capacity to handle all their telecommunications needs.

Minnesota's legislators face a complicated task: rewriting the state's telecommunications statutes to deregulate the telecommunications industry and foster greater competition. Several bills will be introduced and considered, and it is likely that some sort of telecommunications policy will be drafted.

Further opening the industry to competition is considered the most efficient way to achieve lower prices, more services and better technology. Lawmakers must be aware, however, that when it comes to a telecommunications policy that encourages investment and expansion over all of Minnesota, one size does *not* fit all. A policy that works to encourage competition in urban centers will not work the same way for rural communities, and could even hinder their access to high-speed telecommunications. A telecommunications policy that primarily benefits urban areas and leaves rural areas behind will adversely affect the long-term economic health of the state as a whole.

The purpose of this report is to explain why rural is different from urban when it comes to the new deregulated telecommunications environment, and to make recommendations regarding how the state can help create a telecommunications environment that works for everyone. Policy makers will be entrusted with crafting the rules within which telecommunications and information services will function. The decisions made today will shape how this technology is used and by whom for years to come.

The Rural Telecommunications Panel, comprised of 13 individuals representing rural economic development, education, health care, state and local government, and the telecommunications industry, convened over the past five months to discuss the issues facing rural Minnesota concerning telecommunications. The result of these discussions is a list of recommendations on what the state can do to facilitate the expansion of advanced telecommunications infrastructure and information services in rural Minnesota. Those recommendations fall into four categories:

- Access
- Affordability and competition
- Training and skills
- Local initiative

Panel members hope that through these recommendations, they can raise awareness of many important factors

affecting the relationship between telecommunications and the well-being of Minnesota's rural communities.

Origin of this project

The Rural Telecommunications Panel is a project of the Center for Rural Policy and Development, based in Mankato. The Center was established in 1997, created by legislators who wanted a research center that could provide objective data on rural Minnesota to be used in support of legislation. Since its creation, the Center has become a not-for-profit. The center is not a lobbying or advocacy group, but a rural research group focusing on rural Minnesota, providing data at the state, county and local level.

The Humphrey Institute's State and Local Policy Program was engaged to conduct the necessary research to produce this report.

The Rural Telecommunications Policy Panel has spent the last five months examining two questions: what is the role of the state in ensuring access to high-speed advanced telecommunications technologies to all Minnesotans; and what are some viable policy alternatives that the state can explore.

Statement of purpose

The purpose of this project is to 1) identify the issues, including barriers and incentives, that affect the development of high-speed telecommunications in rural Minnesota; and 2) produce a paper that will inform policy makers on the rural issues that should be considered in drafting the state's telecommunications laws.

How the panel was formed

The panel members were chosen from a variety of groups involved in or with telecommunications and/or the rural development community. The panel members represent the telecommunications industry (wireline, wireless and cable), education, health care, municipalities, economic development, American Indian communities and state government. The group met this past fall and winter to develop a list of concerns about telecommunications in rural Minnesota and recommendations on what role state lawmakers and administrators can play in making sure the needs of rural Minnesotans are met.

The panel members are:

Mike Dashner, Minneapolis American Indian Center
John Fredericksen, International Falls School District & Minnesota Educational Technology Council
Ann Higgins, League of Minnesota Cities
Jane Leonard, Onvoy Telecommunications and Minnesota Rural Partners
Mike Martin, Minnesota Cable Communications Association
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Tim Tupy, Midwest Wireless
Mary Ellen Wells, Telemedicine coordinator for Allina Health Systems
Randy Young, Minnesota Association for Rural Telecommunications

Intended audience

The primary audience for this report is the Minnesota State Legislature, but we hope it will be useful for anyone interested in better understanding telecommunications issues from a rural perspective.

Background

There is growing concern over the decline of the economies and the loss of population in many of Minnesota's rural counties. To many, the apparent solution is to wire rural America up to the Internet and let the electronic revolution work its magic. This idea has validity.

Telecommunications technology is revolutionizing the way business is conducted. It is now possible for the smallest business (or the largest) to communicate with and conduct transactions with businesses and customers on the other side of the world, almost instantaneously. Telecommunications and its uses serve to eliminate what has been the biggest drawback to living and doing business in rural communities, the large distances that must be traveled and the costs in money and time that entails. Telecommunications can also be used in innovative ways in education and health care and other means to improve the quality of life in rural communities. Improved amenities and enhanced economic opportunities are key to helping communities retain and even attract new residents. Rural communities and individuals across the country are experimenting with projects to prove just that.

However, there is much more to this revolution than running a fiber line out to every one of Minnesota's small towns. As this report illustrates, there are economic and demographic forces at work in rural communities that make providing telecommunications services an entirely different ball game from providing services to urban populations. Furthermore, the health of rural communities is critical to the state as a whole. For that reason, policy makers must give individual attention to rural communities when addressing the redrafting of telecommunications laws.

Telecommunications reform

Minnesota has been rewriting various aspects of its telecommunication laws over the last few years, but the bulk of the state's statutes are still much as they were when they were written in the 1920s and 1970s. At that time, they were designed basically for heavily regulated monopoly providers.

New technology has made competition possible and the law needs to reflect these changes

The huge changes in telecommunications technology in the last 20 years have changed all that. Today telecommunications mean much more than phone service. New technology makes it possible for more than one company to provide local or long-distance phone service in one market, eliminating the need for monopolies. Today, more and more companies, including wireless and cable besides traditional wireline companies, are piling into the telecommunications market. Besides voice, there are also numerous ways to move data; familiar means are via e-mail and the World Wide Web. Cable and wireless companies are getting into the local and long-distance voice businesses, while traditional wireline companies are getting into all three systems. Over the years, electrical utilities have installed miles of fiber optic cable for their own communications uses, but now these companies are looking at ways to sell the capacity on their lines.

The federal government's former telecommunications laws, written mostly in the 1930s, could no longer keep up with the rapid changes in the telecommunications industry. The federal Telecommunications Act of 1996 was written to address these changes. The intention of the Telecommunications Act is to move the telecommunications industry from being heavily regulated to one that is

driven by competition. The hoped-for results are lower rates, innovative methods of providing service and the faster roll-out of improved services and technology as competing providers vie for customers. Now states are rewriting their telecommunications statutes to comply with the federal act. These rewrites, however, must be done while carefully considering the rural economic environment.

Policy changes could have a profound effect on rural communities

A good part of America's economic boom through the 1990s can be attributed to the increased productivity and efficiency that telecommunications and information technology have brought to almost every aspect of every person's life. But not everyone is benefiting from these changes. The latest report by the National Telecommunications and Information Administration on the "Digital Divide" in America points out that ownership of computers and access to the Internet correlate directly to income level. The lower a person's income, the less likely he or she is to have access to or use the Internet. Additionally, the report states, at almost every income level, households in rural areas are less likely to own computers and are significantly less likely to have home Internet access.[1]

Many states are working hard to get telecommunications infrastructure and services out to rural communities so the residents and businesses there can take advantage of the Internet. But because of the emphasis on competition, the Telecommunications Act of 1996 (and resulting state laws) could have serious repercussions for customers and providers in areas where the kind of supply-and-demand forces that are hoped for just won't work. The one comment heard frequently during the Rural Telecommunications research panel's discussions was that policy makers must be aware that "One size *does not* fit all." What this simple statement means is that the rules, regulations and deregulations that are currently being considered – at the state and federal level – may be an improvement for consumers in urban markets, but they could create serious disadvantages for rural consumers.

Current directions in telecommunications policy

Competition

The Telecommunications Act of 1996 emphasizes competition, but as stated above, some areas of Minnesota will not be able to attract competitors because of distance and low population density. These two factors result in real counter-incentives to potential telecommunications providers. Left alone, urban markets would probably fare all right in a deregulated, competitive telecommunications market. If one segment of the population is snapped up by a provider, there are plenty more potential customers to support other providers.

For rural markets, however, having a deregulated, purely competitive environment would mean providers will go where they can get the best return on investment, which would not be in sparsely populated counties and small communities. Or, in another scenario, competitive carriers could come into a community, cater to profitable business customers, those that will generate enough revenue for the provider, and strand the incumbent carrier or the carrier of last resort with the high-cost, low-revenue customers. It all depends on how the policy is written.[2]

Eliminating subsidies

Turning the markets over to competition also ensures the elimination, or at

least a serious scaling back, of subsidies in the telecommunications industry. Since the telephone industry started, regulators and providers have been aware of how the costs of providing service differ between groups. Cross-subsidies have been used to keep rates affordable for high-cost groups by charging higher rates to low-cost groups. Typically, funds have flowed from urban to rural, long distance to local and from business to residential. Particularly in the case of rural and urban customers, rates are averaged so that both groups pay approximately the same rate for the same service, regardless of what it really costs to provide that service to the individual customer.

Subsidies have been the traditional support of rural telecommunications providers. Without them, the cost of providing service would be prohibitively expensive for rural customers and their providers. To replace those subsidies, the federal government has established a federal Universal Service Fund, and every state is expected to establish a similar fund as well. The idea of universal service has been around almost as long as phone service itself. Universal service refers to providing basic phone service to as many people as possible. The mission of the Universal Service Fund, in replacing the subsidy system, is to level the playing field between high-cost and low-cost communities. Providers who provide these necessary services in high-cost communities can draw funds from the Universal Service Fund to help them provide services while keeping prices affordable for their customers.

Traditionally, the definition of necessary services has been basic telephone service, or basic dial tone. Today there is thought in many areas that necessary services should include at least some advanced telecommunications services as well.

Additional issues

Finally, there is an entire family of issues that must be addressed with the growing use of telecommunications and information services: security and privacy, taxation on electronic commerce, property damage and access for the disabled and low-income people. These issues are beyond the scope of this report, but they are as important to rural consumers as they are to urban, and they will only grow in significance.

The current state of telecommunications in Minnesota

A recent survey of telecommunications and cable providers by the Minnesota Department of Administration measured a number of indicators that show the extent of advanced telecommunications infrastructure and services in the state.[3] (See maps in Appendix C.) The survey documents that 91 percent of the exchanges in Minnesota have been equipped with digital switches, making it possible to transmit digital signals efficiently. CLASS services, which include calling features like call waiting, call forwarding, three-way calling and caller ID, are offered in 93 percent of the exchanges. Digital Subscriber Lines (xDSL), which uses the telephone company's copper lines to provide high-speed service to the customer's premises, is available in only 16 percent of exchanges, but is being deployed quickly.

The cable survey showed that 85 percent of Minnesota's cities are served by cable systems. Residents who want video programming in the 15 percent of communities that do not have cable service use a wireless video service like satellite. In the 599 cities with cable service, 234, or 33 percent, have or plan to have a 750 MHz cable system capacity, the minimum capacity needed to provide Internet access via cable. Broadband modem service is

Some telecommunications myths and realities

Myth: Building advanced telecommunications infrastructure and services will automatically fix an ailing community (the "silver bullet").
Reality: There are many factors that contribute to the decline of a community. For rural communities in particular, these factors include:

- Limited economic and social opportunities caused by distance and the increased costs of traveling. People may find themselves being forced or wanting to move to urban areas for higher paying jobs and more or better amenities.
- A local economy that is dependent on a single industry, such as agriculture. Having such an undiversified local economy puts the community especially in danger from any downturn in that industry.

These factors are as serious as the telecommunications infrastructure issue and must be dealt with just as earnestly.

Myth: There is a shortage of fiber in rural Minnesota.
Reality: The state Department of Administration's survey shows that there is much fiber available in Minnesota. (See Appendix D.) The challenge is the cost surrounding connections and end-user equipment, including such things such as the software that makes it possible to run advanced services over fiber. There is a need in this area to document market demand. This information can then be used to create a business case for provision of services -- either at for-profit levels, or cost-recovery basis.

Myth: Telecommunications companies are highly profitable, and that they could provide us with high-level services at low costs if they wanted to.
Reality: Providers need to ensure a certain return on their investment to take the initial risk of building more infrastructure and/or providing new or additional advanced services on that infrastructure. This is where a healthy dialogue and partnership between users and providers is helpful to outline the strength and potential strength of the marketplace.

Myth: Reliable security using wireless is not possible.
Reality: In order to stand up to the rigorous demands of business, a wireless network must provide powerful, reliable data security. Companies that wish to send confidential information over the wireless network must be confident that it will travel safely — unseen, unchanged, uncopied and intact. This security is achieved by using authentication, access control, confidentiality, and data integrity mechanisms. Central to a wireless network, or even a wireline network, must be the use of strong encryption, and digital certificates, all with proven interoperability.

