

AN OVERVIEW OF RURAL BROADBAND POLICY ANALYSIS: CHALLENGES AND
OPPORTUNITIES

A Thesis

by

TAYLRE BEATY

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Chair of Committee, Rebekka Dudensing
Committee Members, David Anderson
Shannon Van Zandt
Head of Department, Mark L. Waller

May 2019

Major Subject: Agricultural Economics

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ABSTRACT

The digital divide between rural and urban communities continues to be a challenge for broadband stakeholder groups across the nation. Broadband accessibility relates to economic theory through challenges of both supply and demand. Policies have been implemented to address broadband accessibility in rural communities on the federal, state, and local level. However, broadband stakeholders often indicate that current policies are not sufficient. Interviews with 14 broadband stakeholders in Texas, Tennessee, and Michigan suggest that the most common challenges are in relation to funding, mapping, and regulations. Though these challenges impact each stakeholder differently, there is common ground that provides an opportunity for policy makers on the federal, state, and local levels to find feasible solutions to the digital divide. These key themes were analyzed in relation to the impact that broadband inaccessibility has on stakeholder groups and rural consumers.

ACKNOWLEDGEMENTS

I want to thank my committee chair, Dr. Rebekka Dudensing for her guidance, encouragement and support through this process. I also want to thank my committee members for their continued dedication to my project and education at Texas A&M University.

I want to thank my professors at the University of Tennessee who established my understanding of agricultural economics. I want to express my gratitude to Dr. Christopher Boyer, a fellow Aggie and my former professor, for encouraging me to attend Texas A&M University. I would like to thank Dr. Bill Park for always pushing me academically and professionally. Without your contributions, I would not be who I am today.

I express my deepest appreciation for the work of the Tennessee 4-H Program. My time as a 4-Her taught me to have a love and appreciation for agriculture. It was there where I developed a passion for policy that impacts farmers, ranchers, and rural communities.

I want to thank my family: Mitchell, Angela, Bill, and Morgan Beaty for your continued love, support, and encouragement throughout not only my program at Texas A&M University, but also all of my educational and personal experience thus far. You have pushed me to set goals and work hard to reach them. Thank you for always believing in me.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

Committee members include Dr. Rebekka Dudensing, chair, Dr. David Anderson, and Dr. Craig Carpenter, all of the Department of Agricultural Economics in the College of Agriculture and Life Sciences at Texas A&M University, and Dr. Shannon Van Zandt of the of Department of Landscape Architecture & Urban Planning, College of Architecture, Texas A&M University.

Thesis author, Taylre Beaty, conducted all interviews, analysis and writing. Ricki Schroeder assisted with editing the final document.

Funding Sources

No outside funding was received for the research and compilation of this document.

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NOMENCLATURE

BTOP – Broadband Technology Opportunities Program

COG – Council of Government

DSL – Digital subscriber line

ERS – Economic Research Service

FCC – Federal Communications Commission

H.R. – House Resolution

Mbps – Megabits per second

NBP – National Broadband Plan

RUS – Rural Utility Service

USDA – United States Department of Agriculture

USF – Universal Service Fund

1. INTRODUCTION

Access to adequate broadband internet service in rural and remote areas continues to be a topic of interest among consumers, policy makers, farmers and ranchers, providers, and rural community stakeholders. Broadband internet access is carried out by various technologies including wire, fiber, satellite, mobile, fixed wireless, and cable (Kruger and Gilroy 2017). As defined by the Federal Communications Commission (FCC) in 2015, the benchmark for adequate broadband speeds are 25 megabits per second (mbps) download speed and a 3 mbps upload speed. Since the early 2000's, access to broadband has grown across the United States; however, with increased access for some, the divide between accessibility for rural and urban residents has grown as well. Today, many consumers across rural America do not have access to internet due to a lack of broadband infrastructure in the area and prices they feel are too expensive to purchase (Lohr 2018). As of July 2017, 39% of rural Americans and 46% of rural Texans do not have access to broadband (Kruger and Gilroy). Nearly 1.8 million residents across Texas do not have access to high-speed internet services (Texas Rural Funders Collaborative 2018).

With few providers offering broadband service across rural communities generating higher prices to consumers, demand for service is low. In the research, broadband accessibility is connected to a variety of economic implications and outcomes for stakeholder groups. For the general public, access to broadband can have an impact on a multitude of areas in a rural consumer's daily life. Whether it be related to education, access to healthcare, telework, or managing a farm or other business, broadband accessibility can have an impact on many consumers in rural communities, creating unique needs and challenges. Stories in the media

have highlighted families working late in fast food establishments to finish up homework requiring internet access when these services are not available in their household (Lohr 2018). Limited access to broadband is linked to the closing of hospitals and healthcare centers across rural America (Texas Rural Funders Collaborative 2018; Steele and Lo 2013) and can hinder the use of medical technologies including telemedicine for rural and remote patients (O'Dowd 2018; Steele and Lo 2013).

