

BRIDGING THE TECHNOLOGICAL GAP: HIGH-SPEED WIRELESS INTERNET IN RURAL
AMERICA

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This thesis is dedicated to my parents for all their support, guidance, and love through everything that I have done. I would not be where I am today without you! I also want to thank all of my close friends and family that listened to me when I did not know how to continue. Your confidence helped me through this process, which would not have been possible if I did not have you in life.

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ABSTRACT

Currently, there is a large discrepancy in the availability and costs of high-speed Internet in rural areas. The gap between high-speed access and connectivity to the Internet will continue to grow unless alternatives to wireline broadband services are examined. This thesis studies how wireless, high-speed Internet fills the void in broadband services in rural America. By referring to past studies conducted on Internet usage and availability in Iowa, it is shown that broadband is an important service for those in rural areas. Also, through personal interviews with wireless Internet service providers (WISPs), this thesis is able to assess the current state of the industry and study the effect that it has on rural America. Although technical and policy hurdles in this industry still exist, the findings suggest that wireless, high-speed Internet can fill the broadband void in rural areas by providing a cost-effective, reliable service.

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Chapter 1: Introduction

There is a large discrepancy in the availability and costs of high-speed Internet in rural areas. The gap between high-speed access and connectivity to the Internet will continue to grow unless the importance of universal service is examined and concrete solutions are discussed. One of the solutions examined is the use of wireless Internet connections in areas where the infrastructure for Internet availability is not developed. Providing a high-speed connection via a land-based line is not affordable to most that live in rural areas, thus the choice to receive broadband service is often not available. How can wireless high-speed Internet fill the broadband void in rural America? This thesis to assesses the status and development of wireless connectivity in rural areas. The research question will be probed by: analyzing the research literature involved in the topic, interviewing wireless service providers, and positing policy measures that could help ensure success.

Background of Rural Areas and Internet Technology

With wireless technology, small towns and their residents would be able to enjoy many more opportunities in the areas of learning and economic enhancement. Through a wireless signal, high-speed Internet may be able to equalize the difference between the opportunities for those in rural areas as compared to the opportunities for those in urban areas. For example, items that one used to have to drive over 100 miles to purchase can now be delivered to their front door in a matter of days. Inversely, a rural business owner now has the opportunity to promote and sell his/her products on-

line, thus opening a new market for their goods. This interconnectivity of people is important in sustaining the small towns and smaller cities that make up rural America; and with faster, affordable connections, citizens in rural areas will have this opportunity to connect with millions around the world.

Rural development and technological dispersion in rural areas has become a priority in the past decade, but more so for rural areas in developing countries. The disparities between rural and urban areas in America have been examined before, but not within the context of new technology, particularly the Internet. As the Internet becomes a ubiquitous part of our society, it is important to examine the impact that it has on the communities where the technology may or may not be available. With the development and implementation of wireless Internet in recent years, rural areas have solutions and options as to how they can get the same Internet connection as those in many urban areas can. Although there are several ways in which high-speed Internet can be dispersed, such as cable and DSL, these other types of technology are costly for rural areas to receive, because of the cost of building the infrastructure that is needed to obtain and maintain a connection. Wireless, although a relatively new technology, has the possibility of allowing a rural area to be connected to the Internet via a high-speed connection, and to spare many of the costly and time consuming aspects of the more traditional types of Internet connections.

The study of the Internet and its affects on society continues to be researched, although not in great depths by academics, because the technology is still too new to

have any concrete, long-term effects on a given society. Most previous studies have looked at the impact of telecommunications on rural areas and the struggle rural areas encountered in implementing these technologies. In recent years, the telecommunications industry has examined the theory of universal service as a way to get as many people connected as possible, as well as making telephony connection affordable to the majority of the people. The economic implications of a high-speed connection in rural environments have yet to be fully explored. This will probably not occur until the Internet has had the scope of use that telephones have incurred.

Wireless High-Speed Internet as the Answer

Wireless, high-speed Internet technology is emerging into common use across America. In reviewing the literature, little is written on how broadband in general has affected business in urban areas and how it could potentially affect rural areas.

Wireless service providers are beginning to develop throughout many rural states to provide Internet services to people with few or no affordable high-speed connection choices. The emergence of these companies has shown that the industry is becoming more dominant within the technology market. A workshop held at the Office of the Federal Communications Commission in early November, allowed rural wireless Internet service providers (WISPs) to gather and discuss the issues that they currently face and the future of this industry. At this conference, it was realized that this topic was becoming more important as new technology develops and new policy measures are adopted. Because these companies face different challenges than other high-speed

Internet service providers, it is important to recognize these differences as discussion of policy measures and solutions evolve. It was deemed that the best way to discover the characteristics of rural WISPs was by interviewing a small group of providers and getting their insights on the industry, as well as the issues that surround the technology, such as the role of government and how wireless broadband affects rural areas. The insights of these interviews provide a different perspective on the present and future of the industry. They are able to supply the knowledge of how the industry works in a “real-world” setting and how this may be different from the view that those in government or academia have of the industry.

Future of the industry: Policy and Development

Throughout the interviews and the examination of the literature written about rural areas and technology, specifically wireless, high-speed Internet, it is important to draw conclusions on what the future of the industry may be and how government policy affects the course of the technology. The relationship between the government and an industry is often one that has positive and negative influences on each other. The policy that is written to affect the technology may help or hinder innovation and growth just as the innovation and growth of technology may affect how policy decisions are made in the future. What remains to be seen is just how the policies and laws made by government will affect wireless, high-speed Internet and how this industry will respond to legislation. Through the study of past telecommunications policy and by analyzing the current path of the wireless, high-speed Internet it is

possible to see how this industry will affect rural areas and be able to hypothesize that the best way to get broadband to rural areas is through a wireless connection.

Chapter Outline

Chapter two will discuss and clarify terms such as wireless Internet, universal service, and rural areas, as well as give more insight into current policy and legislation that has occurred. It examines the current studies and literature that have been published about telecommunications in rural areas, the importance of universal service, the impact that advanced technologies have on rural areas, and explain wireless Internet networks and how they may be the economical choice to fill the void in rural areas. Chapter three explains the reasoning behind the use of current data sets involving rural populations and their Internet usage trends. It also explains the use of personal interviews as the source for which the information about how the wireless, high-speed Internet industry works and the issues that are associated with it. Chapter four discusses interviews with five different wireless service providers, discussing with each one the different challenges and rewards that they face in the industry. Through interviewing them, this thesis will be able to discern the aspects that go into building and maintaining a wireless Internet infrastructure. Also, the information provided by the rural WISPs allows for insight into how these services affect the rural areas and the advantages of this connectivity for the future. Chapter five concludes with a look at the future policy effects to wireless, high-speed Internet connectivity. Also, it examines what this author perceives as lacking or not yet validated in the research. In addition, it

studies the need for further research into the issues and policies surrounding the wireless industry. In conclusion, wireless high-speed Internet may be the best option for rural areas to receive broadband and the importance of having this service in these areas.

Chapter 2: Literature Review

Broadband: Definition and Importance

Most likely, the average user of the Internet is not aware of the actual meanings of the technological concepts because of conflicting information or they perceive that the knowledge is not necessary. As innovation continues, new technologies develop that require those in the industry to name and define. A new and recent technology has been the invention of broadband Internet. Although it has been around for a number of years, it has not been used as the source of Internet for the majority of the people until recently. Broadband Internet according to the Federal Communications Commission and the National Telecommunications and Information Administration is, “ The capability of supporting at least 200 kilobits/second in the consumer’s connection to the network (“last mile”), both from the provider to the consumer (downstream) and from the consumer to the provider (upstream)” (NTIA, 2000). This definition of broadband is the definition used by many government agencies and scholars as it encompasses the act of not only downloading information but also uploading it. The fact that the information travels both ways at a high rate of speed is important, however most consumers only think of the rate at which they can download information. Much of the research on broadband also uses other terms to refer to this high-speed rate of information exchange. Terms such as high-speed Internet, advanced communication service, and advanced capability are used interchangeably among many others to refer to broadband Internet. These different terms essentially mean the same thing, but may

be used in place of broadband when trying to include technologies that may occur in the future.

Broadband Internet has been in the market for a longer period of time than most people perceive it to have been, but until the last five years, broadband was not available to the majority of customers. There are several factors to why broadband has become the alternative to dial-up Internet. The first reason is that the speed of the service has increased. To many residential customers that have the option to subscribe to broadband, one of the main reasons why they find it cost effective is because of how fast the service is, thus taking less time to execute tasks, such as downloading large files and/or uploading various documents. The demand for broadband greatly depends on the view of users and their perception of the importance of speed. Rappoport, Kridel, and Taylor write, “ Speed may be of little importance for conventional e-mail transmission but not for the origination or receipt of large data files, videos, graphics, or photographs” (2002, p. 59). Since the uses of the Internet are becoming more diversified, it is important that people have the speed necessary to perform these functions of the Internet that they perceive as essential. For new technologies that are up and coming, such as voice over IP and video chat, people are going to need a solid, high-speed connection to use these services.

Secondly, the convenience of having a connection that is “always on” provides a new way to use the Internet, thus changing the perception of uses of the Internet. Many people, especially in rural areas where the technology has not been in place for a

long period of time, do not use the Internet as a resource as much as possible because of the inconvenience that it often takes to get connected. This is primarily the case with dial-up access. Broadband helps to ease the hassle of getting connected because it is always available. Rappoport, Kridel, and Taylor write, “In the end, greater bandwidth allows household Internet users to economize on time. In general, time affects Internet usage in two important ways: through impatience and as a real opportunity cost” (2002, pg. 60). Time has become an important factor when discussing the Internet. For the majority of people, the Internet is used not only as a source of entertainment, but also as a tool to conduct personal business. As broadband becomes more widely adopted, more people will want it and the demand for the service will increase. This raises potential problems for areas that are unable to get broadband because of location and lack of economic feasibility. Rural areas often do not have the option of the services they require or desire because of their remote location. Also, the lack of potential revenue to companies, because of a small customer base, diminishes the desire of larger broadband providers to deploy the service. Understanding the importance of the service is important, but it is also pertinent that one understands the population that is affected by having or not having this technology.