Myth: Interactive television (ITV) learners don't do as well as learners in regular classes.
Reality: The majority of studies have shown no statistical difference. Generally, the ITV learners do a little better, though the difference is not statistically significant. There are many reasons for the difference: higher level of interest in the subject; people more attentive to those differences; interest in technology; interest (during high school) in leaving community; wanting to be different; acceptance of higher achievement. Traditional schools need not fear, however. Most learners tend to prefer traditional classes in a room with a teacher.

Myth: Telecommuting is only for the young.
Reality: Success as a telecommuter has very little to do with age. Much more important factors have to do with a person's ability to work outside the traditional office environment, to be self-directed and his or her openness to new technology. People of all ages have been trained and retrained to be successful telecommuters.

available in 109 cities, or 16 percent of the state's cities, and providers in another 18 percent plan to offer broadband modem service soon. Providers in 15 percent of cities with cable service plan to provide phone service.

In the wireless arena, it is now possible for wireless phones to send and receive data and access the Internet and World Wide Web. In addition, a number of exchanges in rural Minnesota have a wireless company offering competitive local phone service.

The benefits of telecommunications to rural communities

People and governments around the world are harnessing telecommunications technology to improve communications, economic potential and quality of life for those who live outside urban centers. Minnesota is no different. Many of Minnesota's western and southern counties are projected to lose upwards of 20 percent of their population in the next 20 years.[4] As young people with new college degrees and skills and families looking for better job opportunities and amenities move to the city, many people are seeing telecommunications technology as the silver bullet to save rural Minnesota's culture and keep these communities from becoming ghost towns.

We can already see some of telecommunications' effect on economic development, education, health care, and community networking. From a senior citizen at a community center in Winona who sends e-mail to family across the country to a firm in Blackduck that receives orders for specialized fabric production, telecommunications negates the characteristic that has always been a disadvantage to rural residents: distance.

In the past, distance acted as a buffer, protecting businesses in rural communities from competition. No more. Businesses are connecting to customers and other businesses around the world, and the businesses of rural Minnesota may soon find themselves competing with firms in Virginia or Ireland or India as much as the next county over. If Minnesota's businesses are to compete, they will need the infrastructure and services to search for customers in Ireland and India, too.

Telecommunications contains vast amounts of promise and potential for rural Minnesota, and so it cannot be ignored. But it is not a silver bullet, either. There are many myths associated with adopting advanced telecommunications infrastructure and information services. A few myths and their realities have been presented in the box on the opposite page.

There are numerous, urgent reasons to address rural telecommunications issues now. Rural communities need telecommunications infrastructure and information services for all the reasons urban communities need them, but rural communities need them uniquely to reduce the costs of distance. E-mail, distance learning programs, telecommuting, all greatly reduce the time involved in communicating across distances and offer up a large number of alternatives and opportunities to rural residents.[5]

Economic development

Probably the most commonly thought-of use for telecommunications in communities is economic development, a crucial issue to many rural counties. The isolation that used to protect businesses somewhat from outside competition has now become a handicap for those without the telecommunications access that has become so vital.[6]

The availability of telecommunications has become an important factor

for companies that are deciding where to locate. When it comes to the Internet and business, most people think of dot-coms and other attention-grabbing types of e-commerce. Businesses, however, have much broader and more basic applications for telecommunications. High-speed communications offers virtually every business, from an on-line book seller to a tool and die shop, new ways to communicate with customers and with other businesses. Being able to send orders, plans or product information over the Internet saves time and money. And because of what is known as "network effects," the more people who use the network, the greater the benefits are to everyone.

There are many places in rural Minnesota where people do not have the ability to access the high-speed telecommunications infrastructure or its services, and the basic phone network in place currently is not adequate for today's needs. Uses for telecommunications technology run the spectrum from voice, fax and e-mail to credit card verification, the Internet, online transactions and complex systems of just-in-time supplying, manufacturing and shipping. Even the most basic services require high-quality, high-speed systems. A digital voice transmission requires much more capacity than an analog voice transmission, and when the Internet slows to a crawl, it is virtually useless for business applications.[7]

Over the last few decades, many large companies have installed and use private networks to transmit data among branches and to specific customers. These networks, though, are expensive and inflexible: only those connected can use them, and it is difficult to add anyone else to the network. As access to the Internet has become more widespread and its speed and capacity has increased, a growing number of companies are conducting their business over the public switched network (the basic phone network) over which the Internet runs. Once a firm has access to the Internet, it can communicate with anyone else connected around the world.

And it is not just huge companies that use high-speed Internet access. Smaller, home-grown businesses are applying new telecommunications technology. One example is Burnsville-based Cross Consulting's venture in Sebeka, Minnesota. Cross Consulting opened a high-tech facility to produce software programming for Northwest Airlines and deliver the work over high-speed lines. The firm provides training opportunities and higher paying jobs for the local residents and the opportunity for skilled workers from the city to move into a small-town life. Because of the low cost of living in Sebeka and the low turnover of workers, Cross Consulting can deliver its services for at least 25 percent less than the standard market price, despite the higher costs for the high-speed lines.[8] Cross Consulting worked with various groups in the community, including the city, the local telecommunications provider, West Central Telephone, and the Security State Bank of Sebeka, to set up the facility.

Another potential use for telecommunications is telecommuting. In urban areas telecommuting is considered a way to reduce commuter traffic congestion and its resulting air pollution and to cut costs for firms by having employees work from their homes a few days a week. Some employers have found that telecommuting is a way to attract qualified employees during a labor shortage. Telecommuting in rural areas gives employers the ability to tap into a badly needed skilled work force hundreds or even thousands of miles away. Many young people in rural communities leave home for college and never return. Others may attend college in their communities

and learn valuable skills, then leave for the city and a job that pays more than one they could find at home. Through telecommuting, workers could have the opportunity of staying in a small town while putting their skills to use and earning a comparable paycheck.

Education

Telecommunications holds great potential for education, from preschool up through the state's colleges and universities. Especially for rural areas, telecommunications offers the chance for schools to pool their resources and draw on people with talents or experience who are not available locally. Examples would be conducting one class for students in several different locations at the same time, or having a person from Rochester talk to a class in Long Prairie using videoconferencing technology. This kind of technology can be especially useful for classes like specialized math and sciences or foreign languages.

Some of the ways telecommunications are used in Minnesota's schools include:

- *Traditional Internet access:* For student and staff research and staff communications. Some schools allow e-mail for students, while others restrict Internet use to specific applications like electronic language exchange training with students from other countries or speaking another primary language.
- *School administration:* Most rural schools conduct some or all of their payroll, finance, investment, attendance, enrollment, scheduling, discipline, state- and federally required reporting and other administrative tasks remotely. These lines are expensive and must be secure. Quality telecommunications access allows schools to make better decisions on local versus regional computer services in these important service areas.
- *Accessing remote information services:* Many schools use their telecommunications to give students access to remote information services. Minnesota has regional service cooperatives across the state to help disperse needed services and reduce local school district costs, but there are many schools that are one, two or three hours away from their regional service provider. A two-hour ride each way for an educational service visit is difficult, whether for the provider or the learner.
- *Interactive television:* ITV is an important use of telecommunications, providing specialized classes for thousands of learners across Minnesota. ITV is used around the world, although much of the rest of the world has non-interactive or partially interactive TV, where the student sees and hears the teacher but must call in on the phone to participate. Minnesota requires full-screen, real-time, total interaction, which means the transmission looks like normal television and people are constantly in view. ITV is used for meetings, staff training and learner consultations as well.
- *Linking to other institutions:* Telecommunications is used to link up with library and collegiate services for the purpose of sharing resources.
- *Communicating with the family:* Telecommunications are used to communicate with parents and learners for a broad spectrum of services, from daily announcements and attendance violations to away-game bus return timing and school lunch menus.
- *Exchanging ideas and data:* Learners use telecommunications to exchange data for projects. Some examples are the solar boat race and weather reporting.

Health care

Another emerging application is telemedicine. High-speed telecommunications make it possible for rural clinics and hospitals that lack specialists to transfer information and images and consult with doctors elsewhere, avoiding expensive and time-consuming travel. Telemedicine also allows hospitals and clinics to pool resources in places where they may have a difficult time maintaining staff and/or high-tech equipment.

Government and health care providers are becoming increasingly interested in the idea of telemedicine. In a recent survey by the Clinical Panel of the Science Advisory Board, those surveyed who used telemedicine said that the most important reason their institutions implemented telemedicine was to "deliver quality care to rural/underserved areas." Those who did not use telemedicine cited "availability of affordable technology" as their primary reason.[9]

In Minnesota, the biggest users of telemedicine in the state are Allina Healthsystems, the University of Minnesota, and the Mayo Clinics. The most common areas include: radiology, dermatology and wound healing, orthopedics, mental health, emergency medicine, rehabilitation, and cardiology. Physician and patient satisfaction and acceptance of the technology is extremely high.[10]

Minnesota-based Medtronic recently announced a new Patient Management Business partnership with Microsoft and IBM that will provide new computer-based systems to help physicians use the Internet to monitor people with chronic cardiovascular disease.[11]

However, there are two hurdles to overcome before the technology becomes widespread throughout the state. First, the cost of the networks and hardware must come down so they can be deployed in the exam rooms in clinics. Second, insurers must accept the use of telemedicine and be willing to reimburse for the care that is provided.

Community development

On-line services have implications for community building as well. Access to government services is an application being developed in larger cities, but it has strong potential benefits for rural areas. Giving residents the ability to pay fees and fines on line or apply for permits, comment on budgets and register complaints can increase participation in government by eliminating the need to travel great distances.

On-line forums can also give neighbors separated by distance the opportunity to discuss and better understand issues, while community web sites make it easier to communicate news about social events and other news important to the community.

What makes rural Minnesota different?

The United States Census Bureau defines "urban" as territory, persons and housing units in:

- Urbanized areas and
- Places of 2,500 or more persons outside urbanized areas.

An "urbanized area" is defined as one or more places and the adjacent densely settled surrounding territory (1,000 persons per square mile) that together have at least 50,000 persons. "Rural" is simply defined as territory, population and housing units not classified as "urban."[12]

For the purposes of this report, it would be more useful to define rural as "not urbanized areas," rather than "not urban." Urbanized areas -- population centers of 50,000 or more -- better represent what is thought of as urban in

this case. A city of 2,500 in western Minnesota may be technically "urban" for Census purposes, but it would probably not have the kind of population concentration or economies of scale comparable to a community of 50,000.

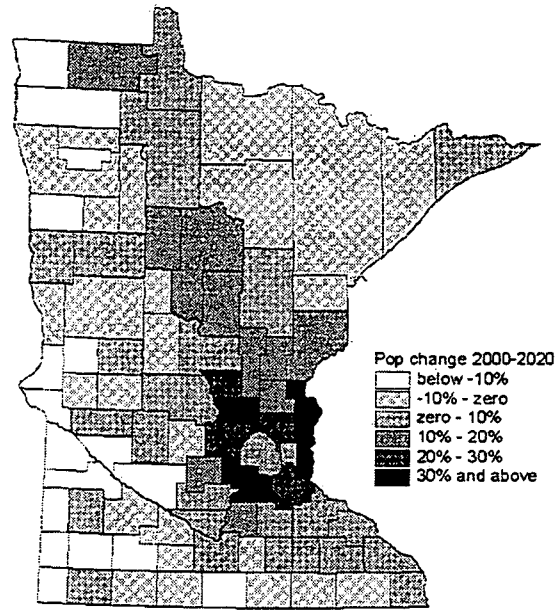
The population crisis

Like most of rural America, Minnesota's rural counties are facing an overall steady decline in population. The population of Minnesota as a whole is projected to increase from 4,375,099 at the last census in 1990 to an estimate of 4,805,970 for 2000, to 5,243,600 by 2020.[13] This growth is not expected to be evenly distributed around the state, however.