Access to broadband is connected to agricultural productivity and technology adoption for farmers and ranchers (Whitacre, Mark, and Griffin 2014). Broadband access can impact the success of small, local, and remote businesses who depend on connectivity for their services, management, and decision-making (Born 2018). Internet service has been found to impact a firm's business location (Mack 2013) and real estate value across rural and remote areas (Young 2002). Research into the socioeconomic consequence of limited broadband access has found that it is linked to the level of education opportunity in rural America (Sundeen and Sundeen 2013). In addition, the impact of internet access in rural communities is connected to economic growth (Whitacre, Gallardo, and Strover 2014), job creation (Crandall, Lehr, and Litan 2007), and telework opportunity (Gallardo and Whitacre 2018).

The ways that access to internet technologies impact a variety of stakeholders across rural communities, and understanding the broad nature of who is impacted, is often missed in the overall analysis of how to create policy solutions. Broadband inaccessibility affects a variety of consumers, across different socioeconomic backgrounds and demographics. Limited access to broadband is not connected to one specific income classification, affecting consumers in rural areas with low and average incomes. This is further justification for understanding how broadband access is connected to rural and remote geography, in comparison to public

perception of accessibility being solely connected to a consumer's socioeconomic factors. This leads to the social argument of broadband being considered a public good by some stakeholder groups who feel that the digital divide requires public investment in order to reach solutions. This argument is similar to the push for the Rural Electrification Act of 1936, which is overviewed in the literature review.

Another challenge associated with understanding the digital divide is establishing a consistent definition of rural. The term "rural" can have a slightly different meaning across different groups and organizations. For the purposes of this study, including the needs assessment interviews, analysis of policies, and literature review, the groups each used their own definition of rural. This allowed them to utilize the definition they felt most suitable for their research, statements, and analysis. There are also challenges regarding the definition of "served," which, within the study, is related back to FCC census block data. However, stakeholder groups have differing needs, making this definition vary from group to group. For example, some stakeholders would not consider an area to be served without reaching a certain speed that meets the needs of their institution or customers. However, data from the FCC may have that group or location counted as served based on a household within the census block have access to broadband that meets the FCC benchmark speeds. Understanding how these discrepancies impact policy implementation and potential solutions is area of focus within the study. These challenges are considered further within the literature review, stakeholder findings, and discussion.

The needs of each broadband group also different in regard to the relevant type of broadband that best meets the needs of stakeholders. For example, while Wi-Fi is of particular interest for groups that are focused on residential broadband accessibility, groups like hospitals

and schools often request fiber due to the need for stronger, more reliable broadband infrastructure to run technologies that are unique to their services. The needs of rural businesses may differ, based on preference or services provided. Due to these varying preferences and stakeholder needs, there is not a one-size-fits-all solution and a combination of alternatives and policy solutions may be needed on the federal, state, and local levels.

While there is a widespread understanding of some of the challenges that come with the rural-urban digital divide, there are discrepancies on how large that gap could be. A study by Microsoft, featured in the *New York Times*, found that the digital divide between rural and urban communities could be greater than what policy makers and the general public think. The study focused on a rural community in Washington where the researchers found large discrepancies between broadband use versus the FCC data on broadband accessibility in the area. A result of these discrepancies is that some areas are ineligible or overlooked for federally funded broadband projects due to the inaccurate or incomplete reported data (Lohr 2018). Another challenge for these communities is the high prices that consumers must pay for broadband services (Lohr 2018). Prices can be higher in rural and remote areas, due to lower population density and fewer internet service providers. This can reduce the purchasing of broadband products and can cause consumers to question the relevance of such products. Due to this issue of relevance, there are economic challenges related to supply and demand. These economic implications, discussed further in the literature review, provide context for the economic argument for policy action and the potential consequences of inaction.

There are few recent notable studies that focus on the impact that limited access to broadband can have on communities, as well as the economic impact that high-speed internet access can have on stakeholder groups. Research by Whitacre, Wheeler, and Landgraf (2016)

analyzing the digital divide for healthcare facilities in rural and urban communities concludes that there is lack of high-speed internet access across non-metro counties. The research also concluded that between 2010 and 2014, the connectivity gap increased for rural communities, and researchers deemed this a cause for concern. Real, Bertot, and Jaeger (2014) found that libraries, while a major hub for providing access to internet in rural communities, have a difficult time meeting the demand for patrons due to a lack of resources. Relevant research has also found areas of interest for stakeholder groups on how deployment of broadband to rural communities can foster economic growth. In 2016, the Hudson Institute released a report on how broadband access impacts the rural economy. The major findings of the report focused on the footprint that rural broadband has throughout the economy, generating demand from economic activity that supported 69,595 jobs in 2015 (Kuttner 2016). The literature review includes an extensive overview of economic research on rural broadband deployment, programs, and policy.