Rural Communities: Differences in Economics and Population

In order to fully understand an idea or concept, it is essential that one understand the subject(s) that they study and the audience that they encompass. The specific demographic being acknowledged are those living in rural America. The term

rural means many different things to different people, and therefore is hard to explicitly define. The definition that is easiest to use is one that is laid out by the Census Bureau and is also discussed by the National Telecommunications and Information Administration and Rural Utilities Service. They state, “ Rural means towns of fewer than 2,500 inhabitants as well as areas out side of towns, including farmland, ranchland, and wilderness” (2000, p. 4). Although it is hard to place a number on what is or is not rural, to make it clear it is often necessary so that there are quantitative parameters. In the early twentieth century, rural America had always been thought of as having a different culture from the rough, urban areas. For many though, these urban areas held the potential of acquiring wealth by allowing more people to be employed at the industrial factories that dotted the landscape. Population in rural areas steadily declined during this time period because the focus was on manufacturing and mass-producing goods, which was done primarily in cities. This continued through the 1980s’, but as the technological revolution of the 1990s’ hit, rural areas began to regain the population that once was rapidly migrating out. According to Johnson, “ The nonmetropolitan population stood at 56.1 million in April 2000- a gain of nearly 5.3 million since April 1990” (2002, p. 65). This growth is due to a variety of factors, ranging from those wanting a quiet retirement, to more companies moving to rural areas because of cheaper costs (Johnson, 2002).

Although rural areas in general have seen an increase in population, the majority of the rural areas in the midwestern states, such as Iowa, have seen a decrease

in population. This is partially due to the influx of corporate farms and the decrease in family owned farms. The other reason is the lack of resources and availability of technologies that are easily available in higher populated areas of the country. Kilborn speaks to this when he quotes Chuck Fluharty, “ ‘What they got was a race to the bottom,’ said Chuck Fluharty, director of the Rural Policy Research Institute at the University of Missouri, ‘with tax giveaways, the lowest wages and the most destruction to the environment’” (2003). Because of short-term incentives, rural areas may be growing some in population, but not without some harmful effects. For example, many industries, such as telemarketing or customer service call centers, move to a rural area and provide hundreds of jobs to the community and the surrounding areas, but do not provide the community with the same opportunity to use the new technology that the company uses for themselves. Premkumar writes, “ The local people were never involved in the implementation and never thought of newer methods of exploiting the technologies to make them more productive and competitive” (2000, p. 96). Many inhabitants of rural areas do not understand what technology exists in larger areas and the possibilities of high-speed Internet connections.

The main problem that is encountered when trying to market new technology deployment in rural areas is the lack of knowledge and perceived need about a different technology. Since many rural areas have a growing population of senior citizens and retirees, the technology does not seem as necessary to them as it is to urban professionals. This is not only because of the gap in age, but also because they do not

know much about the technology and how it works. Grossi writes, “ The key to improved public policy is a better informed public” (2002, p. 94). He is not talking about Internet usage or policy, but as with any new idea, the public needs to have some technological knowledge before they can use it. Premkumar agrees when he writes of the different levels of knowledge regarding new innovations, “ Rogers identifies three different levels of knowledge about innovation: what the innovation is, how the innovation works, and why it works” (2000, p. 97). These three levels of knowledge are key for any business or person to understand why a new technology is important and how it should be implemented into their daily lives. Many smaller companies and/or single-family households need to know how high-speed Internet will make their life easier and more manageable. For example, if a rural family understands that they are connected to the Internet via a wireless signal that is transmitted from a tower a certain distance away, then they can explain or expand this technology to others and indirectly support the growth of wireless technology.

The myths of rural America promoted by the media supports the idea that rural living is slow paced and therefore under educated. Given these perceived attributes, it is assumed that the population does not adopt new technology easily or quickly. Although that may be the case for some towns that are in very rural areas, the majority of people living in non-metropolitan towns have a need for the technology that is developed but often unavailable to them. Many local and state lawmakers see the need for implementation of faster and more efficient technologies and recently the federal

government agreed with the importance of access for everyone when they created the Telecommunications Act of 1996. In this document, the discussion of universal service surfaced and has changed the path of technology once ruled by location and the cost of deployment.

Universal Service

It is easiest to define universal service by using the provisions that have been laid out by the Federal Communications Commission (FCC). They state that, “The goals of Universal Service are to promote the availability of quality services at just, reasonable, and affordable rates; increase access to advanced telecommunications services throughout the Nation; advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas” (FCC, 1996). It was meant at that time to apply to telephony service, as that was the primary form of communication. Crandall and Wavermann state, “Universality of telephone service in this older environment would simply imply that telephone service be available to everyone, that is, that the cost of connecting to the network, including free inward calls, and perhaps initiating a certain number of outbound calls, be affordable to citizens of all incomes” (2000, p. 3). This written definition of universal service simplifies the technical jargon that the FCC included in its definition of universal service. It was important to make telephony service affordable to all, as it had been around for a number of years, yet it was not an affordable option to many in areas that

did not have the infrastructure easily available. Since there was not another communication service available, the goals of universal service were aimed at telephone connectivity. As new technologies have emerged these same goals have now come to be applied to the Internet as well, especially with the view that Internet service is needed and is as important as telephony.

This definition, set forth by the FCC, has been widely debated by scholars in the telecommunications industry. It is a straightforward definition, but the questions that surround the exact meaning of the definition have come into play in recent years because of changing and emerging technologies. What exactly is meant by “just and reasonable” or “advanced telecommunication services”? These are the questions that many policy makers and scholars are asking because the answers provide new opportunities for many people that may otherwise be disadvantaged. “It had been thought that [Theodore] Vail used the term to describe the traditional goal of providing telephone service to all households. However, a second interpretation contends that Vail meant that one and only one telephone company should serve each geographic area” (Loube, 2002, p. 240). This notion that there can be multiple and wide ranging definitions proves that there is no exact way of looking at universal service. Although there has been contention that the author of the term ‘universal service’ meant it in another way than it is thought of, many agree that the main goal of the term is to get technology out to areas and people that for some reason do not have access to the services.

Although originally meant for telephony, universal service has now become a phrase applied to the Internet because its importance has become stronger in the recent years. It is hard for some to believe that it is essential that everyone have access to the Internet, let alone a high-speed connection, because the Internet is still in the process of becoming as ubiquitous as the telephone. With the steep price of hardware, software, and connection, it may be hard for some to see how the implementation of the Internet universally will help economic development (Compaine & Weinraub, 2001).

Greenstein, Lizardo, and Spiller write:

Agglomeration may not persist as advanced technology becomes less exotic to a greater number of users, which occurs as its features become standardized and its price declines. This potentially leads to a decrease in the relative disparity of economic welfare between the late and early adopters (2003, p. 8).

As it becomes more pertinent to business, education, and everyday life, the Internet will continue to be seen as an essential tool for everyone to stay well informed and connected to the rest of the world. This will lead to the spread of the information technologies to areas that have not been able to obtain the technology due to location.

When technologies become more ubiquitous, it is easier to implement them into areas that do not have them, thus allowing the gap between the haves and have-nots to diminish. However, the view of the Internet, especially high-speed Internet, as an entity that is essential to the majority of the people does not have a lot of support as of yet. Crandall and Wavermann write, “ There does not appear to be broad-based support

for a new subsidy program for these high-speed services, but as they spread, the differences between those with the service and the ‘have nots’ will become obvious” (2000, p. 155). Many differences can already be seen among those who do and do not have high-speed service. For example, those in urban areas have a choice to get high-speed service, therefore the Internet is a more useful tool. As more people acquire broadband access, it will become more essential to those who are unable to get the service because they will not be able to utilize the Internet as fast or as long as those with broadband. This occurrence happened with telephony in the past, and it closed the gap of communication between rural and urban areas because of the perceived importance of universal access.

At the very outset of the Internet it was seen to be analogous to the telephone system, which has become essential for business and personal use. This is what is occurring now in regards to the Internet. Many believe that access to the information one can receive over the Internet equals power, resulting in a strong push by policy makers and the public to get the Internet available to everyone. According to Compaine and Weinraub, “At the ITU [International Telecommunications Union] conference, [former vice president Al] Gore called for all nations of the world to cooperate in building the Global Information Infrastructure founded on the principles of universal access, the right to communicate, and diversity of expression” (2001, p. 162). The push of universal service, in regards to the Internet, throughout the world has been supported by many top government officials in different nations because a vast

amount of information can help equalize those in areas that do not have daily access to the resources of those in urban areas. The Internet can be seen as the next communication technology that will one day be essential for all to communicate and gain information. As it becomes more important, it is necessary to implement the technology to everyone, regardless of location or any other factor that may hinder acquiring advanced telecommunication services. Crandall and Wavermann agree when they state, “Universal service has recently come to have another meaning: the availability of new, innovative services to all potential users” (2000, p. 4). By implying that universal service also includes new technologies that may or may not be implemented yet, policymakers can support the advancement of a certain technologies because of the impact that they may have on society. Since universal service is one of the goals of the Federal Communications Commission, it is imperative that it be applied to any and all advanced telecommunication technologies because different technologies may affect people in different ways.

On the surface, the theory of universal service seems like the best incentive to get everyone connected to the Internet. With more people able to use the Internet, it becomes more profitable to telecommunication companies and businesses that do a large part of their marketing and sales online. The factor that hinders the support for universal service is who will end up paying for the connection of everyone. Those in areas where high-speed connections are readily available and cheap do not want a rate added to their charges to pay for the connection of those in rural areas. On the other

hand, customers in rural areas do not think that they should be responsible for paying a much higher rate for technology that is not available simply because of location. This notion is supported by Compaine and Weinraub when they write, “ He [Wenders] defines the demand for telephone access as how much the subscriber would pay for the right to be connected to the network...” (2001, p. 156). This can also be applied to the Internet. The technology is only as valuable as the customer perceives. If no one subscribes to the service, then it is not a commodity but rather a luxury good. The high-speed Internet market in rural areas is not yet seen as a commodity, but could be if more people support the need of high-speed access. Some scholars view that the key to getting any advanced technology, such as high-speed Internet, into areas is to make it a necessity. Greenstein, Lizardo, and Spiller write, “Competition among localities to attract the key technologies and infrastructure linked to economic growth may lead to direct subsidies of public enterprises or indirect subsidies to enterprises that operate quasi-public infrastructure” (2003, p. 8). If it is seen as a necessary component to business and personal use, then governmental agencies and telecommunications companies will become more inclined to try to work and offer the product in rural areas. The struggle of universal service is largely between those in rural areas and the state and federal governments, but in the middle of the debate are the cable and phone companies that are trying to provide affordable, quality service to all but are unable to because of the lack of funds or subsidies from the government to build.