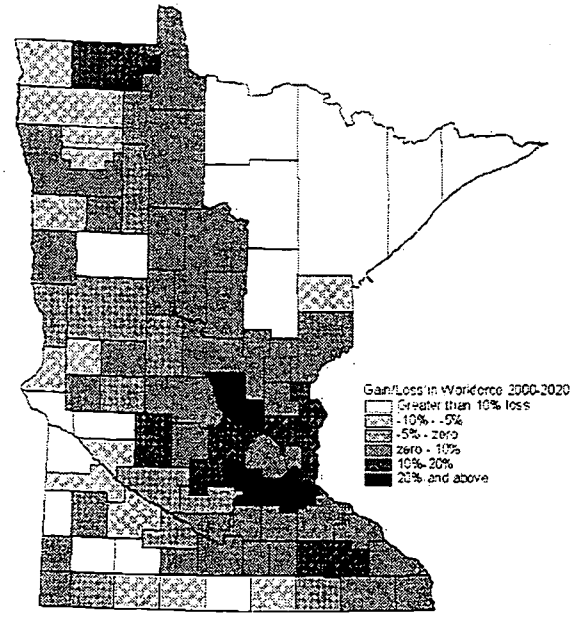
A look at the projections for population growth by county across the state (Map 1 and Table 3 in Appendix A) shows that the most intense population growth is expected to occur in the suburban ring around the core counties of Hennepin and Ramsey, especially in the corridor between the Twin Cities and St. Cloud. Some of the counties expecting increases are Anoka (24.8 percent), Washington (32.1 percent), Scott (41.9 percent), Carver (46.3 percent) and Sherburne (51.7 percent). More modest growth is expected from the Twin Cities southeast through Rochester, and from St. Cloud up through the central part of the state.

On the other hand, a dramatic decline in population is expected along the western and southern borders of the state. Some of these counties, which already contain as few as 5,000 residents, are projected to decline by as much as 20 percent in the next 20 years, including counties such as Big Stone, Lac Qui Parle, Lincoln and Yellow Medicine.

It is probably not a coincidence that the counties expecting the largest decrease in population are the counties



Map 1: *Estimated population change in Minnesota between 2000 and 2020. Data: Minnesota State Demographic Center, June 1998.*



Map 2: *Estimated workforce gain and loss in Minnesota between 2000 and 2020. Data: Minnesota State Demographic Center, June 1998.*

the most dependent on agriculture for their economies. Agriculture is one of two sectors (along with mining) that are expected to see a decrease in jobs; within the ag sector, only the occupations of farmer and farm worker are expected to decline, from 51,394 in 1996 to 46,336 by 2006.[14] People leaving the farms will account for some of the population increase in the Twin Cities-St. Cloud area and other population centers around the state.

Population projections are, of course, just that, projections, and they can be wrong in the end. Some counties sit on the fence: their growth projections are close enough to zero that their population could go up or down. Some counties, especially in west central Minnesota, have defied demographers by increasing their population in the last ten years. However, the long-range projections are based on large-scale trends such as past population migration behavior, and birth and death rates. While the final numbers may turn out to be wrong, the trends themselves very likely will prove to be accurate if nothing is done to shift them.

Factors affecting the deployment and use of telecommunications in Minnesota

Why is it harder to deploy and use telecommunications technology and services in rural communities than in urban ones? The reasons, which have to do with supply and demand, are diffuse, but three stand out: distance, low density and education.

Distance and low density

Distance has always been an issue for rural communities. The resulting isolation makes providing services difficult and isolates the people who live in the area from the rest of the world, from larger population centers, and from each other. The good news is that telecommunications and information services have the ability to virtually eliminate distance as a factor, both in time and cost. A document, a business plan, an order for parts or supplies that could take days to deliver in person or by mail can now be sent and received in minutes or even seconds. Such a savings in time and delivery costs increases efficiency and productivity.

The bad news, however, is that distance, as it raises the price of everything else, also raises the price of delivering telecommunications services. Signals are sent over wires, whether copper, fiber optic, or coaxial cable, and in wireless systems, towers need to be built. In rural areas there is the dual problem of needing more wire to reach fewer customers. A wireline, or "local loop," that runs from the homes and businesses in the telephone exchange to the exchange's central office switch (which connects the local loop to the outside world) is on average longer in rural exchanges than in urban ones. There also tend to be fewer customers per loop and per mile of wire, which means fewer customers to pay for more equipment. Data from the Federal Communications Commission, which collects information on the nation's largest telecommunications providers, and the Rural Utilities Service, which lends money to America's small rural telecommunications providers (Tables 1 and 2), shows some of the differences between large and small local exchange carriers.[15] (A term that will be heard frequently is "local exchange carrier," or LEC. These are the telecommunications providers for a particular local exchange. A large LEC is a very large company, usually national, like a former Bell company. They serve many local areas, but typically do not provide long-distance service between these areas. A small LEC is a small company, usually locally owned and operated. An incumbent LEC, or ILEC, is the incumbent

provider for that exchange. Competitive LECs, or CLECs, are any companies competing with the incumbent in that exchange.)

Nationally, the large local exchange carriers, mostly baby Bells, serve the most urban areas in the United States, while the small local exchange carriers serve the rural markets. As Table 1 shows, the biggest expense for both large and small providers is cable and wire. The other expenses are fairly similar, but small local exchange carriers spent almost 50 percent more on central office switching (the switches that route calls through the network) and nearly twice as much on cable and wire than large local exchange carriers did in serving their denser exchanges.[16]

Another cost-raising factor is that as the loop exceeds 18,000 feet in length, the quality of the signal being transmitted degrades. To keep the signal intact, the telecommunications provider must install loading coils and range extenders to boost the transmission. The farther the signal must travel from the source to the central office, the more equipment is needed to keep the signal intact. High-speed, high-capacity broadband signals, the kind used to transport advanced services such as data and video, begin to degrade over even shorter distances, 6,000 to 12,000 feet.

Ironically, loading coils and range extenders, which improve the quality of voice transmissions, actually interfere with data transmission by slowing it down and garbling it. Considering the common use of loading coils and range extenders in rural loops (the average loop length for RUS telephone companies in 1993 was 20,300 feet), they act as an obstacle to installing an advanced telecommunications infrastructure.[17]

Finally, not only distance, but the type of terrain can have an effect on costs. Hilly, mountainous or forested terrain will be more expensive to run lines through than a flat, sandy plain.[18]

All these factors result in higher costs to the rural provider, and higher costs are not an incentive that will attract com-

Table 1: *Comparison of investments in telecommunications facilities per subscriber for the United States.*

US	Large LECs Per subscriber	Small LECs Per subscriber
Land and support assets	$ 264.62	$ 385.72
Central office switching	$ 376.91	$ 568.73
Central office transmission	$ 370.95	$ 342.62
Information originating/ Terminating assets	$ 31.02	$ 24.23
Cable and wire facilities	$ 844.08	$ 1,591.19
Other	$ 18.53	$ 8.90
Total	$ 1,906.11	$ 2,921.39

Source of data: Rural Utilities Service, Federal Communications Commission.

Table 2: *Comparison of subscribers per mile of installed line and subscribers per switch, for the United States and Minnesota.*

US	Subscribers	Miles of line	Total switches	Subscribers per mile of line	Subscribers per switch
Large LECs	159,387,219	3,936,278.9	24,020	40.5	6,635.6
Small LECs	5,596,953	883,914.0	7,093	6.3	789.1
Minnesota	Subscribers	Miles of line	Total switches	Subscribers per mile of line	Subscribers per switch
Large LECs	2,546,843	59,258.4	196	43.0	12,994.1
Small LECs	368,243	70,119.0	535	5.3	688.3

Source of data: Rural Utilities Service, Federal Communications Commission.

peting providers. If the rates for services are to be based on actual costs of provision instead of a regulated rate supported with subsidies, as has been the tradition, those higher costs will be passed on to the rural customer.

Low population density is the other major factor affecting provision of services to rural customers. While urban areas can have hundreds or thousands of customers per square mile, rural areas have population densities in the double or single digits per square mile. Table 2 shows the difference in customers per mile of line and customers per switch for large and small local exchange carriers. This factor results in very low demand, with far fewer potential customers for the amount of equipment that must be installed to serve them. Telecommunications providers will not have the incentive to invest in an area with demand so low that they will not see a return on investment.

The population of Minnesota's western and southern counties is low and expected to get lower, while the suburban ring around the Twin Cities is expected to mushroom. Overall demand in a given area will be higher in places with higher population. Telecommunications providers, making rational business decisions, can be expected to compete for these well-populated and lucrative markets first, and therefore, the benefits of competition, lower prices and newer technology, will happen there first.[19] Demand is very important in establishing a telecommunications infrastructure. Telecommunications providers, which are businesses, must be able to make a return on their investments in equipment and services. If they do not feel there is enough demand to support these services, or there won't be in the future, they can't make the investment.

Education: Flight of the young and skilled

Many of the people who will be leaving the state's rural counties are young residents. Minnesota Planning projects that some counties could lose as much as 40 percent of their workforce between the ages of 16 and 44.[20] (See Map 2.)These people are the most likely to be skilled in the use of new technology and its applications, whether in computers, telecommunications or manufacturing. With no shortage of jobs for skilled workers in population centers like the Twin Cities, young people have been gravitating toward the higher pay and higher amenities of cities.

These people, however, are precisely the people who are needed in rural communities to help take advantage of advanced telecommunications and information services. One of the biggest problems for rural communities today is that new businesses, besides wanting a telecommunications infrastructure, also want a skilled workforce. As skilled workers leave the community, they not only shrink the labor pool, they also shrink the number of people who could train other potential workers, and it has become extremely difficult to attract instructors to rural Minnesota communities.

Another problem is that people in rural communities may have no idea of what advanced telecommunications could do to help them, and if they do have an idea, they may not know where to start. Trained individuals can help educate the rest of the community on how best to use telecommunications.

Rural communities with residents who have experience with advanced technologies tend to demand it more, while those who do not have experience with it tend to demand it less. This in turn lowers the demand for these services

further, giving a telecommunications provider even less incentive to install advanced telecommunications infrastructure and services. It also causes communities not using telecommunications technologies to fall behind even further.[21]

The special problem of rural Indian communities

America's Indian communities face special problems concerning infrastructure and competition. While the average rate of basic telephone service penetration across the United States is estimated to be 94 percent (on average 94 percent of American households have at least one phone), phone penetration in tribal communities averages 40 to 55 percent. In some communities it is estimated to be as low as 10 to 25 percent. At a Federal Communications Commission hearing in New Mexico in January 1999, Indian nation leaders testified that tribal communities often had few lines coming in and phone service was very basic, busy, slow and unreliable.[22] Requests for service have been known to take months or even years, and those making the requests are quoted prices in the thousands and tens of thousands of dollars.

Indian communities share the same dilemmas as other rural areas: their remoteness and isolation increase the costs of installing hardware and providing service. However, these problems appear to be compounded by acute, persistent poverty, lack of information about special programs and complex rules made more complex by the Indian nations' sovereign status and their special relationship with the federal government. Besides the long waits and high prices, some other issues cited at the hearing include:

- Telecommunications companies have run fiber optic backbones near or through tribal lands, even near Indian communities, but these communities are not able to tap into these lines.
- Some tribal communities were able to use special programs to get a few lines into their libraries and schools for Internet access, but they then had to carefully ration anyone else's access (i.e., police or administration) so as not to tie up the lines.
- Local calling areas are very small, making a call to a neighboring community (long distance) very expensive.
- Lack of access has been not only bad for business development, but also creates serious problems in emergencies. People are forced to travel miles to find a telephone to dial 911.
- Many residents are unaware of federal programs that subsidize phone service for low-income customers.

Adding to the problem is a bureaucracy special to American Indians that has evolved over the years. Because of their sovereign status, American Indians often have a different system of laws and their own set of federal agencies to deal with. According to an extensive study on telecommunications and American Indians,

> "federal agencies with major responsibility for telecommunications policy, such as the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA), have not applied Indian law to telecommunications policy. The federal agencies with lead responsibility for Native programs, such as the Bureau of Indian Affairs (BIA), Indian Health Service (IHS), and Administration for Native Americans (ANA), do not have a Native American telecommunications policy."[23]

It was suggested during the New Mexico FCC hearing that the concept of "federal trust," that the federal government is responsible for the well-being of American Indians, implies the assurance of adequate phone service. No single government department, however, appears to be equipped to deal with the combination of telecommunications and the American Indian community. In addition, state governments may not be sure what their roles are. Providers, on the other hand, may be unsure as to whom they are responsible.

Some questions policy makers may want to consider when thinking about tribal communities are:

- What is the current state of telecommunications services in Minnesota's tribal communities?
- How can researchers get to the core reasons for lack of service in tribal communities?
- What role are state policymakers able to take in this situation?
- Where would a state Universal Service Fund fit?
- Are some tribal communities creating successful initiatives that can be studied and applied elsewhere?