The Texas Rural Funders Collaborative (TRFC) views broadband to be a top investment priority for rural and community economic development. In a report for The Future of Rural Texas: A Texas Tribune Symposium, TRFC (2018) along with Connected Nation, provided a section on rural broadband and the status of its deployment across the state of Texas. The report also included an overview of some of the most pressing challenges in the state that are related to broadband accessibility. Connected Nation conducted 12 listening sessions with Councils of Government (COG) across various areas who have shared concerns for the digital divide in their community. The results of the listening sessions provided the following issues of interest:

- Lack of connectivity in rural schools

- Loss of hospitals and of opportunity for telemedicine due to limited internet access
- Limited fiber infrastructure and broadband access
- Difficulty applying for broadband grants across communities
- Need for active state policies regarding rural broadband
- Broadband reliability in the event of an emergency or natural disaster
- Discrepancies in mapping data lead to challenges for community planning and program application
- Need for specific broadband action plans on the state and local level (Texas Rural Funders Collaborative 2018).

The provision of infrastructure often falls within the public sphere. Infrastructure related to education and healthcare, both of which experience high levels of government regulation and funding and are regarded as rights by many citizens, may intensify calls for policy intervention. Like education, public health, emergency management, roads, and electricity, broadband internet exhibits characteristics of quasi-public goods. While the benefits of broadband are partially non-excludable and partially non-rivalrous, incomplete markets for broadband in rural areas may signal a market failure. Because of this, and how access to broadband impacts other public goods like access to health care, education, and others, these calls for policy intervention are many across stakeholder groups. From the perspective of groups like the Texas Rural Funders Collaborative, broadband is a good that is becoming a necessity for the social and economic sustainability of rural communities.

From a policy perspective, broadband internet in rural communities has become an issue of focus for the FCC, USDA, and Congress, as well as many state and local governments across

the United States. While the issues remain unresolved, there are many stakeholders who have varying interests in solving the digital divide in rural communities. The challenge comes also from competing ideologies of how these solutions should be sought out, developed, and enacted.

The need for rural broadband research is a result of ever increasing technologies that are infiltrating almost every sector. With the contour of education systems, healthcare, business strategies, farming and ranching, and information processing changing and developing quickly, it is important to understand the challenges that limited-to-no-internet access has on rural consumers, communities, and businesses.

This study overviews the challenges to rural broadband deployment and the creation of inclusive rural broadband policies and programs on federal, state, and local levels. In addition, the project analyzes both cooperation and competing interests of broadband stakeholders in addressing the urban/rural digital divide.

In order to better understand the needs of stakeholder groups involved in the broadband space, a needs assessment was conducted. The needs assessment included interviews with individuals who contributed the perspective of their organization or their background working on broadband issues. Some of these interviews included stakeholders who provide internet services in rural communities, often sharing their experiences of successful policy and grant programs, as well as challenges they have been working to overcome as an organization. The needs assessment also included conversations with anchor institutions, including stakeholders from education, healthcare and libraries, who often shared about the unique needs their specific groups require to provide services to rural Americans. The needs assessment also included interviews with stakeholder groups involved in agriculture, including agribusiness, farming and ranching. The final group involved in the needs assessment was stakeholders from state and local

governments, government agencies, and broadband policy initiatives. The interviewees often shared success stories and lessons learned from organizations, providers, and consumers with which they interacted during their time working on broadband deployment.

A set of research goals was created in order to guide the development of the needs assessment for each stakeholder group. These goals were designed to create an objective understanding of the status of broadband from the perspective of each stakeholder group as well as the policy needs for those involved in broadband deployment. In addition, they were created to analyze multiple stakeholder groups in order to observe how these groups have sometimes similar, but often unique, differing, or competing needs. Understanding how these needs are similar or different across stakeholder groups provides a picture of potential policy challenges, as well as areas of possible common ground. The project included the following research goals to guide the development of the needs assessment and analysis of the research findings:

- Research Goal 1: Overview the status of broadband deployment and policy, as well as the policy needs for a variety of relevant stakeholder groups, with a focus on economic challenges.
- Research Goal 2: Based on stakeholder responses, further explore common themes, gaps in resources or information, and opportunities for action in research and policy.

Chapter 2 provides an overview of relevant research that has been done regarding rural broadband. The literature review includes research in the fields of agricultural economics, finance, business development, community development, economics, and public policy. The literature review provides an introduction into the economic impact of the digital divide between rural and urban communities. In addition, the literature review provides an overview of policy work regarding rural broadband within the 115th Congress and relevant background legislation.