Several years have been spent on figuring out the best way to charge for price discrepancies between areas. Some scholars agree that the government needs to get more involved and get the companies on a path to providing this service by offering more subsidies. Compaine and Weinraub quote Browning when he says, ““ By pushing companies to offer network services at something like the cost of providing them...regulators can put networks on a sound financial footing, and so make them independent of the whims of politics and subsidy”” (2001, p. 166). Another theory would be to keep the government out of the issue and not dole out subsidies, but add a tax to the service that would essentially pay for the service. A theory called Net Transmission Account System asserts that since it is a tax it can be applied to any advanced technology, thus removing the government from deciding who and what technology gets access to the funds. (Compaine & Weinraub, 2001). Both possibilities of how to fund technologies that require universal service are valid and have been explored, but have yet to be implemented or tried. The current method of promoting universal service has been the implementation of the “Universal Service Fund.” This fund was set up by the Federal Communications Committee when the Telecommunications Act of 1996 was implemented to off- set the costs that are incurred when providing people who are at a disadvantage technologically to become connected to the network (Dodd, 2002). It requires telecommunication companies to pay a certain percentage of their profits into the fund so that public institutions, such as schools and libraries, are able to receive the same telecommunication and technology

products at comparable cost as those in urban areas. The previously mentioned alternatives, to possibly assess a more equal charge, would give more incentive for companies to expand their services to those in rural areas because in both instances it would not be seen as a forced fee that they must pay, but rather just an added cost or tax for them regardless of the profit they make. Universal service is an important factor when discussing policy that has been made in regards to telecommunication services for rural areas.

Past Telecommunication Policy and Implementation

Past policy incorporated in rural areas has dealt largely in part with telephone services and their development and implementation in rural areas. The history of telephone service is one that is filled with accidental findings and necessity for all to have the technology once it is standardized. This is where telephony encountered problems during its first fifty years of use and deployment. Everyone wanted telephone service, but the price was often too high to get it to everyone, thus excluding people that did not live in the certain areas defined by the corporate telephone companies. The past emergence of telecommunications in rural areas went through many changes and government support before they found the right way to successfully deploy the technology while also keeping the costs down.

Many people have the notion that rural America is primarily farmland, thus composed only of farmers and their families. While this was true in the days of settlement and still holds some truth, towns grew around farms and developed into

communities where everyone had access to things that those in urban areas did. They could go to town and go to the bank, post office, and grocery store, as all of these places have been deemed necessary for all people. What they could not do was call other people from their own home, they had to travel to town to talk to people. The dissemination of telephone service began partially because of the views of the federal government, but largely because of the perceived need of residents in the area. The local governments and citizens recognized that telephone service was essential for economic stability in rural America, especially right after the Great Depression. The National Cooperative Business Association describes the growth of rural telecommunications as, “Rural telephone cooperatives formed in the early 1900s’ to provide telecommunications services in rural areas that were considered unprofitable by for-profit companies. According to the U.S. Department of Agriculture, in 1949, only 39 percent of rural residents and farms were receiving telephone service of any kind” (2003). They go on to attest that since the formation of cooperatives, the number of households and businesses that have access to telecommunications services has grown to provide millions with the communication and information services that are common for those in urban areas. These cooperatives became an integral part of rural telecommunications because, collectively, these cooperatives provide a strong force in the federal government and regulatory bodies. Today, organizations such as, the National Telecommunications Cooperative Association, represent and provide centralized resources for rural telecommunications co-ops. Along with government

agencies, these independent, non-profit organizations provide the link between the federal government and the local cooperatives.

The government set up federal agencies with the specific purpose of helping rural areas build the infrastructure needed to be successful in telephony services. In the late 1930s President Roosevelt created the Rural Electrification Administration (REA) to combat the lack of availability of telephone service in rural areas (OTA, 1991). As the Office of Technology Assessment writes, “REA’s goals were ambitious: universal, high-quality service, rapid deployment, and low rates. It was quite successful in achieving them” (1991, p.138). The reason that they were so successful in implementing telephone services was because of their use of “rural telephone cooperatives.” These small, independently owned companies received federal loans in order to operate, and brought the majority of the population in rural areas telephone service. These cooperatives are still around in rural areas and some have developed into county extension offices, which offer support in other technological ventures that have come up in recent years, such as high-speed Internet.

In order to sustain the networks that these cooperatives built, more money and resources from the government had to be put into them. Since the beginning era of telecommunications, new laws have changed the involvement of government in the telecommunications industry. The Telecommunications Act of 1996 focused somewhat on deregulation, thus hindering the current system that many rural states relied on, government funding to sustain the telephone services that were comparable to urban

areas. As Korsching and El-Ghamrini write, “To keep pace with customer needs and demands telephone companies must be in the position to upgrade their physical plants as new technologies become available and new services become feasible” (2000, p. 45). Many of the companies in rural states, such as Iowa, have had to consolidate or close down because of the increase competition among national players. They no longer have as much funding or support from the federal government as they did when the cooperatives began. If they are unable to update the infrastructure then they will not be able to compete with the new technologies that may overtake traditional phone service. The high-speed Internet industry may have to go through many of the same obstacles and problems that early telephone companies had to endure because the technology is too new and not cost effective yet.

The Problem with the Lack of High-Speed Connections and Access to Networks

Throughout the short history of telecommunications, the lack of the most up-to-date technology in rural areas has been a problem to not only the inhabitants of these regions but also to the regulators and policy makers that have tried to give access to these areas. As Korsching, Hipple, and Abbott state, “ The local development of such state-of- the-art telecommunication infrastructure is fundamental to a community’s sustainable economic development, whether that development is based upon a strategy of grow your own, retention and expansion, or recruiting new business and industry from the outside” (2000, p. 5). These scholars agree that the need for current high speed technology is equal throughout rural areas all over the world, but is also a

concern and need for rural communities in America. For much of the early twentieth century, technological development has continued at a rapid pace thus placing those who have a hard time of getting the newest technology at a disadvantage. As soon as one technology is adopted and finally implemented everywhere, a new technology comes into play, thus making most areas have to start all over in getting the technology out to the public. As the Internet continues to become a ubiquitous entity, it is even more important that rural areas keep up with current technology to give themselves an equal footing in their economic development.

With services now being offered on-line, it is even more important that those in sparsely populated areas have a high-speed connection. It is not only in their best interest, but also in the interest of businesses. If someone has a high-speed connection to the Internet, there is a greater opportunity and desire to purchase things on-line and have them shipped to their house, rather than traveling thirty or more miles to a town that has that certain store. Jonscher quotes IBM executive Lou Gerstner when he writes, “ Networks are collapsing the physical barriers between nations, markets, cultures and people. This connectivity will change everything: the way we access entertainment and interact with one another” (1999, p. 200). This is exactly why high-speed connections are so important to rural America. For example, if cable or television is unavailable, live news feeds are available on-line as well. There are so many applications that only a high-speed connection can bring to rural areas, but deployment of this technology have yet to become widespread or cost efficient. Hilda

Gay Legg, a Rural Utilities Service administrator agrees with the importance of high-speed Internet when Noguchi quotes her, “ ‘High-speed broadband in areas of 20,000 population or less is absolutely essential if those rural communities are going to remain viable in the next decade. The challenge is always: How are you going to make a good business case? How do you get enough revenue to pay back those loans?’” (2003).

The technology in rural areas must evolve with urban areas in order for the region to survive and be viable economically and socially. Unfortunately, it is hard to implement and sustain new technology due to the landscape of rural areas. The sparse population and large distance between areas makes it hard to connect people, but it will be necessary if smaller towns want to maintain their population and development.

The technology of this era is the Internet, which has developed significantly over the past years. It has developed into a tool that can transmit data a rapid speed, often giving people a vast amount of information in seconds. Obtaining pertinent information is essential for those in rural areas to compete with other companies throughout the world. Without the ability to obtain the data, many of the smaller companies in rural America have been put at a high disadvantage. Hales, Gieske, and Vargas- Chanes write,

Telecommunications infrastructure investments, notably in technologies that involve the use of computers to access databases or other online services, provide entry into information exchange networks, and permit participation in

video educational programs, classes, or conferences are critically important to the economic vitality of rural communities. (2000, p. 259).

This is exactly why it is important to develop not only the infrastructure but also ways of getting higher speed to customers in areas that do not always receive the technology. As the physical barriers of obtaining ideas and things become smaller, it is essential that all be given the opportunity to obtain these goods.

It is not only important that small businesses and farmers in these regions have access to high-speed Internet because of the economic gains that are at stake, but it is also important that citizens have access. For example, the increasingly competitive job market has forced many people to seek post-high school education, but many cannot move to a larger city and do the coursework. That has been a problem until recently when it is possible for those in rural areas to take classes and obtain degrees from universities all over the country via the Internet. This is made easier and more efficient if it is done through a high-speed connection. The convenience factor of on-line products or services is not easily measured as it depends on the perception of the user. Litan and Rivlin agree that convenience is hard to measure but can be done in several ways. They conclude that the prices of goods bought on the Internet versus those that are purchased in stores are about the same; however, the additional components of traveling to the store and the time that it takes to accomplish the task outweigh the additional cost that the product may have on-line (2001). To most consumers this is an important aspect that weighs into the actual purchase of a good or service, but without

the high-speed access many consumers do not have the added benefits that those in larger cities have.

It has been difficult to get the physical infrastructure out to rural areas because of cost and geographical problems. Since the beginning of broadband deployment, cable and telephone companies have done a lot in the area of upgrading infrastructure and offering their product to those in urban areas where it is easier and less costly to connect people. They have not been so fast to get the technology to rural areas of America because of cost and lack of demand from the population in these regions, but the people that do live there often want and need high-speed Internet. With the development of new technology there may now be a feasible way to disseminate high-speed Internet. Through the adaptation and advancements in wireless technology, particularly with the use of unlicensed spectrum, many rural areas are beginning to obtain a viable solution to the problem of lack of services.

Why Wireless?

There are several different types of technologies that are able to give people high-speed Internet access. Most consumers receive this connection through cable or direct subscriber lines (DSL). These are technologies that have developed through communication channels that have been used for different purpose, but have developed to put out a high-speed connection. While they have been successful in the deployment of broadband, cable and telephone companies have lacked in their development of these technologies in rural areas. This is because it is hard to lay the infrastructure to

people that are spread out over a broad landscape. The demand is not as high because the population is so sparse in many areas, but many of these people want to have a connection.

According to a study conducted by the Iowa Utilities Board, high-speed means, “technology capable of providing access services with over 200 kilobits per second” (2002, p. 3). The difference in this definition in comparison with the FCC is that their definition require that the speed be in one direction only, either when uploading or downloading information. The FCC’s definition says that it must be over 200 kilobits per second in both directions (Iowa Utilities Board, 2002). Of the technologies available for this high-speed data transmission, the one with the most flexibility is wireless Internet. It not only allows the customer to have a high-speed connection, but also does not require a lot of capital for infrastructure to be built. It is a unique technology with a lot of promise to providing areas with an affordable, high-quality service. In the case of wireless technologies, there are two different types of wireless frequencies, and both types play a part in the development of high-speed connections in rural areas, but one more so than the other.