On the brighter side

New technology

There is a bright side for communities in need of access to advanced telecommunications infrastructure, however. Advances in technology are bringing down the cost of providing service and increasing the capacity of the networks. Wireless technology is becoming a feasible solution to providing communications in sparsely populated regions. Wireless has been as expensive as wireline in the past: towers and microwave transmitters, which have to be set up a certain distance apart to provide continuous service, have their price. And it was only recently that wireless signals could transmit data to give people access to the Internet on their wireless phones. With new high-capacity transmitting technologies, wireless users will be able access the Internet from their computers at the same speeds as wireline access at a lower cost, and security technology makes wireless as safe as wireline. The Department of Administration's recent survey shows several places where wireless is offering local phone service. Point-to-multipoint broadcasting is another new technology that could address the last mile problem by combining wireless and wireline. A provider can bring a line into a community and connect it to a transmitter. Customers then access the service using satellite dishes like those used for satellite TV.

Cable is also making strides in providing broadband service. The Department of Administration's survey shows that a number of cable providers have installed or are planning to install the 750 MHz circuits that are needed to allow Internet and voice access through the cable system. However, the problem of low demand will have to be addressed before some cable providers will feel it is feasible to install these circuits, and several communities in Minnesota do not have cable access at all.

Two Minnesota cities are examples of the convergence of these technologies. In Alexandria, the city government has partnered with the rural electric cooperative to offer local-call Internet access and other telecommunications and information services. In Winona, Hiawatha Broadband Communications overbuilt the existing cable system and offers competitive cable programming. It has now announced that a competitive local exchange carrier based in Wisconsin, Chorus Communications, will offer local and long-distance phone services over

HBC's hybrid fiber coaxial cable system. HBC has also announced plans to offer an array of broadband services.

Small local providers

One very promising fact for rural communities seeking access is that the small independent telecommunications provider in their community is much more likely to upgrade its facilities and bring in new technology and services than a large telco with headquarters in a distant city. Today, 34 percent of these providers' customers have access to ISDN service and 32 percent have access to xDSL service. These numbers are expected to double within a year.[24] The local telecommunications provider is generally owned and operated by people who live in the community and who have a long-term, personal interest in seeing that community thrive.[25]

Models

Lastly, many rural communities around the country have had success putting telecommunications technology to work for them, and they serve as models for other communities to use as examples. A list of models and best practices can be found in Appendix B.

Recommendations

The research panel members settled on four issues they believe are priorities if rural communities are going to take advantage of information-age technologies: access, affordability and competition, skills and training, and local initiative. Within each category are recommendations that this group feels are important to improving the use of telecommunications infrastructure and services in rural communities.

Access

Goal:

All Minnesotans should have access to affordable, "always-on," advanced information infrastructure for use with broadband applications in three to five years.

Right now, high-speed, "always-on" access to data and information services like the Internet, e-mail and the World Wide Web is inconsistent around the state, and the price for better access may be out of reach. While just about anyone in Minnesota with a computer and a modem can plug into a phone line to access the Internet, data may travel over that line too slowly to send and receive large files via e-mail, conduct business transactions over the Internet or even send a fax. The system may not be "always on" because a business owner is not able to use the phone while accessing the World Wide Web, the Internet access provider shuts down for the evening, or the means of delivery, whether wireline, wireless, cable or a combination of these three, doesn't have enough capacity to handle traffic without slowing down or stopping altogether.

The changing economy is making it necessary, even crucial, for businesses of all sizes to have access to high-speed, high-capacity telecommunications infrastructure and services. Some things the state can do to help improve access all over the state:

- **The state should define a standard level of service and the necessary standards for providing high-speed, broadband service.** The state needs to set a clear standard of advanced service that every community in Minnesota can understand, expect and work toward achieving. Access should be available to and useable by any size of customer.
- **The standard should be able to float with changes in technology.** Telecommunications technology is moving at an astoundingly fast pace; there are now many different ways of delivering the same broadband service. New technology is making access cheaper all the time as providers introduce ways of using and combining wireline, wireless and cable technology to deliver high-speed, high-bandwidth telecommunications services. For this reason, the state should remain "technology neutral," by not favoring or discouraging one method of delivering service over another (i.e., favoring wireline over wireless or cable over wireline) through regulation or deregulation. The state should also remain open to new means of delivering service that may develop in the future. Instead, "let the market decide": each customer should be allowed to choose what means of service delivery works best for him or her.
- **The state should create a board immediately to identify hard-to-serve areas of the state and develop a strategy to address the needs of those areas.** The goal of access to advanced telecommunications infrastructure and information services will be substan-

tially achieved through regular market forces for most of the state in three years' time. However, there will still be hard-to-serve areas. The state should establish a board comprised of public and private representatives, including telecommunications providers and local individuals, to identify these areas and develop a strategy for how best to extend service to them.

- **Create incentives, including a state Universal Service Fund, and remove barriers for telecommunications companies that want to build infrastructure and provide services in rural communities.** The state has the ability to create an environment that is welcoming to telecommunications providers, especially in high-cost, low-demand areas that may not attract providers. To facilitate this environment, the state should be prepared to offer providers incentives to serve these areas. Among them should be a state Universal Service Fund that meets the needs of rural and urban residents, is financially sustainable, and is available to anyone providing the defined standard of service, regardless of what kind of technology is used to deliver the service. The state can also become a catalyst for developing infrastructure and services through public-private partnerships with technology and service providers to create innovative solutions.
- **Focus on the telecommunications needs of the rural Indian communities.** The task of providing service to rural Indian communities is particularly complex. The state should support rural Indian communities to help determine their telecommunications needs, the barriers to providing service on reservations, the most expedient efficient way to overcome these barriers, and the state's role in the solution.

Affordability and Competition

Goal:

Competitive forces should help to generate affordable services and technological innovation, and in areas where competition may not occur, consumers should be protected from the effects of monopoly, particularly in the form of excessive costs or inferior services.

There are unique factors that drive price and competition in rural areas, and therefore, a one-size-fits-all approach cannot be taken with telecommunications reform and deregulation.

Policy makers look to competition to be an incentive for telecommunications providers to lower their prices and introduce new technologies and services faster to attract customers. This will very likely be the case in markets where there are enough customers to support a number of competitors. High costs and low demand in many small, rural markets, however, make it difficult for competitors to survive. Communities should not be penalized with unaffordable costs and antiquated service because they are served by a monopoly provider. On the other hand, lawmakers must be careful that, in trying to attract competitive providers to rural communities, the new rules do not penalize incumbent telecommunications providers already serving rural markets. This especially applies to those providers who are showing initiative by adopting new technology that reduces costs and improves services for customers. Recommendations include:

- **Barriers to competition should be eliminated throughout the state.** Part of creating a welcoming technology environment includes ensuring that competition is welcome throughout the state. This includes welcoming "non-traditional" providers such as elec-

trical utilities, and requiring cable companies that offer phone and data services to open up to interconnection with other providers.

- **The state should monitor competition by establishing a benchmark to assess the level of competition in markets throughout the state.** In areas where competition may not occur, consumers should be protected from the effects of monopoly, particularly in the form of excessive costs or inferior services. However, incumbent providers should not be put at a disadvantage with rules that are favorable to incoming competitors.
- **The state should not inhibit the integration of public and private uses along the same transmission lines.** Government entities generate a large amount of telecommunications traffic. By isolating that traffic from the telecommunications traffic of the rest of the community, a significant portion of demand is removed from the community's overall demand. In rural communities, especially, government demand for telecommunications infrastructure and services can constitute a large fraction of overall community demand. The state should, in fact, encourage the exploration of creative approaches to public-private sharing of facilities. By combining public and private demand, the local infrastructure and services can be used more efficiently.

Training and Skills

Goal:

All Minnesotans should have the information and opportunities necessary to use telecommunications and information technology for business and workforce development, education, and community training.

Access is not just a technology issue, but a people issue. Access to telecommunications and information services provide people with the ability to live and work in rural Minnesota. An advanced telecommunications infrastructure, however, is worth nothing if the people it is built for do not know how to use it. There is a serious need in rural Minnesota for the information to apply telecommunications technology to their businesses and the training to use it.

Rural communities in Minnesota today face the dilemma of having their most skilled and best trained people leaving for urban areas where jobs fitting their skills are more plentiful and the paychecks larger. An advanced telecommunications infrastructure allows businesses to locate in rural locales, but they need a pool of workers who are trained to use the applications and maintain the systems. Ironically, many people with high-tech skills would like to live in rural communities if they could find jobs that used their abilities and offered a competitive wage.

Despite the tight job market, there is a significant potential workforce to be tapped in rural Minnesota. There are also segments of the rural population, especially young people, who are well trained. Notable efforts are going on right now to train people in rural communities to use and apply telecommunications technology, but there are several barriers between the people and the programs. The state is in a strong position to give education and information a higher profile and make it easier to access. Some things the state can do are:

- **Broaden definition of "educational purposes" to include workforce development, business applications and community training.** Funding for programs and financial aid for students – "education," in other words -- fall right now into narrowly defined

categories. The state should broaden the definition of education to include training programs for workforce development, business applications for technology, and training for the community in general to give educational opportunities to many more people. The criteria for distributing financial aid should be looked at closely to ensure it is going to more than "traditional" students (e.g., farmers looking for retraining).

- **Develop a one-stop, statewide system to make information on training opportunities easily accessible to everyone.** The state can serve a clearinghouse for information by developing a one-point, statewide system to make information on training opportunities easily accessible to everyone (e.g., searching by Zip code). There are already resources in place that can be used, such as the MnVU/iseek web sites and the Department of Economic Security's Workforce Centers.
- **Support and publicize existing and emerging demonstration and applications training initiatives for community and business outreach.** Many programs already exist that help build local awareness and understanding of technology use for work, home and community. Such programs include the University of Minnesota Extension Service's Access Minnesota Main Street, the Minnesota Technology Inc. Manufacturers' e-Commerce Network, the Red River Trade Council's e-Tech Network, and the E-Commerce Ready designation effort by the Minnesota Department of Trade and Economic Development and the Minnesota High Tech Association.
- **Develop programs to attract and retain skilled people to serve as instructors.** Rural areas are losing trained people and having a hard time attracting new ones. Bold initiatives will be needed reverse this problem.
- **Create incentives for employers to provide training to employees.** Tax rebates and write-offs (as are being proposed in Wisconsin) or other mechanisms should be used to encourage employers to provide or fund training to improve their employees' skills. These incentives can also be used to encourage telecommuting and work from home.
- **Ensure that the K-12 and college systems within the state produce technology-literate students.** Better coordination is needed among the state's higher education systems to reduce isolation and improve planning. In K-12 schools, including tribal schools and colleges, a greater effort is needed to see that K-12 teachers are properly trained in using the technology. Also, no school should be forced to choose between teachers, smaller class size or technology.

Local Initiative

Goal:

Communities should have access to the information and opportunities needed to adopt successful models for community and economic development using communications technology to spur growth and improve quality of life.

Demand aggregation in rural communities has been shown to improve the community's access to telecommunications infrastructure and the cost of the services. Rather than each group in the community (i.e., the school, the clinic, the courthouse, the senior center) trying to purchase telecommunications and information services on its own, the community can "aggregate" its demand by pooling everyone's needs. Aggregating creates a larger demand overall, giving the community more purchasing power and making providing infrastructure and services to the community more efficient.

Communities that could benefit from the use of telecommunications, however, often do not have the leadership, information or funding necessary to create a comprehensive plan to take advantage of this technology for their community and economic development.

Much has been said about what can be done for rural communities, but in the end, it is up to the local community to determine what it needs to help it grow. Every community is different, whether because of the age or racial mix, the predominant industry, or the terrain of the region, and these factors all affect total (aggregate) demand for the community. It would be impossible for anyone at the state level to determine what the best mix of technologies and applications would be for each town and city in Minnesota. Therefore, it should be up to the individual community to gather all the interested parties – local government, schools, health care, civic groups – together to determine the needs of each group and decide what will be the best means of meeting those needs through telecommunications technology. Of course, any local telecommunications providers must be included from the beginning, since these are the organizations that will be providing the infrastructure to the community.