There are a couple different types of wireless standards that are available today. The first is wireless cell phone technology, which is known as third generation (3G) wireless technology. 3G technologies are available through frequencies that were auctioned and set up by the FCC to be the frequency for this type of technology. It allows those with a 3G compatible device, such as a cellular phone or laptop, to receive

the signal from the cellular towers, thus becoming able to connect to the Internet in this manner (Dodd, 2002). This is not as fast as the technological standard explained below, but it is an option when referring to wireless Internet. The other type of wireless technology that will be referred to is wireless signals through unlicensed frequency. An example of unlicensed spectrum used is with the popular wireless standard known as Wi-Fi. The standard that Wi-Fi uses and has help to establish as the principle standard is 802.11b. This standard is specified for the general use of a signal that is transmitted through unlicensed frequency from a base station to several other computers that have a wireless card with the same standard. It allows many people to get a high-speed connection through one location, thus making the product cheaper. Although it is less reliable in security and guaranteed speed, new standards such as 802.11g and 802.11a are being developed to combat the concerns that are associated with wireless technology (Dodd, 2002).

When discussing wireless technologies, it is important to understand how they work and how the signal is transmitted to the user. The use of frequency is technical jargon for many people not in the technological industry, but it is important to understand its meaning. In order to understand how a wireless infrastructure can be used to successfully expand high-speed Internet to those in rural America, there must be a working definition of frequency. The National Telecommunications and Information Administration describes frequency use as follows:

Electromagnetic waves propagate outward in all directions. A transmitter generally seeks to communicate with a particular receiver; the transmitting antenna directs the majority of the signal toward that receiver and the receiving antenna is most sensitive to signals coming from the direction of the transmitter (2003).

The “waves” form a frequency that can transmit vast amounts of information at once; however, they have varying strengths and speeds. NTIA discusses the importance of the management of spectrum because of the implications that it has on the product working properly. “The spectrum is scarce, though, because at any given time and place one use of a portion of the spectrum precludes any other use of that portion. The use of the radio spectrum is regulated, access is controlled and rules for its use enforced because of the possibilities of interference between uncoordinated uses” (2003). From broadcast stations to police radios, or any arena where a type of spectrum is used, it is important that the signals do not interfere to the point that they would cause the other not to work properly. This is why the government has chosen to regulate spectrum use. The Federal Communications Commission is in charge of spectrum allocation and maintenance. Until recently only a small amount of frequency could transmit a wireless signal, but with increased demand the FCC has allocated more frequency for wireless use. Although this is a progressive step, Salant writes about the disagreement in the amount of spectrum allocated, “Federal regulators say they are expanding the radio spectrum for wireless Internet users to help bring

broadband connections to rural areas, but consumer groups argue that the frequencies won't fulfill the promise" (2003). This is the common debate between regulators and wireless Internet service providers (WISPs). The frequencies that are allocated for use are often not powerful enough to get the highest speed connection available, especially if physical barriers block the transmission of the signal. This makes it harder for wireless companies to become competitive because without the speed and availability of higher frequencies to transmit long distances the wireless company is not necessarily the cost- effective Internet provider.

The question of how this would be better suited for rural areas still remains a debate, but for many people wireless seems like a cost-effective answer to the lack of high-speed connections in rural areas. Wireless technology has become readily available in many rural areas, because of the commitment and ideas of small, independently owned rural wireless Internet service providers. Many of these providers convened at the FCC on November 4, 2003 to talk about a strategy of deployment and what challenges they face in providing fast, quality service. Many discussed the problem of physical barriers, such as hills, trees, and buildings that block the signal, thus not allowing a good signal to come through. Another commonality among the service providers were their difficulties in obtaining funding for the cost of building an access point. Although the cost for the infrastructure is much less than laying down cable or copper wire, there are some cost in wiring and installing the base station where the signal will originate. The other common problem has been the lack of

security not only within the network, but also the security that other devices will not interfere with the signal. This is problematic because the signal is transmitted via unlicensed frequency, therefore, wireless Internet service providers do not have the sole ownership of that frequency which allows other devices, such as baby monitors and microwaves, to cause interference with the signal. This is a problem that could be solved by allocating frequency to wireless signals only, but this would also probably increase to cost of these services because frequency must be purchased (FCC, 2003).

Many questions on how wireless technology works and why it would be the easiest, cost effective way to distribute high-speed Internet access are still arising in the industry. The problems that occur with wireless signals have yet to be resolved but government agencies and wireless Internet service providers are in the process of doing so. In order for the Internet to become ubiquitous and universal, it is agreed that policies need to be updated or changed. This is necessary because high-speed Internet will be an integral part in the future for those in rural areas to compete both in the business market as well as in demographics. By keeping young people in the rural area small towns can remain viable. Many scholars that have written on the subject agree that the importance of high-speed Internet can be equated with the importance of the telephone that occurred in the early part of the twentieth century. With the Internet, those in rural areas of America will be able to conduct business with those in large, urban areas, while still enjoying the small town life.

Chapter 3: Method: The How and Why of Information Acquisition

In a research setting, there are certain characteristics of a method that may make it superior to another method, depending on the purpose of the research project. This thesis uses a combination of research designs to explore the hypothesis and seek a conclusion about the question that is being asked. Through the use of personal interviews and data sets that have already been collected, it is possible to show the need and desire for broadband in rural areas and the way in which many rural service providers are choosing to get it into homes and businesses, through wireless networks.

Analyzing the Numbers

Statistical data is useful in studies because it can quantify the variables that may or may not influence the hypothesis and research question. It can put abstract ideas into a number that is easy to compare and contrast with other figures. A part of this study is to show that wireless broadband is important to rural areas, and to do so it must be shown that rural populations exist in small percentages, but still impact the market in some way. The first numbers used were from the census data set, which estimates the percentage of people living in rural areas or non-metropolitan areas. It was important to understand the location of the population that is affected because the geographical implications of wireless technologies play an important role in how well the technology will work in a given area. Also, the movement and distribution of people need to be examined to show the changing dynamics of rural areas and where wireless networks are the most useful. The data had already been collected and sorted into

different maps and figures for use by the government, which proved helpful in analyzing the data. Looking at the population distribution figures helped pinpoint the states or counties that have the most space, but fewer people populating that area. Many of these maps and figures are from 1999, which being five years old can be considered out-of-date, however more recent data has not been fully collected or analyzed at this time. Although the mobility of the population in the United States is not static, the maps and data from the previous census are useful because it has had time to be thoroughly analyzed. Through the maps and figures that measure not only population distribution but also change in population, it became apparent where the population trends were headed, thus allowing this thesis to show where the rural populations are located.

Another important factor in understanding the population that is being addressed in the study is to look at their views regarding the utility of the Internet and the perceived importance of having a connection. There have been a few studies conducted on Internet usage and the perceived need of the Internet, especially Internet that uses a high-speed connection, within the rural American population. Those that have been conducted were used primarily for a very specific purpose and not for a broad look at how those in rural areas think about technology and technological development. Although the data available is often very specific, it provides insight into the utility of the Internet and the need for a high-speed connection. The data this thesis looked at and used in showing the importance of the Internet was a study done in Iowa

showing the change in Internet usage and deployment. It asks questions that deal with broadband deployment, and has broken down the type of technology used, such as cable, DSL, satellite, and wireless. This study has been conducted in consecutive years starting in 2001 and shows the changes in availability and perceptions of the different types of technology. The survey was given to users and providers throughout the state of Iowa. The majority of the study was used to show the availability of these services by county and sometimes by city. As mentioned, the respondents were high-speed Internet providers specifically from Iowa, which made it hard to apply the findings to other rural states because of the differences in technological advancements that are aided by the state and local governments in Iowa seemingly more so than in other rural states. The report is still applicable to other rural areas, as the same trends are occurring, but not necessarily under the same circumstances.

Analyzing Opinions

The numbers found in the statistical portions of this study address the population that is most affected by the new technology and how they perceive the use of the technology. How this new technology can successfully be deployed in order to make a profit for the businesses, and provide quality, high-speed Internet connections to those in rural areas who want it, is not the easy trend to analyze. It was decided to ask open-ended questions to Internet service providers in rural areas that provide a

wireless, high- speed service in order to find out how it is currently being devised.¹

Table 1 lists the name and company of those that were interviewed and the type of technology that they employ to provide service.

¹ See appendix A for more information on the Internet Service Providers that were interviewed.

Interviewee	Company	Location of service	Connection type
Marlon Schafer	Odessa Office Equipment	Washington	Wi-Fi in the 2.4 Ghz band
Douglas Campbell	AMA TechTel Communications	Texas	900 MHz, 2.4 GHz, and 5.7 GHz ² ; 5 GHz ³
Neil Mulholland	Prairie iNet	Iowa and Illinois	Fixed wireless; 802.11b standard
Jay Maxwell	Pixius Communications	Kansas and Minnesota	Motorola Canopy wireless solution
Mark Schultz	Monet Mobile ⁴	South Dakota	Qualcomm 1x PCS Spectrum

Table 1: List of the Wireless Internet Service Providers (WISPs) Interviewed.

² These are the bands used that connect the customers to the towers.

³ 5 GHz is used to connect AMA TechTel to the tower.

⁴ Filed for bankruptcy in 2004.

This approach is useful because it allows the researcher to gain more insight into how those in the industry think about the present and future of rural wireless broadband. The importance and usefulness of these types of questions are explained by authors Miller and Salkind who write, “ Open-ended questions are appropriate and powerful under conditions that require probing of attitude and reaction formations and ascertaining information that is interlocked in a social system or personality structure” (2002, p. 310). These academics, which have written several research method books, agree that open-ended questions are important in getting the personal experience and insight that comes with actually doing a project. Because of the composition of the rural service providers and the tendency for these companies to be isolated in certain areas, open-ended interviews are able to provide a more in-depth look into the business practices of these companies. In general, the questions asked pertain to their perceptions of the industry, challenges they face, and why it is important for rural areas to receive this service. By answering specified questions on these topics, this thesis will be able to answer the overall research question of how can wireless high-speed Internet fill the broadband void in rural areas. The personal interaction of allowing the interviewee to expound on a topic, rather than fill out a survey that uses a scale, allows this thesis to obtain a better perspective on the issues involved in providing wireless broadband to those in rural areas.