Planning a telecommunications infrastructure will be a daunting task for community members who have little experience with the ways telecommunications can be used. The state's best role at the local level, therefore, is to serve as educator and resource to communities that want to improve their infrastructure and services, and as a mediator to help bring the various groups in the community to the table to work out the best solutions for everyone. The state can:

- **Help communities learn how to link telecommunications and information services to their community life and economic development.** State government can play a role in funding, initiating projects and especially in bringing various groups to the table, but it should maintain the role of a neutral entity. Some things the state can do are: Create better interagency and interdepartmental cooperation for working with local communities. Help communities appoint a local telecommunications commission to look at the resources and the use of telecommunications. Indian communities must also be included in rural initiatives. Recognize the public sector's role as largest consumer of telecommunications services and develop purchasing strategies to encourage the use of telecommunications, competition and demand aggregation.
- **Encourage local leadership to have a long-term, proactive attitude toward telecommunications development.** Telecommunications is not a quick fix. It requires long-term planning and involves economic and community development plans besides infrastructure planning to really pay off. The local leadership must be willing to stick with the project for the long term.
- **Encourage as many parties as possible to be included in the planning process.** Encourage school districts to recognize their broad role within the community as a user of telecommunications technology and an agent for change.
- **Public-private partnerships, including institutions and foundations, can offer support in the form of funding and information to fill gaps that might otherwise prevent projects from going forward.** Other organizations should also be involved in helping with community planning. The League of Minnesota Cities and the Association of Minnesota Counties can play special roles in communicating, educating and assisting communities in increasing their benefits from telecommunications. The various non-government development groups throughout the state, such as the chambers of com-

merce (including local chambers, the Minnesota Chamber of Commerce, the Minnesota American Indian Chamber of Commerce), and regional industry development groups (e.g., the IRRRB) should take on the role of educating communities on the benefits of telecommunications and ways to apply it, as tools for economic and community development.

Conclusion

Telecommunications technology and information services are integral to the way we communicate and do business every day. With telecommunications technology, Minnesota's businesses compete with others in not just the next block or the next city, but in another state or another country. Minnesota's residents communicate with and glean information from people and institutions across the country and around the globe.

For Minnesota's rural communities, adequate access to high-speed, high-quality telecommunications infrastructure and information services holds the promise of eliminating distance and making their towns, people and businesses as competitive as any urban area.

With telecommunications technology and its many uses changing at breakneck speed, the options and decisions can seem overwhelming. New technologies, applications, even new language, appear almost daily. Any change seems to hold the risk of being obsolete tomorrow, and any decision runs the risk of being the wrong one. The greatest risk, though, is to do nothing at all.

All the components of success – access, affordability, competition, training and local planning – must be considered and implemented in concert, to create the most effective, efficient, and self-sustaining system to benefit all Minnesotans.

Appendix A

Table 3: Population changes in Minnesota's counties, 2000-2020.

Minnesota county population projections 1995-2025
Change in Minnesota population, 2000-2020
Minnesota State Demographic Center June 1998

	2000	2010	2020	2000-2010 Percent change	2010-2020 Percent change	2000-2020 Percent change
Minnesota	4,805,970	5,066,540	5,243,600	5.4	3.5	9.1
Aitkin	14,010	14,760	15,410	5.4	4.4	10.0
Anoka	296,880	337,590	370,530	13.7	9.8	24.8
Becker	29,970	30,720	31,120	2.5	1.3	3.8
Beltrami	38,870	41,340	41,280	6.4	-0.1	6.2
Benton	36,510	42,450	46,980	16.3	10.7	28.7
Big Stone	5,660	4,990	4,570	-11.8	-8.4	-19.3
Blue Earth	55,810	56,650	56,490	1.5	-0.3	1.2
Brown	27,750	27,710	27,740	-0.1	0.1	0.0
Carlton	31,050	31,020	30,720	-0.1	-1.0	-1.1
Carver	65,160	80,460	95,360	23.5	18.5	46.3
Cass	25,190	27,050	28,180	7.4	4.2	11.9
Chippewa	12,680	11,710	10,960	-7.6	-6.4	-13.6
Chisago	39,820	46,290	52,670	16.2	13.8	32.3
Clay	53,750	54,850	54,100	2.0	-1.4	0.7
Clearwater	8,390	8,170	8,070	-2.6	-1.2	-3.8
Cook	4,300	4,400	4,440	2.3	0.9	3.3
Cottonwood	12,440	11,650	10,970	-6.4	-5.8	-11.8
Crow Wing	51,770	56,700	59,730	9.5	5.3	15.4
Dakota	350,120	407,520	455,080	16.4	11.7	30.0
Dodge	17,120	17,530	17,950	2.4	2.4	4.8
Douglas	31,510	32,810	33,740	4.1	2.8	7.1
Faribault	16,010	14,680	13,850	-8.3	-5.7	-13.5
Fillmore	20,510	19,720	19,500	-3.9	-1.1	-4.9
Freeborn	31,900	30,280	29,020	-5.1	-4.2	-9.0
Goodhue	43,050	44,490	47,290	3.3	6.3	9.8
Grant	6,070	5,560	5,220	-8.4	-6.1	-14.0
Hennepin	1,082,570	1,106,900	1,103,090	2.2	-0.3	1.9
Houston	19,420	19,590	19,740	0.9	0.8	1.6
Hubbard	17,180	18,540	19,530	7.9	5.3	13.7
Isanti	30,260	32,240	33,910	6.5	5.2	12.1
Itasca	42,890	42,920	42,780	0.1	-0.3	-0.3
Jackson	11,570	11,050	10,670	-4.5	-3.4	-7.8
Kanabec	13,630	14,210	15,430	4.3	8.6	13.2
Kandiyohi	42,430	44,200	45,630	4.2	3.2	7.5
Kittson	5,380	5,010	4,830	-6.9	-3.6	-10.2
Koochiching	15,620	15,000	14,200	-4.0	-5.3	-9.1
Lac Qui Parle	8,340	7,370	6,600	-11.6	-10.4	-20.9
Lake	10,540	10,230	9,720	-2.9	-5.0	-7.8
Lake of the Woods	4,440	4,470	4,520	0.7	1.1	1.8
LeSueur	24,840	26,030	28,080	4.8	7.9	13.0
Lincoln	6,480	5,830	5,380	-10.0	-7.7	-17.0
Lyon	25,620	26,010	25,740	1.5	-1.0	0.5

	2000	2010	2020	2000-2010 Percent change	2010-2020 Percent change	2000-2020 Percent change
McLeod	34,960	37,430	40,310	7.1	7.7	15.3
Mahnomen	5,070	4,950	5,010	-2.4	1.2	-1.2
Marshall	10,480	9,840	9,300	-6.1	-5.5	-11.3
Martin	22,330	21,580	21,550	-3.4	-0.1	-3.5
Meeker	21,460	21,220	21,170	-1.1	-0.2	-1.4
Mille Lacs	20,700	21,710	23,140	4.9	6.6	11.8
Morrison	31,150	31,220	31,470	0.2	0.8	1.0
Mower	37,310	36,400	35,680	-2.4	-2.0	-4.4
Murray	9,290	8,490	7,860	-8.6	-7.4	-15.4
Nicollet	30,650	32,000	32,000	4.4	0.0	4.4
Nobles	20,550	20,720	20,860	0.8	0.7	1.5
Norman	7,670	7,130	6,700	-7.0	-6.0	-12.6
Olmsted	118,730	125,440	129,490	5.7	3.2	9.1
Ottertail	54,340	54,830	54,220	0.9	-1.1	-0.2
Pennington	13,400	13,390	13,370	-0.1	-0.1	-0.2
Pine	23,400	24,650	26,550	5.3	7.7	13.5
Pipestone	10,160	9,530	9,060	-6.2	-4.9	-10.8
Polk	32,610	31,660	30,940	-2.9	-2.3	-5.1
Pope	10,890	10,510	9,950	-3.5	-5.3	-8.6
Ramsey	497,710	504,920	504,290	1.4	-0.1	1.3
Red Lake	4,380	4,030	3,800	-8.0	-5.7	-13.2
Redwood	16,960	16,100	15,490	-5.1	-3.8	-8.7
Renville	17,240	16,180	15,430	-6.1	-4.6	-10.5
Rice	54,710	57,290	58,560	4.7	2.2	7.0
Rock	9,570	8,910	8,540	-6.9	-4.2	-10.8
Roseau	16,660	17,600	18,490	5.6	5.1	11.0
St. Louis	199,400	194,170	187,050	-2.6	-3.7	-6.2
Scott	79,040	96,060	112,160	21.5	16.8	41.9
Sherburne	60,390	77,030	91,620	27.6	18.9	51.7
Sibley	14,350	14,170	14,590	-1.3	3.0	1.7
Stearns	134,730	142,480	144,050	5.8	1.1	6.9
Steele	32,290	32,830	33,410	1.7	1.8	3.5
Stevens	10,780	10,590	10,050	-1.8	-5.1	-6.8
Swift	11,000	11,060	11,110	0.5	0.5	1.0
Todd	23,390	22,670	22,710	-3.1	0.2	-2.9
Traverse	4,170	3,760	3,530	-9.8	-6.1	-15.3
Wabasha	20,580	20,600	20,850	0.1	1.2	1.3
Wadena	13,470	13,410	13,030	-0.4	-2.8	-3.3
Waseca	17,830	17,410	17,150	-2.4	-1.5	-3.8
Washington	200,830	237,890	265,370	18.5	11.6	32.1
Watonwan	11,460	10,990	10,750	-4.1	-2.2	-6.2
Wilkin	7,200	6,800	6,550	-5.6	-3.7	-9.0
Winona	49,990	50,730	50,350	1.5	-0.7	0.7
Wright	84,060	95,160	105,550	13.2	10.9	25.6
Yellow Medicine	11,240	10,360	9,700	-7.8	-6.4	-13.7

Appendix B: Models of Advanced Telecommunications and Information Services Used in Rural Settings

Community planning: Onvoy's Integrated Community Network program. An Integrated Community Network is a community development process which helps a community (whether a single town, county, region or state):

1. Assess what they already have in place for telecommunications infrastructure and applications;
2. Brainstorm ways in which people and institutions need to connect with one another;
3. Then based first on community and economic development issues (not technology products), develops networking solutions that efficiently aggregate demand through community-desired cross-connections and applications.

ICN takes what once may have been silo (isolated, vertical) approaches to communications planning and investments – in health care, education, business, government – and works to integrate them and get them all working together, rather than operating in a vacuum. The most important success factor for the process is the involvement early on of the communications providers (data, voice, video, etc.) in community discussions. The providers must come to the table as community members and not as companies on the far end of the process wanting to sell certain products, whether they fit community needs or not. The community gets a better understanding of how to use communications technologies to spur growth and improve quality of life, market demands are unveiled to providers, and partnerships are struck to wisely plan for and implement communications investments, integrated with community and economic development goals. Onvoy has been doing ICN in Itasca County, the northwest region of the state and now the west central region with much success. – *Randy Young and Jane Leonard*

Economic development: The Iron Range Resources and Rehabilitation Board and Minnesota Power's subsidiary, MP Telecom, brought fiber optics to Ely, Minn., 10 to 15 years before it would have been economically feasible to do the project. As a result, Ely is enjoying great potential for information technology-related business and economic development. – *Dick Nordvold*

Education: The Telecommunications Access Grant (TAG) initiative. A legislatively funded program to ensure that all schools and libraries have access to video and Internet connectivity. The state investment for schools and libraries has also leveraged additional investments by telecommunications providers in telecommunications infrastructure for the surrounding communities. – *Randy Young*

Local initiatives: Examples of municipally owned telecommunications infrastructure are instructive. In 1992, the city of Coleraine overbuilt the incumbent private cable system operator. Since that time, the city-owned and operated cable system has succeeded in signing up a sufficiently large number of subscribers, and charges approximately $16 a month ($33 for the premium service level) for a full package of cable programming services. At these rates, the city experiences a positive cash flow from system operations. The city is considering providing additional broadband services such as high-speed data transmission, Internet access, and telephony. In order to do so, the city is exploring a system upgrade. City officials and residents are satisfied with the municipal provision of cable services and are interested in pursuing cooperative efforts vis a vis additional telecommunications service delivery with other Iron Range communities.

Another example is the city of Alexandria where city government has partnered with the rural electric cooperative to offer local call Internet access and other telecommunications and information services.