There is no particular order to how the questions were asked, but if an interviewee started to talk about a question that was to be asked later, then the question

order would skip to the part that they wanted to address. At that time more specific details could be asked about the issue, and it was beneficial for the interviewee to express their ideas in the order they thought would be the most useful. Although the order of the questions given did not have a pattern in regards to why they were asked and when, different genres of questions were usually grouped together. For example, the technical questions or the questions on perception were usually asked in relation to one another. This helped to keep the conversation centered on the same general topic, so that there was not a lot of “skipping” around between areas, thus resulting in less repetition and time. Listed in Table 2 are the questions that were asked to the interviewees.

<ol style="list-style-type: none">1. What is the biggest challenge in providing high-speed Internet access to rural America?2. How do you propose that this be remedied?3. How would wireless high speed Internet help rural areas?4. What role should government play in the deployment of wireless Internet?5. What is your perception of the need for high-speed connections in rural America?6. Technically, how does the wireless network that you run work?7. What is the cost to have the service and how many customers do you currently have?8. How did you start funding the system and equipment?9. How many employees do you currently have?10. How reliable is the network? Usually how and when is service interrupted?11. What are some of the technical obstacles that you face in setting up the wireless network?12. Who are your main competitors? Do you see that their technology has any advantages or disadvantages? In other words how is wireless better for rural areas?

Table 2: Interview Questions

The first five questions addressed the need for broadband in rural areas and why it is important for the population of these areas. This provided a chance for the interviewee to express their ideas of what rural communities encompass and why high-speed wireless access is important to obtain. They were encouraged to talk about why they started the company and how they think the future of the industry will prevail. These questions were good to open the conversation because it allowed the respondents to discuss their unique ideas on how the industry works and how they think their company is helping the specific communities that it services. At this point, the interviewees were able to address the issues that rural areas face in regards to technological innovation and availability. Also, they had the opportunity to discuss their view on the role of government in the technology and how things should be handled differently in regards to policy-making in the future. Throughout the first five questions the interviewees had the chance to discuss a lot of their initial perceptions and ideas about the industry in which they are involved. After these questions, the natural course of questions led to the technological side of the industry and the specifics on their company.

The questions about their specific company and the technology were useful to the research because it provided a look at how the technology is adapted and used. The specific company information will allow this thesis to compare the different companies on the technology that they use and how successful they have been in disseminating the service to rural areas. Since the technology is new and there are several different

ways that it could be set up, the questions on the specific type of technology used are important to understand. Once the technological background of the company is understood, then the foundation of the network and its benefits in rural areas can be discussed in the research. Asking specific questions about the companies, such as size and number of customers, allows the researcher to obtain information about the scope of its service and the amount of people that it reaches. Finally, getting their views on their main competitors in the market and how they compete against them is interesting to note because then one may be able to support the claim that wireless is a viable option to wired lines in regards to high-speed Internet.

As stated before, the questions were asked in the order presented here but there was no particular method to asking them in a specific sequence. The questions addressed the specific issues that are relevant to the objectives of the study. This thesis hopes to find out if rural wireless high-speed Internet can fill the broadband void in rural areas of America. The interviewees' answers to these questions give insight into the perceptions and feelings of those that are directly involved in the industry of wireless broadband in rural areas.

Choosing the Respondents

There are several different ways in which a researcher can choose those that they want to respond to questions that they perceive as important. This project uses the method of informational interviews given to professionals in the wireless broadband industry, specifically those that operate in rural areas of America. The interviewees

were chosen by examining the presentations given at the Rural Wireless ISP Conference held at the FCC on November 4, 2003. This was the starting point for contacting people with the appropriate knowledge and experience needed to provide informative answers to the questions. Once the contact information was collected, e-mails were sent to those that were chosen to participate regarding background information about the project and the reasons for wanting to research rural broadband. All the people contacted work for or own a company that provides wireless high-speed Internet to people in rural areas, but each company has varying degrees of wireless use. The differences among the companies in regards to technology used, size, and geographical location were some of the key factors in choosing a group, so the findings of the study can be applied to as many in the industry as possible. The diverse group of people allows the question to be thoroughly answered as the interviewees provide answers to questions regarding the wireless industry as they see it, and therefore ideas can be more generalized.

The interviewees were contacted via telephone in most cases to discuss the questions listed above. The different wireless service providers included people from several different states and in various stages of the business. Those interviewed; Marlon Schafer, Douglas Campbell, Neil Mulholland, Jay Maxwell, and Mark Schultz, all have different backgrounds and business models that they incorporate. The variety of these respondents was useful in discussing the future of wireless high-speed Internet because it allows what has and has not worked to become more apparent. The

viewpoint and opinions of those in this industry are important in understanding the potential growth of this technology, and are also needed in assessing the current trends in this market. The interviewees were asked the questions above that pertain to the industry and the market. Their answers were then written down, some in the form of direct quotes, while others were paraphrased. Their specific ideas will be used to answer the research question and support the hypothesis of this thesis by providing the personal experiences of these rural wireless ISPs. The answers gained by interviewing these people can provide another perspective on how and why wireless can fill the broadband void in rural areas. From these interviews and use of statistics that have already been examined, this study is able to answer to the research question as well as support the idea that high-speed Internet is necessary and wireless is the most viable option to bringing high-speed access to areas with a smaller population.

Chapter 4: Findings and Research Data

Wireless networks that operate across America seem to be the new technology of the future. A future in which you can take your computer anywhere and have a signal in which you can sign on to, thus allowing a user to have more mobility and options. More importantly, however, wireless signals provide a high-speed Internet connection to those in rural areas that may have no other choice in service. How can wireless high-speed Internet accelerate broadband deployment in rural areas? Through the use of interviews and census data one can better understand the importance of obtaining a high-speed connection for those in rural areas. The census data provides clarity into the population distribution in the country, while the personal interviews provide insight to a certain area and how the wireless network has been set up and maintained.

Rural America: Survey and Census Numbers

In order to gain the full perspective of the area that is being discussed, past census data of the different areas of the United States is relied upon, to show how the population is distributed throughout the country. Defining and seeing the actual numbers on rural areas helps to put into perspective the actual low number of people and why it is at times so hard to get products to people where the demand is there, but the actual number of people is too low to gain a profit. According to the 2000 census data, 79 percent of the United States' population was in urban areas, while the other 21 percent of the people lived in rural areas. To put it in another perspective, those in

metropolitan areas, which include the city, suburbs, and surrounding rural areas was at 80.3 percent in 2000. This is compared to the 19.7 percent that do not live in metropolitan areas but live in a town that is not considered rural as it has a larger population. The slight difference in the percentage numbers is due to the different classification of the population that the census bureau is measuring. In the first survey, the census was measured strictly by the number of people in town and classified them as urban or rural. The second survey included the rural towns that lie close to major cities in the metropolitan area. The Census Bureau states that, “Each MA [Metropolitan Area] must contain either a place with a minimum population of 50,000 or a Census-Bureau- defined urbanized area and total population of at least 100,000” (1999, p. 5). With such a small percentage of the population living in rural areas, it is economically challenging to provide a service, such as broadband, when one’s profit is made by having more customers signed on to the network.

Although the actual numbers of the population are not there to support a broadband network, it is still needed and wanted by consumers in those areas. As the technology grows and becomes more common the demand for high-speed access will most likely grow in all areas. An assessment done by the Iowa Utilities Board found that, “The deployment rate of high-speed technologies in rural and non-rural Iowa communities continues to increase at a significant rate. 67.8 percent of rural communities (less than 2,500 inhabitants) currently have high-speed Internet access” (2003, p. 3). Although the percentage of communities with access was written about, it

was not shown how many actually subscribe, or if it is affordable. The study also found that the demand for high-speed access is greatest for the DSL and cable technologies. This may be due to the fact that DSL and cable are more widely advertised and discussed, whereas wireless broadband is still in the early stages of development. Another fact reported was that, “Access to wireless technologies is expected to increase very slowly in rural and non-rural communities” (Iowa Utilities Board, 2003, p. 5). The projections assessed by this study concluded that wireless access in rural areas would be the only growth seen in one year and that non-rural communities would not gain more access to high-speed wireless technologies (Iowa Utilities Board, 2003).

The conclusions and projections apply specifically to Iowa, which has differences compared to other states with a high rural population, but if this study was done in other states the findings would seemingly be similar. Elevated demand for high-speed Internet access and the steady but slow growth in high-speed wireless Internet are both trends seen in other states in the country; however, there is not an updated study validating this as in Iowa. Although it is based specifically in Iowa, this study shows the continued effort that is being placed in developing high-speed Internet technologies, especially wireless broadband. It does not, however, show the depth of the rewards or problems that many of the service providers face.

The interviews conducted give greater insights into what is involved when starting and running a rural high-speed Internet access company. They also give personal accounts of why broadband is needed in rural areas. By using personal

interviews and asking open-ended questions this thesis is able to gain more specific information on the industry and the differences that are involved within the industry.

The Interviews: Gaining Specific and Personal Insight

Providing service: Challenges and Rewards

As with any emerging industry, there are challenges and rewards to starting and maintaining a high-speed, wireless Internet company. One of the appealing characteristics to wireless Internet is that it does not require one to physically install the wires that go to the home, thus freeing up the time that it takes to get the service to the home. Douglas Campbell addressed this point when he discussed the idea that wireless is making better “in-roads” versus fiber because of the substantial cost difference between the two technologies (Washington, D.C., March 24, 2004). Due to the cost of the physical fiber and wires and to the cost of paying technicians to install the wires, wired lines are much more expensive to lay out and maintain.

Another reward or benefit in providing service is that the desire for a high-speed connection is evident in rural areas. This is the reason why many of the rural wireless Internet service providers started their businesses. They saw the need and demand for a high-speed connection, and then sought to make a profitable business from it. Mark Schultz from Monet Mobile confirms this when he said, “The need is there and people want the service, but costs have to be driven down by the technology side in order [for wireless Internet] to become more viable” (Telephone interview, March 31, 2004). The desire for high-speed Internet in these areas has the potential to

continue to grow as more services and goods become available on the Internet.

Although the need is there, the challenges in bringing broadband service, specifically wireless broadband, to rural areas is the lack of affordable technology or funding to start the service.

Many of the interviewees said that one of the biggest challenges in providing the service is getting the funds available to build and maintain the network. Jay Maxwell with Pixius stated that the biggest business challenge in his opinion is “access to capital” (Telephone interview, March 31, 2004). For entrepreneurs interested in starting a company in this industry, the lack of access to funds to do so is one of the largest challenges. Neil Mulholland with Prairie iNet agreed as he stated that one of the most challenging aspects of providing high-speed Internet access to rural America is “the capital to build the networks” (Telephone interview, March 31, 2004). Lack of available capital has many speculating on how to remedy the problem and that will be addressed further in this thesis.