A third example is in the city of Winona where Hiawatha Broadband Communications (HBC) has overbuilt the incumbent cable service provider. HBC has announced that a competitive local exchange carrier based in Wisconsin (Chorus Communications) will offer local and long-distance phone services over the hybrid fiber coaxial cable system through a newly formed division, which will be known as HBC Telecom. HBC introduced competitive cable video programming services in the Winona area beginning last February and already has 1,700 subscribers. There are plans now to roll out cable modem services, with about 50 percent of its 750-MHz system equipped for two-way interactive services. The system should be fully bi-directional by early 2000. HBC has also announced ambitious plans to offer an impressive array of broadband services and is building its network with 250 homes per node. – *Ann Higgins*

Private initiative to open Internet-facilitated business: Cross Consulting's expansion to Sebeka. Sebeka is one of the rural communities where Cross Consulting, based in Burnsville, opened a high-tech facility, providing training opportunities and higher paying jobs for the local residents and the opportunity for skilled workers from the city to move to this small town. The facility does software programming for Northwest Airlines, sending the work over high-speed data transmission lines. Because of the low cost of living in Sebeka and the low turnover of workers, Cross Consulting can deliver its services for at least 25 percent less than the standard market price, despite the higher costs for the high-speed lines. (From The Dallas Morning News, Sept. 12, 1999.) Cross worked with the city, the local telco, West Central Telephone, and the Security State Bank of Sebeka to set up the facility. – *Jon Schmid*

Public-private partnership: The Access Minnesota project to bring Internet demonstration projects and training into rural areas opened the marketplace for Internet back in 1995-97. The same thing is happening for e-commerce applications through the successful, but cash-starved, Access Minnesota Main Street program. Both of these efforts were led by the Minnesota Extension Service, supported by partnerships that cut across public, private, and non-profit sector lines. It was the best cooperative effort Minnesota pulled off to foster understanding of the community and economic implications of the telecommunications revolution and provide training in the use of the technologies. – *Jane Leonard*

Support: The Minnesota Technology Inc.'s manufacturers e-business electronic network, www.mfgnet.org. "In December, the Manufacturer's eBusiness Network will complete two years of service to Minnesota companies. During that time we've delivered more than 90 workshops and helped more than 250 manufacturers get started with an Internet business strategy. The Network's 'Internet Incubator' operates as a partnership project with the University of Minnesota, Minnesota Technology, Inc., and the National Institute of Standards and Technology, Manufacturing Extension Partnership. It is a model that allows Minnesota manufacturers to get the highest quality of personal service, access to emerging technologies, and a chance to work with numerous firms experiencing the Internet for the first time. The next six months our staff will focus efforts more specifically on eCommerce awareness and implementation projects." From the website. – *Jerry Nagel*

Telemedicine: Grant County Medical Center in Elbow Lake, uses Telemedicine for Clinical Specialty consultation, education, support groups, and meetings. – *Mary Ellen Wells*

Wireless technology: One can look at the wireless industry as a model where telecommunications has provided a great deal of increased productivity in the rural areas of Minnesota. In the future, these wireless communications providers will provide competition in the rural markets, which will drive the advanced service offerings. – *Tim Tupy*

Comprehensive approach to wiring rural communities: Connecting Canadians, a six-part initiative "to make Canada the most connected country in the world." The six parts are: Canada On-line, Smart Communities, Canadian Content On-line, Electronic Commerce, Canadian Governments

On-line, and Connecting Canada to the World. The plan involves multiple agencies working with private partners. For example, one sub-component of Canada On-line is the Community Access Program, operated by Industry Canada, which has the ambitious goal of setting up 5,000 public access sites in rural and remote communities across the country and 5,000 more sites in urban areas, all by March of 2001. The object is not to wire every home, but to set up public sites at school or libraries, staffed by trained personnel who can help people use the Internet to access information and services. The website for Connecting Canadians is http://connect.gc.ca/en/100-e.htm.

Funding support for individual initiatives: The Wisconsin Advanced Telecommunications Foundation is an incorporated, public-private partnership foundation that uses contributions from the private sector, government and foundation funds to support local initiatives that use advanced telecommunications. The foundation is funded chiefly by the state and more than 60 Wisconsin and national telecommunications providers. Anyone is eligible to apply for funding, although the projects cannot compete with the private sector.

Examples of projects receiving awards include:

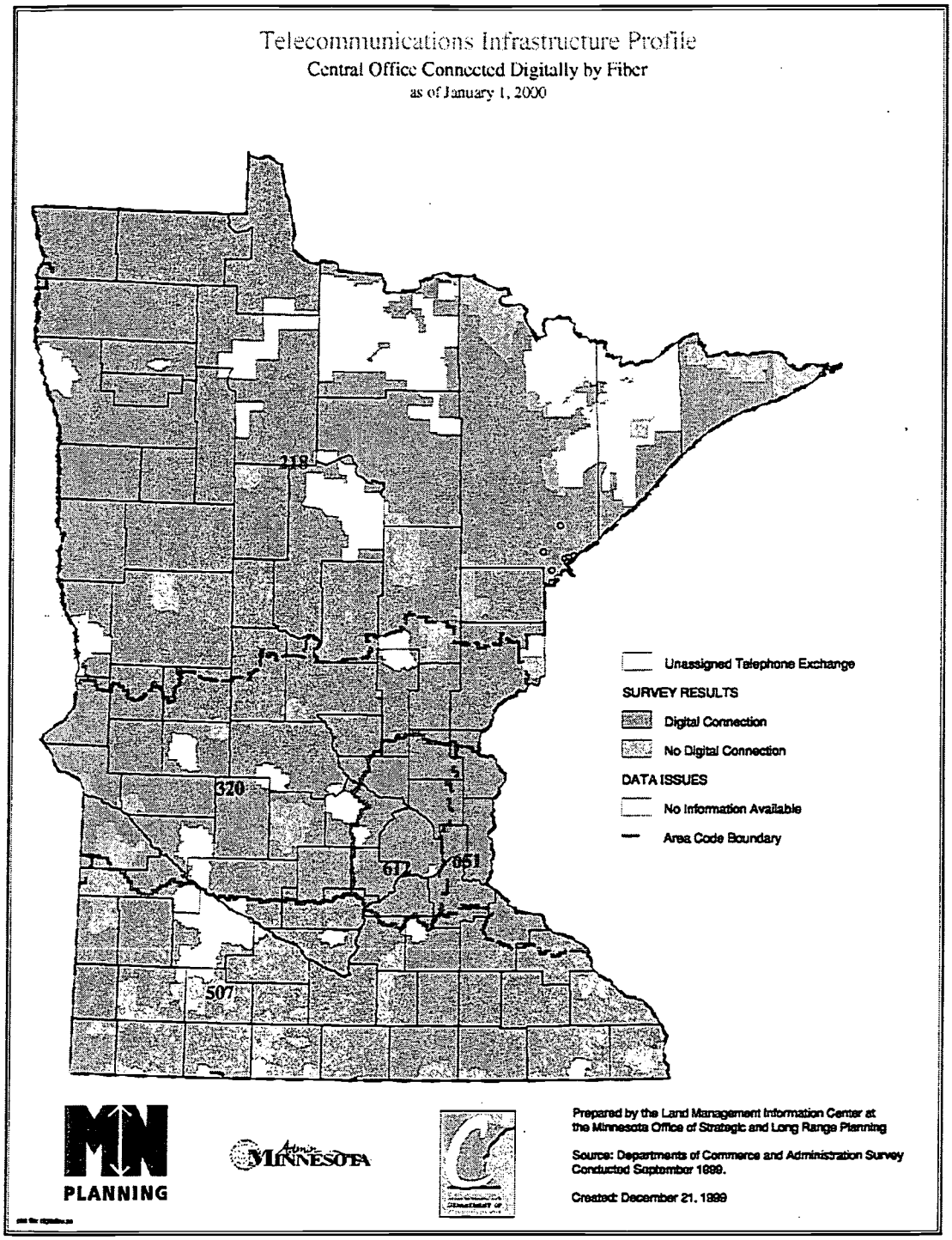
- Children's Hospital of Wisconsin, Milwaukee in consortium with the University of Wisconsin Hospital and Clinics, Madison; $55,212
- Clark County, Neillsville; $47,495
- Madison Area Technical College, Madison in consortium with the Dane County Sheriff's Office, Jefferson County Sheriff's Office, and Department of Corrections Division of Community Corrections; $50,000
- Montfort Public Library; Montfort; $4,107
- School District of New London in consortium with New London Public Library; New London; $50,000
- School District of South Milwaukee; South Milwaukee; $45,978
- St. Thomas Aquinas Parish School; Waterford; $31,180
- Washburn County Public Health/Home Care; Spooner; $37,003

The website describing this program is: http://www.watf.state.wi.us/index.html.

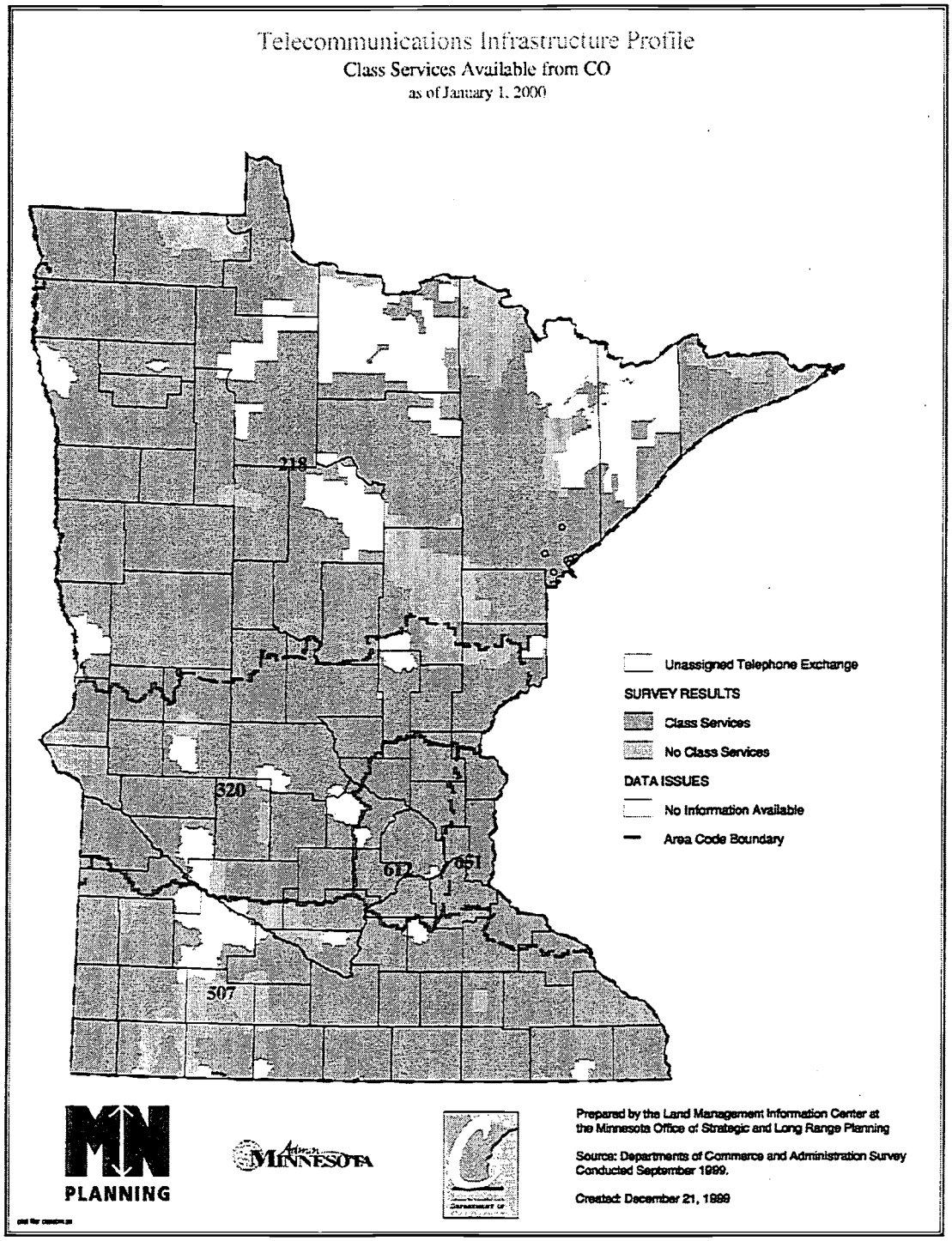
Government services on-line: IOWAccess, the Iowa state government's presence on the Internet. The IOWAccess plan is made up of 14 sub-projects, including an Internet gateway to government services and technical training for all government employees. The website describing the IOWAccess projects is http://www.state.ia.us/main/projects /index.html.