The type of business model that companies use varies depending on the background and goals of the company. This also applies to the companies involved in providing high-speed Internet service. There are many different options that one can follow when entering a new field of business. One option is that private investors can be a part of the business, thus spreading the costs out to several different sources. Monet Mobile and Prairie iNet both used this plan when starting their company. Schultz states that they “raised equity and debt to fund business but the infrastructure

was funded by LG electronics” (Telephone interview, March 31, 2004). In other terms, they used funding from other companies to get their business started.

Muhlolland used a similar strategy when starting his company; he states that they used “private equity markets and raised strategic capital” (Telephone interview, March 31, 2004). This option has its strengths and weaknesses, as it uses funds already available, but those investing need to be satisfied and sure of the product, otherwise they may have doubts and pull funding. That is what occurred with Monet Mobile, as their business grew, it became harder for them to raise more capital to keep it as profitable as one of the investors wanted.

Another way in which a company can begin is through the use of loans.

Currently, there are several loans that are available through the Rural Utilities Service (RUS), but as discussed the access to these funds has been limited. Although these types of federal loans take a while to obtain, they are available and that is what Jay Maxwell used when building his network. He discussed that the company received the loan from RUS about fourteen months ago; and since then, they have been working at building a network that is consistent with the standards that other telecommunications companies use. They have put millions of dollars into obtaining top equipment, so that they can provide a high level of service (Telephone interview, March 31, 2004). In his view, the loans provided by the federal government are necessary in building a quality service because in their case not many in the private sector would invest in the company. As with any other type of business, one can also obtain private loans from

financial institutions. Marlon Schafer used this strategy to partially fund his business. He explained that he took out a loan from a bank, which just got paid off this year (Telephone interview, March 24, 2004).

Finally, new businesses can begin with the private capital of the business owners. Douglas Campbell began the wireless sector of the business partially with the money that he had acquired while running a dial-up ISP, and eventually a local telephone company. Once the wireless technology was available, it only made sense to invest and begin a wireless Internet service (Washington, D.C., March 24, 2004). Schafer signed up ten subscribers, and in combination with the loan provided by the bank, it was enough to cover the initial and recurring costs. Pre-subscribing people in combination of investing one's own money allows these businesses to begin without a lot of the hassles that other methods of investment have; however there is a certain amount of risk involved (Telephone interview, March 24, 2004). Once a business plan is in place the next challenge is acquiring customers in order to make the company profitable and sustainable.

Another challenge that was cited is the lack of available customers because of the make-up of the area. Marlon Schafer of Odessa Office Equipment voiced this problem when stating that the biggest challenge was customer density, or lack of, and that a reasonable rate of return was needed to cover initial expenses that are incurred when the network is being built (Telephone interview, March 24, 2004). As noted above, Schafer was able to acquire enough subscribers to cover the initial costs and

maintain the network, but after a certain point, there are not as many people available to subscribe. This also ties into what Mark Schultz stated when he expressed that it was hard to sell the product of high-speed wireless service because it was a new product, a new company, and a new type of service. He went on to discuss that the market that his company targeted was much smaller and therefore the initial “growing pains” that a new company often experiences were even more difficult for his company (Telephone interview, March 31, 2004). The lack of available customers at the outset makes it hard for new companies to secure a good business model; and therefore, the incentive to make this type of service available becomes less.

Usefulness and Need in Rural Areas

Despite the benefits and challenges that these companies face, there are many reasons to why it is a useful alternative in providing high-speed access in rural areas. The interviewees validated the theoretical premise and the arguments in the literature stating that there are many benefits for rural areas to have a wireless high-speed connection. As previously mentioned, the wireless connection provides more mobility and is more cost-effective to many consumers. Moreover, there are several unique cases in which the wireless connection is the only choice for those in rural areas who want a high-speed connection. The uses of broadband in rural areas are the same as they are for many in urban areas. As more people start to use the Internet as one of their primary communication media, the need for a faster connection will only increase. Marlon Schafer offers an example of a woman in his area who sells shoes as

an additional source of income, and has to have a high-speed connection to do so. She buys shoes that are out of date or older and takes a photograph of them. She then posts the photo and a description on eBay and waits until people bid on the shoes. In order to do this, she must have a broadband connection to keep track of merchandise and to also communicate with the customers in “real-time.” In extension of this, she also uses voice over IP to talk to her customers, as typical long distance is very expensive in her area (Telephone interview, March 24, 2004). Mark Schultz agrees, that the same type of people in rural areas, as compared to urban areas, want a high-speed connection, but that there are just fewer people to have the service (Telephone interview, March 31, 2004). All of those interviewed attest that there is a demand for this type of service in rural areas, and that as the technology continues to grow so will the demand.

According to Campbell, market surveys show that about 35 percent of the population in his area have or want broadband access, and that once people start to adopt it, more in the area will start to use and subscribe to it as well. He went on to give the example of a town in his area of about 500 people with a total of about 200 households and that once the service was available there they had 50 customers subscribe in one month (Washington, D.C., March 24, 2004). There was a need for broadband in this specific town, and as more small towns realize the need for this technology then companies like Mr. Campbell’s will continue to experience higher penetration rates. The need and desire for high-speed Internet will also continue to grow because of the advantages this technology offers.

One way that wireless high-speed Internet is useful, is that it is able to provide service to customers that live far from towns, such as people who reside on acreages and farms throughout many of the states that consist of a high rural population. Not only is it hard to get service to those that live in small towns, but it is also extremely difficult to provide service to those that live in outlying areas. Most of the time, it is not economically feasible to get service to areas that have such a small number of people, which is especially true for traditional types of broadband, such as cable and DSL. The reason why many of these rural wireless ISPs began their business is because they saw a need for the service in areas that did not have a chance to get it because they were too small. Campbell quoted that the smallest town they provide service to is composed of only 44 people (Washington D.C., March 24, 2004). This is not where they make their profit, but because of the technology it is easier to get the service to those towns than it is for wired lines to get there. Often, these very small towns are able to get the service by receiving a signal from a wireless base station within their area. Jay Maxwell with Pixius agreed as he stated that the small rural towns are their biggest customers, and that wireless is the best way to get high-speed Internet to rural areas, especially those in outlying areas (Telephone interview, March 31, 2004). The fact that wireless technology often allows for it to be implemented in a matter of months, rather than years, thus allowing for quick deployment and use of the technology.

Faster deployment of a technology is advantageous to those in rural areas because they can begin to use the service right away and “catch up” to those in areas that have had the technology for more time. Mark Schultz of Monet Mobile stated that wireless Internet would help rural areas the most in this area, because the speed of deployment is so much faster than other types of broadband (Telephone interview, March 31, 2004). When customers in rural areas sign up for wireless broadband, they don’t have to wait for a telephone or cable company to provide the infrastructure for the technology to work. They can connect faster and begin to use the other benefits of the faster connection. The benefits of the actual service not only affect the individual user, but to many of the service providers these benefits help the communities and regions as well.

Rural areas often struggle to have equal access in many of the services and/or goods that urban areas have, such as education and choices of different products, but with a high-speed connection some of these gaps can be closed, and therefore allow rural areas to have more opportunities. Maxwell discussed the importance of the service by emphasizing that many town governments are pushing for the service, because they realize the importance of a faster connection on the well-being of their community (Telephone interview, March 31, 2004). Mark Schultz gave some examples of the benefits of broadband when he discussed that rural areas often have a higher need for the technology because it is important in developments in telemedicine, and in various aspects of farming, such as in interactions with buyers of their products

(Telephone interview, March 31, 2004). Schafer further described the benefits for farming when he gave the example of farmers that can now sell their crops directly to the end user and can cut out the middle man, thus making a higher profit. By using a broadband connection, farmers have the opportunity to research the markets and sell their product; therefore being able to better compete with the corporate farms that are becoming more prominent in the farming industry (Telephone interview, March 24, 2004). This also leads to securing a better economic future for those in rural areas.

As previously mentioned, there are certain needs rural areas have that do not exist in urban areas because of the differences in the composition of these areas. Some of these issues include the trend of younger generations moving from rural areas at a faster rate. Douglas Campbell discussed the fact that the regular availability of a high-speed connection in rural areas would help to curb the out-migration trend in these areas and possibly strengthen the economic health of the area (Washington, D.C., March 24, 2004). Business and commerce in a community are not the only areas helped by the deployment of this technology, as schools and families also benefit from the access to the technology. Mulholland gave the example of children in school that no longer need to rely on information from only text books, as they now have the opportunity to use the Internet to find information that is more up-to-date than a text book. He went on to discuss how the installation of broadband “shrinks the world” and allows for people around the world to connect, thus making a stronger network of people (Telephone interview, March 31, 2004).

Not only does the use of wireless high-speed Internet have immediate benefits to rural areas, but the future also holds many more possibilities and uses for the service. Neil Mulholland discussed the idea that broadband is the telecommunications medium of the future, and that it will “enable voice, video, and data delivery over one pipe” (Telephone interview, March 31, 2004). This technology will allow many different forms of communication to converge into one service, and make communication easier and more accessible to populations that do not have easy access to these types of services. He went on to compare the use of high-speed services to the first integration of cell phone technology. When cellular phones first became available, they were not reliable or practical to many consumers outside of urban areas because the towers were not built in many areas. As the technology developed, it became better and more people adopted it, thus making the physical network and the network of users stronger. Now cellular phones are becoming a regular part of society and to many people it became a necessity to be able to use a cell phone. Mulholland envisions that this is how broadband will progress and that it will become a telecommunication service that allows the user access to not only high-speed Internet service, but also access to other services such as Voice-over IP, which allows the customer to talk via the Internet on a telephone (Telephone interview, March 31, 2004).

Broadband will encourage the growth of alternatives to typical services, such as telephone, television, and other media of entertainment. Without the option of using the emerging technology, many will be left at a disadvantage. Wireless high-speed

Internet will help rural areas get connected and enjoy the many benefits of broadband. Support from outside agencies, particularly agencies within the government is needed in order for this to be a sustainable venture.

Government Involvement

As with any issue that affects people and business markets, wireless Internet has also had to develop some type of relationship with government agencies. Since the majority of the wireless ISPs are in rural areas, this involves other agencies that work with rural areas as well as agencies that regulate the technology industry. Although most realize that some type of government involvement is necessary to deploy and sustain wireless Internet in rural areas, there are varying degrees to which these providers feel that government should be involved, as they are operating on different levels of unlicensed spectrum. Not only do people have different ideas as to how much the government should get involved, they also think differently about how exactly it should be involved. Through the collaboration of government agencies and local service providers, wireless high-speed Internet can be the way that many in rural areas receive broadband.

Most interviewees were in the middle about the importance of government involvement, meaning that while they support it, because at this time it is necessary, many would agree that, if possible, the government should stay out of the issue and let the technology and market be the force behind the growth of the technology. Neil Mulholland stated that he believed that, “The government should be technologically

agnostic” (Telephone interview, March 31, 2004). This sums up the view of many in the field, who agree that the government should not be as controlling of the technology by choosing to support different types of technology in some way.

Some of those interviewed view the government as trying to make it hard for companies to start a new business, and that it is supporting the larger telecommunication and cable companies. Mark Schultz had the view that the government is supporting these large companies already in the market by continuing to support the high entry costs involved in getting new technology out into rural areas by not providing enough monetary support (Telephone interview, March 31, 2004). He went on to discuss the fact that government should be supportive of new ideas and not “pick winners and losers on the technology side” (Telephone interview, March 31, 2004). Marlon Schafer agrees as he discussed the importance of government to “break up monopolies and put money into small up and coming companies” (Telephone interview, March 24, 2004). Although in favor of no government involvement, he discussed that at this time the government needs to be involved in order to protect competition, so that the large companies do not control the full share of the market (Telephone interview, March 24, 2004). The idea that government should not be involved has been incorporated into many of the past technologies that have emerged because that is the basis of capitalism. However, because of the tendency for the market to consolidate and go towards one standard, it is necessary for different

agencies, such as the Federal Communications Commission, Rural Utilities Service, and the NTIA, to be involved.

Many agree that in order for wireless to successfully be deployed in rural areas the government must have input into several aspects of the industry. One of these aspects is spectrum management. Almost all of those interviewed cited this as a significant factor in the development of wireless high-speed Internet. Jay Maxwell expressed that the FCC needs to open up new bands of spectrum to use, because a lot of areas need higher power than is currently available to get the signal out to the rural areas. He went on to say that the improved distance that a signal could travel with this higher range could solve many of the problems that are encountered at this time (Telephone interview, March 31, 2004). Schafer agreed that the UHF television bands of spectrum should be opened as unlicensed as they are not being used in many areas. He supports this because if more spectrum was available the signal would be able to travel farther and through more physical obstacles than is currently possible (Telephone interview, March 24, 2004). The issue of spectrum management has been discussed more lately, but the main source of government involvement is in the form of helping companies economically.

Those interviewed reiterated the importance of government involvement by giving out more loans or grants to starting companies by interjecting in the economic aspect of the industry. Due to the initial lack of customers, because of population size and because of the dominant position of big companies in telecommunications, it is

often very difficult for a new company to provide the service and be profitable. Because of this, the government has tried to put into place several loan and incentive programs, such as possible tax breaks, so that companies can provide these services. The loans have only become available recently but are difficult to receive because of certain government obstacles . Neil Mulholland conceded that the loan programs available are, “fundamentally correct, but operationally flawed” (Telephone interview, March 31, 2004). This sums up the feelings of many people in regards to these programs. Jay Maxwell discussed the Rural Utilities Service and its efforts to make low interest rate loans available to service providers. He stressed the importance of making “cheap money” available so that it is easier to deploy the service (Telephone interview, March 31, 2004). These loan programs intend to give capital to entrepreneurs to help them start a company that would provide the services that people in their rural areas want, but are unable to receive through the cable or telephone companies. The government has made money available, but obtaining those loans is a difficult process. Mark Schultz stated that part of the reason his company, Monet Mobile, went bankrupt was because the loans that were set aside for rural broadband deployment had parameters that were too specific. For example, he stated that the definition of “rural” is too small, and although it encompassed very small towns, it did not include the mid-sized towns that needed the service just as much as the really small communities (Telephone interview, March 31, 2004).

While many agree that there needs to be government funding available to implement these services, not all think that loans are the best way. Marlon Schafer believes that the best way to help out rural wireless ISPs is to see that grant funding made more available. His contention is that loans stifle the growth of technology, because of the bureaucracy involved in obtaining a loan (Telephone interview, March 24, 2004). As gained from the interviews, many of the service providers in rural areas believe that some sort of government help is needed to get the service to people; however, it is still hard to gauge exactly what should be provided and to whom. Without the assistance of government agencies economically or technologically, this service may not develop as rapidly or as well as it could. Government involvement will be necessary to implement these services into rural areas, not because of the faults of the technology, but because the population is much smaller. Because of demographics and the distance between people, wireless seems to be the best option to get broadband to rural areas, despite the lack of available funds.

Wireless Technology: Reliability and Obstacles

As faster and more reliable technology becomes available in the area of wireless, the demand for it will also grow. The advantage that rural areas will have is that they will already have the technology, and it will not be as difficult for them to upgrade the equipment. The companies currently in the wireless Internet industry strive to provide a fast and reliable connection at a lower cost than wired access. There are several different standards that can be used and also several different wireless

infrastructures that are currently available. For example, some companies like Odessa Office Equipment use radio transmitters that are installed on towers or buildings that emit the signal over unlicensed spectrum that subscribers can pick up (Telephone interview, March 24, 2004). Other companies like Prairie iNet use a fixed wireless technology, which operates on licensed spectrum. While others use a standard and network that is already set up using cellular technology standards and also unlicensed spectrum. The standard used matters in the sense that there are different advantages to each, but it does not matter in the fact that the signal is still getting to the customers. The focus of this thesis is not the different standards and choices available, rather the focus is on the fact that the service is being provided through some sort of wireless technology.

As with any new technology, there are some problems or difficulties that may occur. This is the case for wireless broadband, as it is still in the beginning stages compared to other technologies. One of the problems with using the wireless standard as the source for Internet access is that there tends to be interruption within the frequency. Schafer reported this as a problem in the technology that he uses. He said that there is a lot of spectrum congestion because there are other unlicensed devices that using the same frequency. One of the ways that he has remedied this is by putting a shade over the transmitter, so it does not get interference (Telephone interview, March 24, 2004). This is a problem experienced by many in the field. Maxwell expressed this concern as about the technology he used to operate on a different

spectrum, it had a lot more interference than it does now. The new equipment also helped to reduce the interference. He said, though, that with advancements in technology the interference problem is becoming less of an issue (Telephone interview, March 31, 2004).

Another main problem that many of the interviewees expressed were the internal problems that occur in using wireless. When trying to make a technology work exactly the way that it is supposed, there is conflict at times within the network. Schultz discussed that one of his main problems was the newness of the service and trying to get all of the different pieces to work together correctly (Telephone interview, March 31, 2004). Campbell agrees as he said that wireless high-speed Internet is “not an exact science but an art” (Washington, D.C., March 24, 2004). This seems to be the case for many of the providers that were interviewed. They agreed that they work to fix new problems that may arise in the network, and that there is not always a quick fix or answer to the problem. Jay Maxwell agreed that the problems are internal, and that they “step on their own toes.” He said that the customers are patient and willing to accept problems as the technology is new and many do not have a choice of how they get service (Telephone interview, March 31, 2004). As with most Internet service providers, these companies have systems in place that monitor the network at all times and are alerted if there is a problem within the network.

Despite some of the problems that occur with wireless Internet technology, there are many benefits and advantages that this technology has over the typical cable

or DSL connection. Because of the specific characteristics of rural areas, the benefits of wireless broadband are even more apparent. One of the advantages that wireless broadband has that is on a general level is that it is developing as a communication medium that is meant to transmit all the different types of data that are in use. Neil Mulholland discussed the fact that wireless broadband is meant to be a two-way product, meaning that it is equipped to process data quickly both upstream and downstream. This is opposite to the systems of cable and telephone, which were originally built to send information in one direction. He went on to say that as the demand for faster information services grows, wireless broadband has the opportunity to expand quickly to meet the needs of demand (Telephone interview, March 31, 2004). The fact that wireless broadband has developed with cable and DSL, gives it an advantage, because it is a system that is easier to adapt and upgrade, yet it also takes the speed of the traditional forms of broadband.

Specifically, wireless high-speed Internet has advantages over DSL and cable in the fact that it is more mobile than the other two. Jay Maxwell discussed that many of the larger rural towns, such as those with 2,000 or 3,000 people, do have access to DSL, his company provides service for those in the towns that have a choice. But his company's main objective is to get broadband to areas that do not have any choice for service. He believes that wireless is the best solution to getting the service to outlying areas (Telephone interview, March 31, 2004). Mark Schultz of Monet Mobile agrees with this concept as he discussed that they covered many small towns in their area that

were somewhat isolated and did not have a choice in broadband. In his view, the main advantage of wireless is that it allows for many options in regards to equipment. It is mobile within a household that is important because the hardware can be placed anywhere and many of the wires and cords are eliminated (Telephone interview, March 31, 2004). This mobility may be the biggest advantage that wireless broadband has over the other types, as it will allow companies to set up and upgrade the equipment more often and also allow the customer greater freedom in the use of the technology.

Finally, according to many of the interviewees the reliability of this technology is very good, even when compared to wired technologies. Despite the interferences that may occur, those interviewed related that the network is just as reliable as the other technologies. Marlon Schafer said that the service he provides is more reliable than DSL based on speed and quality of the connection. Also, it is less expensive and to some areas the only choice for broadband. He went on to note that if the service does go down it is much easier and faster to fix, as there is less hardware (Telephone interview, March 24, 2004). Douglas Campbell agreed that DSL has limitations in getting the wiring out to all areas because the farther they try to extend the loop the slower and more unreliable the service becomes (Washington, D.C., March 24, 2004). Another disadvantage that cable and DSL have according to Neil Mulholland is that they were initially created for a different purpose than to provide high-speed Internet. Cable is a one-way line to get images into the home as entertainment Phone lines

(which DSL uses) were originally created as an analog voice medium so that consumers could talk using their home phones (Telephone interview, March 31, 2004). Due to the different purpose of the equipment at this time, it is often outdated and many areas are not equipped to handle the different amounts or types of data that are now being shared among users. With wireless broadband being developed to handle the different forms of data, such as voice, picture, and video, it will be more suited to evolve with the demand that will most likely occur once more people switch to broadband.

One can draw many conclusions from speaking to those that are directly involved in a certain industry. The many personal insights gained attempt to show the “big picture” of the issues involved. In this case, speaking with those that are currently involved in some way in providing high-speed Internet access via a wireless signal has brought new perspective to the challenges and benefits that are involved in the industry. With these perspectives, new policy measures can be made and the future of this technology can be ensured by policy measures that are beneficial.