Appendix C: Minnesota Department of Administration Telecommunications Survey Maps

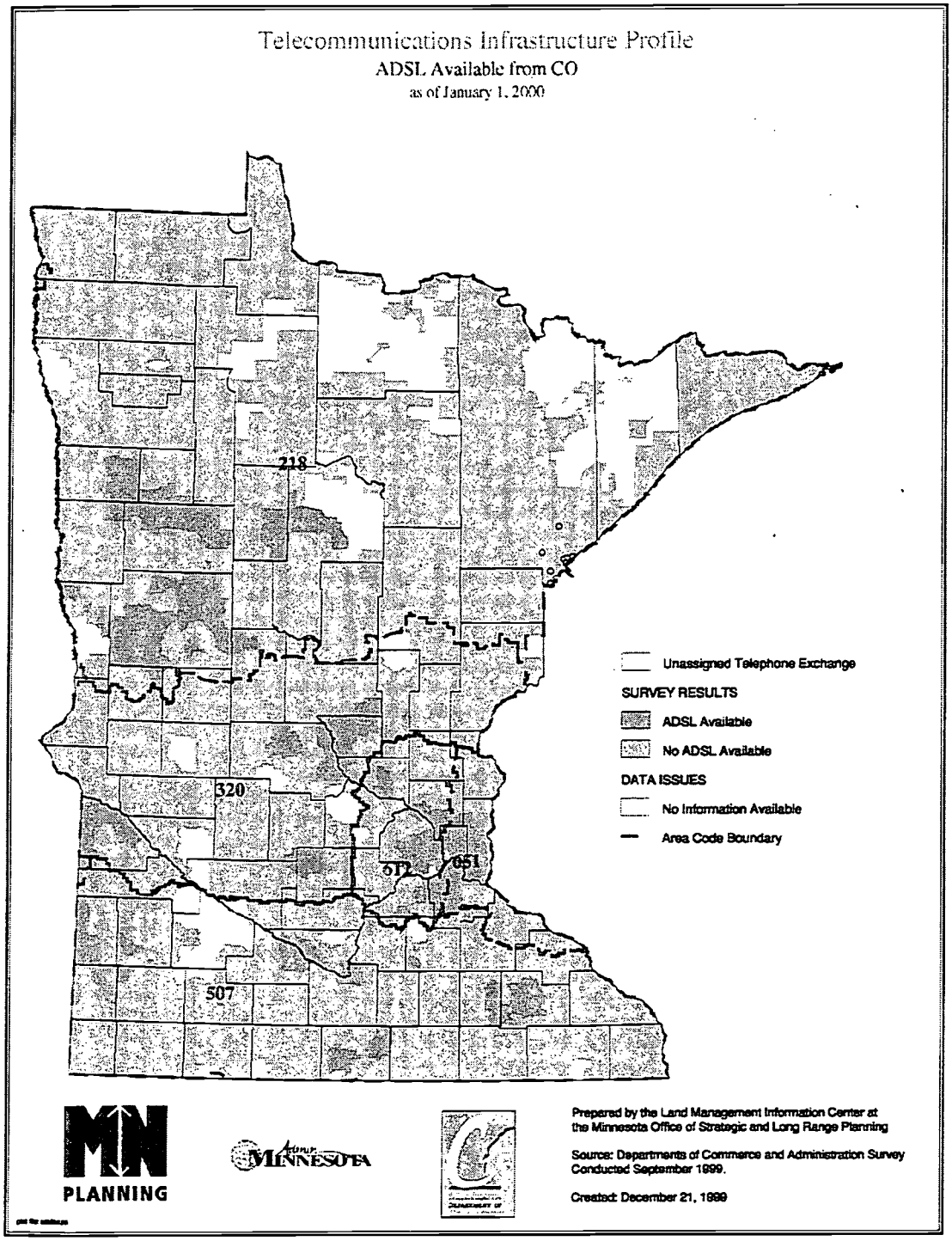
Map A: Central Offices Connected Digitally by Fiber



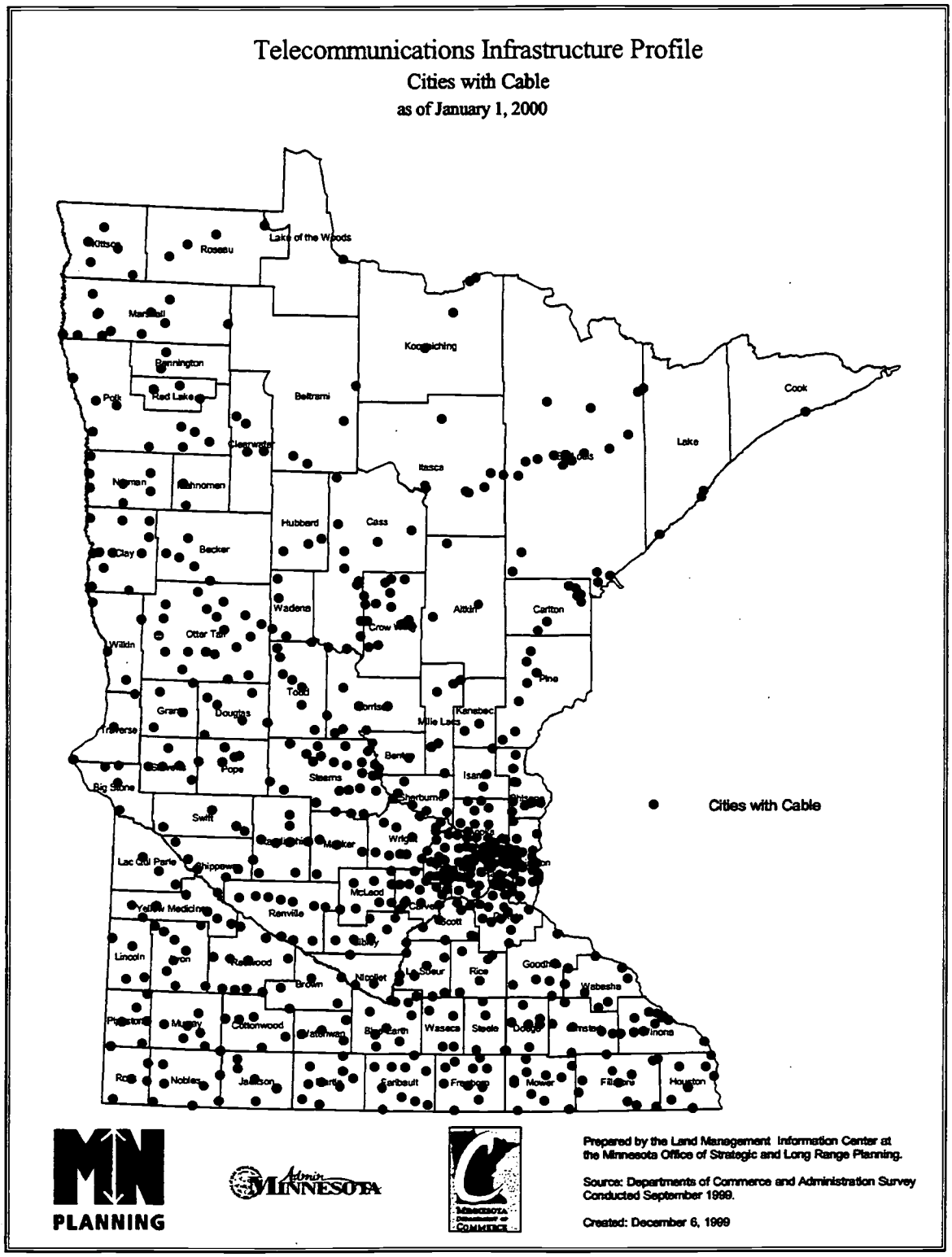
Map B: Class Services Available from Central Office



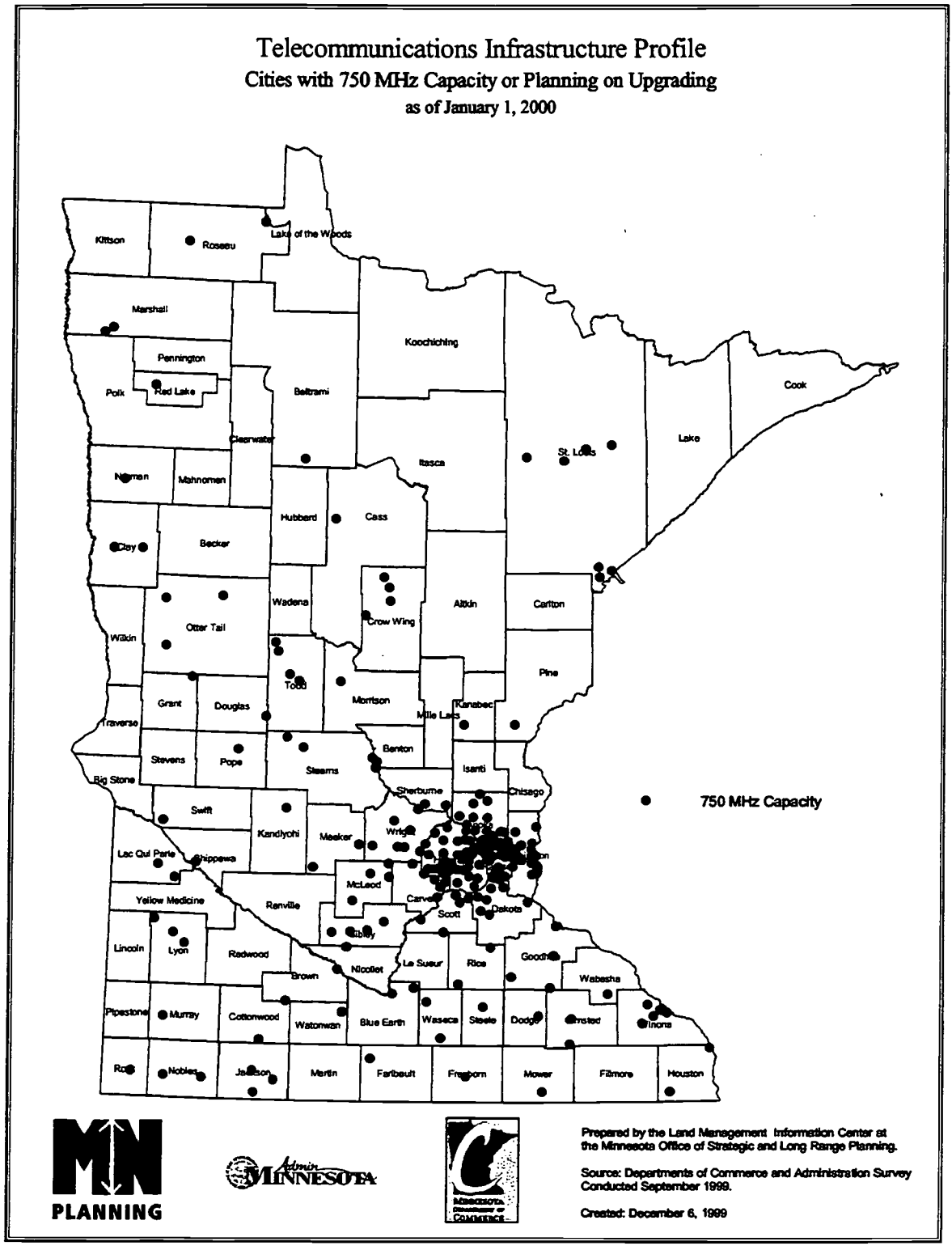
Map C: ADSL Available from Central Office