Chapter 5: Conclusions

The perspective that one has on technological development and use relates to how one relates to the importance of a certain technology in their personal life. In the past twenty years personal computer use has grown dramatically due in large part to the advent of the Internet. As the Internet becomes a more ubiquitous entity in the lives of people, especially in America, the need for the high-speed connection will continue to grow. As seen in previous research, the desire for a high-speed connection is present in those that were surveyed. Because many people in America do not have access to these services, due in part to geographic location, wireless high-speed Internet seems to be the only option at this time to successfully deploy high-speed services to rural areas. Those in the field of wireless broadband seem to believe that this is the logical action, because those in the telephone and cable industries do not see rural areas as a priority as they are not guaranteed a high profit compared to providing service to urban areas. Wireless connections to rural areas can fill the broadband void that has been left by these companies; however, there are still barriers, both technologically and physically, that impede high-speed wireless Internet service from developing to its full potential.

Future Policy: Where Does the Government Go From Here?

As discussed by those interviewed, there are certain policy decisions that need to be made in order for wireless Internet to fully be able to grow into a highly profitable and competitive service. The first hindrance that is occurring lies in the

difficulty to obtain the federal loans in place to deploy these services. Brasher from the Des Moines Register writes:

[Senator Tom] Harkin said few companies are getting the low-interest loans or even applying for them because the lending rules ‘appear to be so restrictive and exclusionary.’ Harkin complained after The Des Moines Register reported that the department’s Rural Utilities Service has approved only 12 of 90 loan applications since the program began more than a year ago” (2004).

The bureaucracy involved in filling out these forms often deter people from trying to receive these loans because of the time-consuming hassle that is associated with these forms. A policy needs to be in place would include help in filing for these loans and allowing the businesses to receive them in a timely matter, so they can get the technology out to people in their area as soon as possible. Without the added hindrances in obtaining a loan, more entrepreneurs would be apt to provide this service.

The next policy measure that needs to be taken is in regards to spectrum management. Currently, the spectrum that is used as unlicensed does not consist of any bands that are of extremely high frequency, thus many physical obstacles obstruct the signal from the transmitter to the receiver. The Federal Communications Commission writes:

Some experts foresee a need to migrate to unused or even occupied portions of the spectrum in order to accommodate the broadening need for wireless

connectivity. Potential solutions include...allowing unlicensed devices to operate as an underlay in bands that are currently allocated to existing licensed services, and allocating more spectrum for unlicensed operation (2003).

However, higher bands of spectrum would need to stay unlicensed, in order for them to continue to be economically sustainable in rural markets. With the additional bands of spectrum, providers would be able to give better service and use less equipment, making the service less expensive yet still as reliable. The current rules regarding spectrum use make it harder for unlicensed wireless technology to develop because as the equipment becomes more sophisticated, the available spectrum stays the same and there is no growth.

The final policy proposition is the definitions used by many of the current policies are too strict in regards to what is rural and what should be considered as unlicensed. For most government agencies, rural means communities of less than 2,500 people, but even communities with 5,000 people can be in rural areas. In this view, it should not be the exact population of the town but where they are in proximity to larger cities. For example, if a town has 1,000 people but is less than 15 miles away from a town with 250,000, it is still rural but the benefits of the nearby larger community are still available. This is compared to communities that are well above the 2,500 mark, but are not located near any other larger city, thus making them isolated, relatively small, and still less accessible to get a wired line. This combination is often more detrimental to an area, because it does not have the resources of a larger town, yet

it is not considered “rural enough” for many of the programs that help to fund programs for the area. By broadening the definition of rural more resources could be made available and could potentially help to sustain the vitality of these areas that collectively compose rural America.

Future Research: Working Towards Sound Evidence

There are still a lot of questions that pertain to the topic of rural broadband deployment, because of the many variables that factor into the scenario. Future research should focus on how this technology may build a way for rural areas to become more competitive economically compared with urban areas. As many of the interviews with the wireless service providers showed, the demand for a high-speed connection exists in rural areas. What needs to be studied further is the best way to provide quality service at an affordable rate. As this thesis concludes, wireless seems to be the answer to that dilemma. The data that is missing, however, is the statistical data that can support this assertion, which can only be done once time has passed and this technology, as well as new technologies, has had time to develop and become more ubiquitous. There is some research on the importance of broadband deployment, but there is not a lot of research on the importance of broadband in rural areas. Most officials and authority figures on the subject agree that the need for the technology is there and that it is important for under-populated areas to be up-to-date on technology, but there has not been quantified proof that this is the case. This is a study that could be conducted in the future, when the effects of the technology in an area are more evident.

Another area of study that is somewhat related to the previous course, would be how the emergence of new technology would help rural areas sustain their population and achieve economic growth. It is hypothesized that if rural areas were able to obtain the conveniences and resources of a city, more people would stay in these areas and continue to sustain these areas. As discussed throughout the paper the demographics of rural areas has been changing to include an older age group of people, with less of the young people staying in these areas. This would be one variable that could be considered in future studies. It would be interesting to research the correlation between the availability of broadband and the economic growth in these towns. It may be a stretch to connect the economic growth, which may or may not be achieved, with the continued presence of a younger population, but with more people open to technological development there is a better chance that technologies, such as high-speed Internet, will be implemented into their everyday lives.

Another field where more research could be conducted is in the area of policy decisions as applied to new technologies, such as high-speed wireless Internet, and how these decisions will affect different areas depending on their unique characteristics. In the past, certain policy decisions made have adversely affected areas that need the service or technology. For example, certain restrictions placed on utilities have caused the prices to dramatically increase, especially in the case of rural areas. Another example of this has been the struggle in the telephone industry in the last century. Certain restrictions and regulations have hindered the growth of smaller

telephone technologies as the government has continually sided with large telephone companies. It would be interesting to compare the different trends that occur in an open market, where there is not a specifically developed standard, as compared to a technology that has a standard that has developed. The competition among technologies with a set standard is very different than those in which no standard has been set. It would be interesting to see if wireless, high-speed Internet would be different from other technologies, in the fact that there is not a set standard that has been adopted within the field. Because many of the technologies that begin in the area of wireless are experimental and ever changing, it will be interesting to see if the government can continually keep abreast of the technology enough to accurately provide policy guidelines.

Future of the Industry

The next step in this constantly changing industry seems to be to accept that the technology will keep evolving and to understand that it is necessary for those involved in wireless, high-speed Internet access to continue to find ways on improving the network and equipment. As more developments occur in this area, wireless broadband must be able to maintain the elements that have made it an attractive alternative. It first must continue to provide more and more mobility. The new trend will be to start developing the technology that allows it to be used while moving, for example, while in a car, which would be useful to emergency personnel as well as service contractors. Mobility can also refer to the range the technology can span. As people become more

mobile, so must technology. In the future, the importance of a high-speed connection as a service will likely become more predominant in society.

Secondly, wireless networks must continue to be an affordable answer and/or option to consumers in rural areas. Affordability is a major component in why wireless, high-speed access has been successful in rural areas. Service providers have provided a seemingly simple solution to the problem that many have in obtaining a broadband connection, which is actually getting the service to the home by using a wireless network connection. They need to continue to provide this service at an affordable rate, because it is often the only choice for rural populations. Although faster and better technology may emerge, they need to be as reliable and cost effective as the technology being used today. This market may become one that makes impulsive decisions to get faster and more advanced technology but that neglects the needs of the average customer. One of the challenges will be to resist that urge and develop equipment that is reliable yet affordable.

Lastly, it seems as though the future of this industry may be different from the events that have occurred in the past history of telecommunications. Past history shows that telecommunication companies tend to go towards concentration, thus creating large corporations. In the case of wireless, high-speed Internet, the small little companies may continue to be successful. Many other network industries, such as cable and telephone companies, have historically become more and more concentrated, until only one company serviced a given area. Although there are many different

characteristics involved in the wireless, high-speed Internet industry, it seems as though it is more likely that many different companies can prevail in an area. This will be an important and interesting factor in the growth of this technology.

With more providers the consumer is able to have a choice in the service they have, as a result, this will stimulate further development of the industry. Another scenario is that it may hit a point where the market is too saturated and therefore larger companies will begin to acquire smaller, struggling companies to create a larger network. If the second option occurs, it will possibly make for a stronger and larger network, but it may also make the service less affordable and impede on the advancements in the technology. It is hard to predict the future of an industry that is constantly changing, but whichever path the market takes in regards to wireless, high-speed Internet, this technology has already made an impact on the broadband industry, especially in rural areas.

Appendix A

Marlon Schafer- Odessa Office Equipment

Odessa Office Equipment first started employing dial-up service to customers in 1997. Since then the company has brought broadband access to customers in the Odessa area via a wireless, high-speed connection using Wi-Fi as the standard. Mr. Schafer also does independent consulting in order to help other ISPs deploy broadband to their customers efficiently. Mr. Schafer utilizes several towers with equipment attached to them to provide the signal (FCC, 2003 & Personal Interview).

Mark Schultz- Monet Mobile Networks

Monet Mobile Networks was founded in mid-1999 to provide high- speed wireless access to certain cities in the United States. They then expanded their wireless service to include rural areas especially in Minnesota and North Dakota. Since then the company has recently gone bankrupt because they could not raise enough capital for some of the investors to continue to support the company. Their wireless platform was based on Qualcomm CDMA 1x technology, which is a part of Sprint and its PCS network (FCC, 2003 & Personal Interview).

Neil Mulholland- Prairie iNet

Prairie iNet has been a leader in deploying wireless broadband to rural communities in Iowa and Illinois since 2000. They utilize the unlicensed, 802.11b standard to provide broadband, which has given over 100 communities access to the technology. They used private equity markets to begin their business and soon built a

reliable service that catered to the many people living in the surrounding rural areas (FCC, 2003 & Personal Interview).

Jay Maxwell- Pixius Communications

Pixius is a company based in Wichita, Kansas that provides high- speed connections to the Internet as well as several other computer services not only in Wichita, but also in the areas of Junction City, Kansas and Burnsville, Minnesota. They are a rural wireless ISP that offers broadband via its wireless standard, extendSM, which reaches where cable or DSL does not in the area (FCC, 2003 & Personal Interview).

Douglas Campbell- AMA TechTel

AMA TechTel is a regionally based telecommunications company that is based in West Texas. They serve many areas in Texas that no wireline service reaches, which has proven successful in the fact that they have deployed broadband to many customers that may not have received it, had it not have been for wireless technology. They employ the use of unlicensed devices in the 900 Mhz, 2.4 Ghz, and 5.7 Ghz bands for “last mile” connections and use the 5 Ghz to connect to the towers (FCC, 2003 & Personal Interview).

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