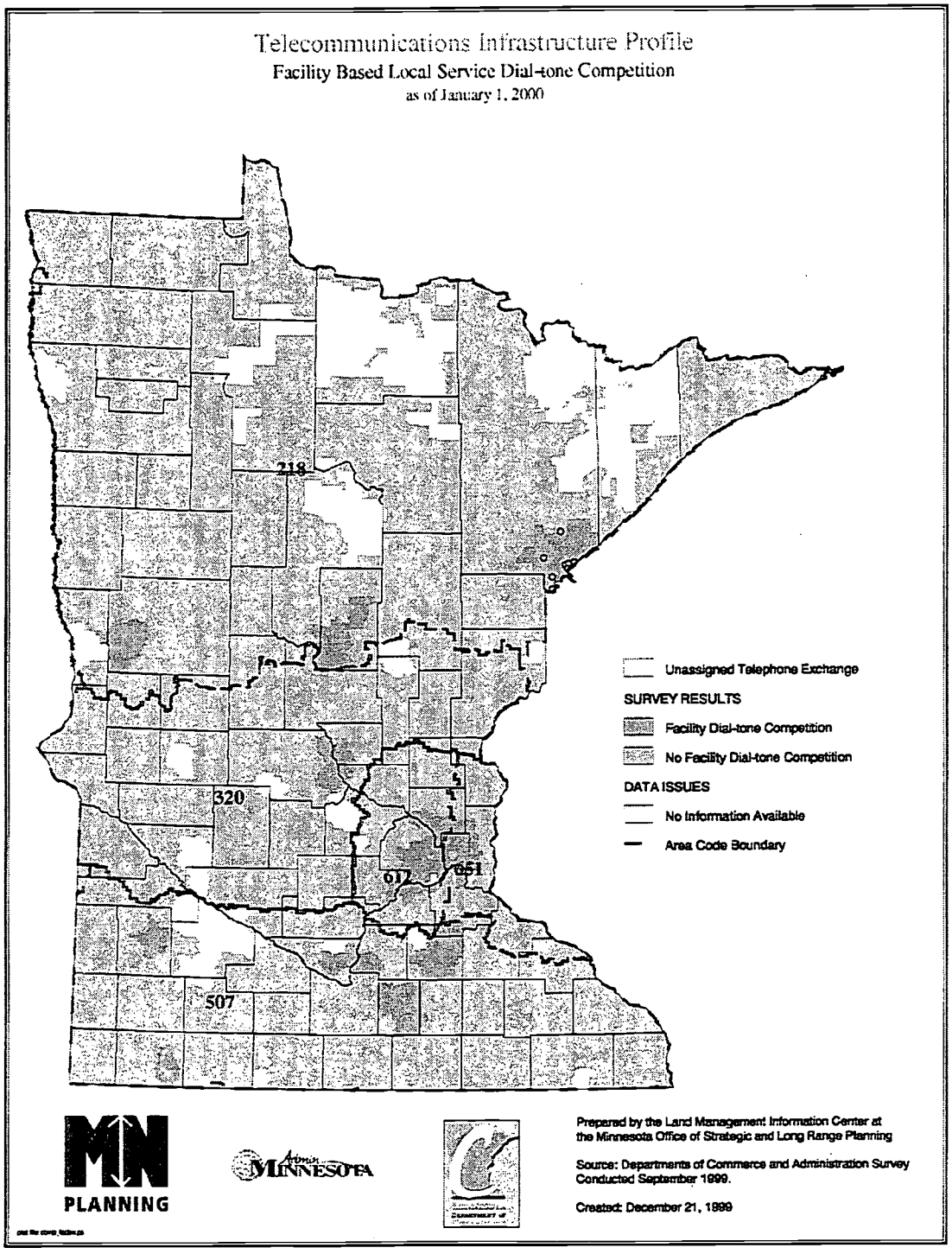
Map D: Cities with cable



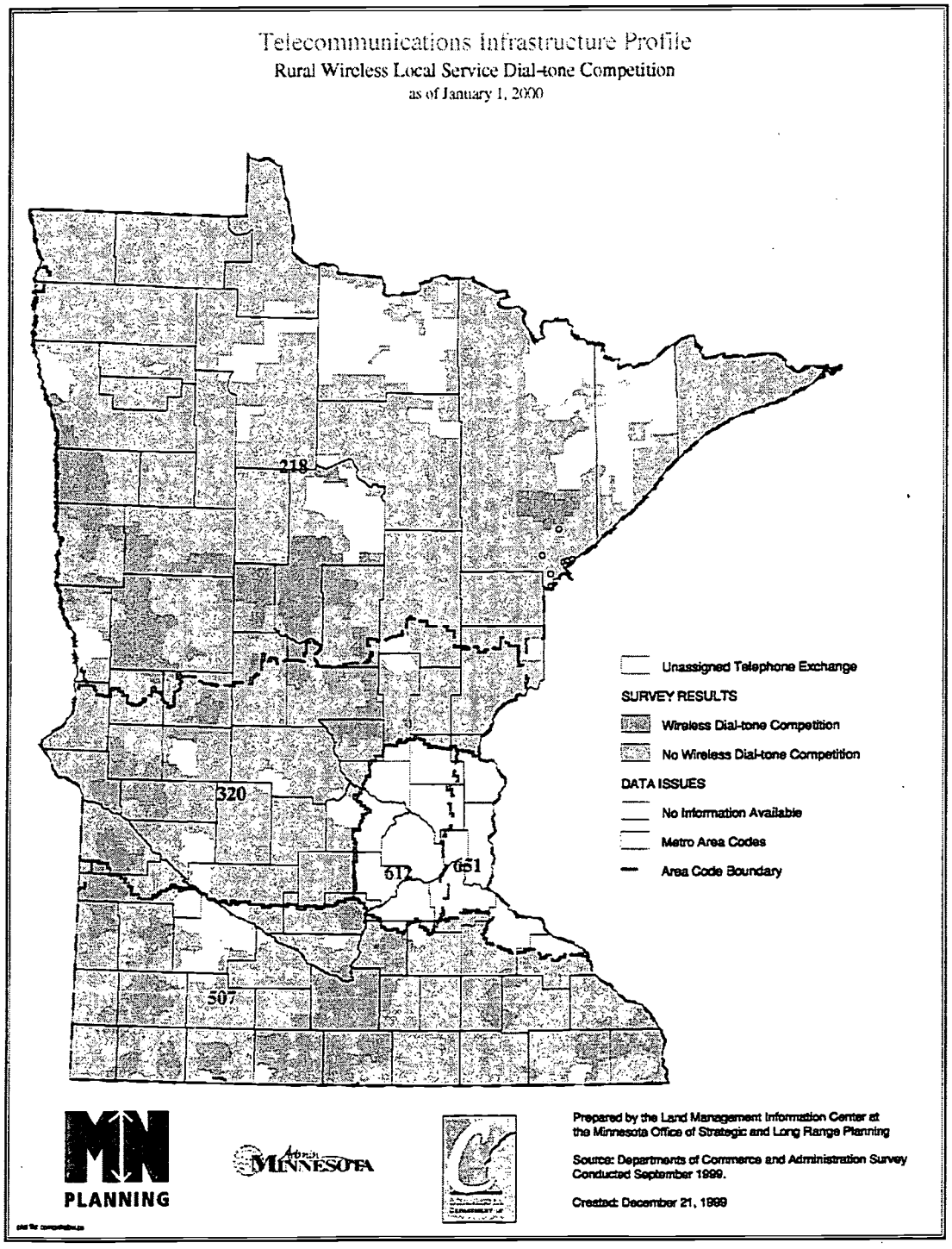
Map E: Cities with 750 MHz Capacity or Planning on Upgrading



Map F: Facility-based local service dial-tone competition

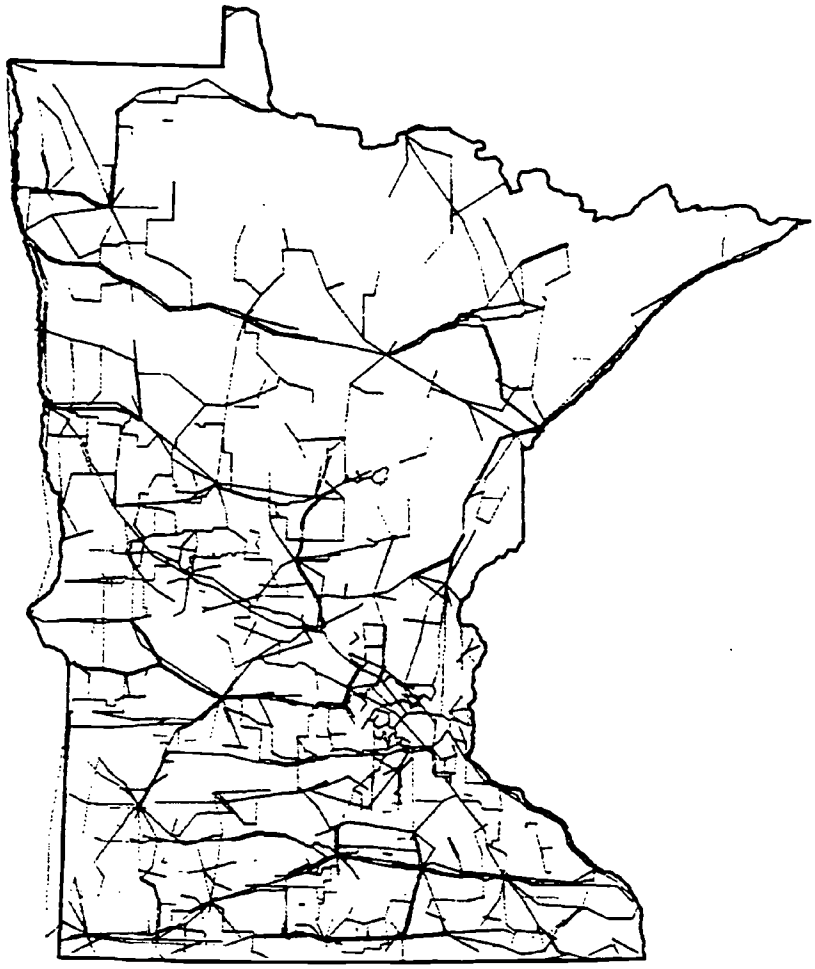


Map G: Competitive local service offered through wireless



Appendix D: Fiber network in Minnesota

(Source: Minnesota Association for Rural Telecommunications)



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[2] Rowley.
[3] "Ventura Administration Strategic Plan," Dec. 14, 1999. http://www.admin.state.mn.us/govplan.htm.
[4] Minnesota Planning, Minnesota State Demographic Center, June 1998. http://www.mnplan.state.mn.us /demography/demog_3c.html.
[5] National Telecommunications and Information Administration, "Falling Through the Net: A Survey of the 'Have Nots' in Rural and Urban America," July 1995, www.ntia.doc.gov.
[6] Northern Great Plains Rural Development Commission, "Telecommunications," 1997, p. 6.
[7] Rowley, Tom. "Rural Telecommunications: Why your Community Isn't Connected and What You Can Do About It." TVA Rural Studies Staff Paper. January 1999, pp. 4-5.
[8] The Dallas Morning News, Sept. 12, 1999.
[9] "Telemedicine Survey Offers Valuable Findings," TelemedLaw, February 1999.
[10] Mary Ellen Wells, director, Telemedicine Program, Allina Healthsystems.
[11] "Medtronic launches new e-business, 'Medtronic.com,' Minneapolis Star Tribune, Jan. 24, 2000.
[12] United States Census Bureau, 1995. "Urban" or an "urbanized area" is not the same as a Metropolitan Statistical Area (MSA), where the basic unit is a county. An MSA is a county or group of counties that contain at least one city with 50,000 or more inhabitants or a Census-defined urbanized area (at least 50,000 inhabitants) and a total metropolitan population of at least 100,000. An MSA, however, can contain both urban and rural areas. For instance, the Minneapolis-St. Paul MSA contains 13 counties, but large parts of those counties would be classified as rural because they do not meet the density requirements (in general, 1,000 persons per square mile).
[13] Minnesota Planning, State Demographic Center, June 1998.
[14] "Minnesota Employment Outlook to 2006," Minnesota Department of Economic Security, May 1999.
[15] Egan, Bruce L. "Improving Rural Telecommunications Infrastructure." TVA Rural Studies, University of Kentucky, Lexington, Ky.
[16] Data from the FCC's annual report, "Statistics of Communications Common Carriers (1997)," which reports on the statistics of all local exchange carriers generating more than $100 million during the reporting year was used to represent large (urban) local exchange carriers. Most of these companies are regional Bell operating companies serving urban markets. Data from the Rural Utilities Service's "1997 Statistical Report, Rural Telecom Borrowers" was used to represent small (rural) local exchange carriers. This annual report provides data on all small rural telecom providers that borrowed from the RUS loan fund in 1997.
[17] Rowley.
[18] Egan.
[19] Rowley, p. 2.
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[21] Rural Policy Research Institute. "Telecommunications and Economic Development in Rural Communities," June 16, 1995.
[22] Federal Communications Commission, public hearing, Jan. 29, 1999, Indian Pueblo Cultural Center, Albuquerque, N.M., http://www.fcc.gov/Panel_Discussions/Teleservice_reservations/tr-newmx.txt.
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