Chapter 3 includes a detailed description of the needs assessment. It provides an explanation for the methods and procedures for interview participation, questions involved throughout the need assessment. Chapter 4 covers the findings from the needs assessment by stakeholder group. The sections within the chapter overview conversations from the needs assessment, as well as include statements and testimony by stakeholder organizations. Chapter 5 is a discussion on how the needs and challenges of each stakeholder group relate to each other. This section compares how the needs and challenges are often similar, while detailing a few areas where there are competing interests. Chapter 5 also includes recommendations from stakeholders that were included in the needs assessments and congressional testimony, as well as overviews current policy that has been released by members in the 116th Congress. Chapter 6 provides conclusions that synthesize the needs assessment findings and discussion, while and drawing attention to areas that need further research.

2. LITERATURE REVIEW

2.1 The Rural-Urban Digital Divide

One of the most common areas of interest for economists, policy makers and stakeholder groups is “digital divide,” or the gap between internet and cellular technology adoption and availability between urban and rural communities. Gabe and Abel (2002) found that the digital divide between urban and rural communities in respect to rural broadband was widening. Economists continue to look for causes of the growth in the divide and have attributed connections to multiple factors. Gabe and Abel (2002) suggested that much of the digital divide can be attributed to telecommunications investment challenges. The study found that there were a variety of factors that influence, and often discourage, telecommunications infrastructure investment, including demand for advanced services, market uncertainty and the state and federal regulatory environment.

Another challenge that economists have found to impact the digital divide is available broadband speeds. Barnes and Coatney (2015) find that slower broadband speeds are inhibitors to broadband adoption. The study also suggests that without controlling for the type of infrastructure and network speed, previous research studies might have overestimated the impact that demographic variables, including income and age, have on the rate of broadband adoption in rural communities.

2.2 Job Market and Employment

2.2.1 Job Creation

Broadband deployment has been linked to growth in employment and job creation. Crandall, Lehr, and Litan (2007) found employment to be positively associated with broadband internet within several different nonfarm industries. The study utilized data from the FCC on broadband penetration and state-level data from the lower 48 states to analyze the impact of

broadband output and employment. The results of the research showed that impact of broadband internet on employment is most significant for jobs in health care, finance and education. In addition, the study found that for each increase in broadband penetration by one percentage point in a state, there is a projected employment increase from 0.2 percent to 0.3 percent each year, equating to an approximate increase of 300,000 jobs across the continental United States.

In a study on investment into information technology infrastructure, Atkinson, Castro, and Ezell (2009) found that the investment and implementation of broadband systems is connected to job creation through a “network multiplier.” The study included an economic analysis of three categories of job creation that come from investment into infrastructure: direct, indirect and induced job creation. Atkinson, Castro and Ezell (2009) define direct jobs as those created exclusively from the investment. In the case of broadband deployment, an example might be a worker hired to install broadband fiber. The study defined an indirect job as one created to provide supplies and inputs for the production of the project. An indirect job from broadband deployment might be a job producing the broadband fiber that will be used for installation by a broadband technician. They also define induced jobs as those positions that come from establishments that utilize the finished product. In the case of broadband, an example of an induced job might be a worker in a company or organization that opened as a result of now having access to internet.

The research conducted by Atkinson, Castro, and Ezell (2009) utilized industry specific data from the Bureau of Labor Statistics, industry-level employment statistics from the Bureau of Economic Analysis at the United States Department of Commerce, and a proposed stimulus package to analyze the impact that such an infrastructure investment would have on creating direct, indirect and induced jobs. In addition, the researchers applied a “network multiplier” to

calculate any additional jobs that would come from the investment due to a “network effect.” The results of their analysis showed that a \$30 billion investment in information technology infrastructure would create roughly 949,000 jobs in the United States, 524,225 of which are estimated to be for small businesses with less than 500 employees.

2.2.2 Telework and Income

Another avenue through which broadband affects employment in rural communities, is the ability for individuals to telework. Analysis of the impact of telework on employment is particularly of interest among rural communities as it relates to job retention and creation for rural residents. Gallardo and Whitacre (2018) found telework to be connected to growth in local income. The research utilized the digital divide index (DDI) score, developed by Purdue University (Digital Divide Index 2016).

The DDI score is calculated using infrastructure and socioeconomic factors. The first calculation, accounting for infrastructure and adoption, consisted of the percentage of the population in 2010 that did not have access to the FCC broadband *cut off of 25/3 Mbps. It also included the average advertised speeds for download and upload and the total number of connections for fixed broadband for each 1,000 households that have broadband speeds of 10/1 Mbps (Digital Divide Index 2016). The second calculation controls for socioeconomic factors and included the percentage of the 2010 population that is 65 years and over, 25 years and over with no more than a high school degree, poverty rate, and civilians with a disability that are not in an institution (Digital Divide Index 2016). The study equally controlled for each of these variables, as they impact adoption rates for broadband. A higher DDI score indicates a greater digital divide.

Gallardo and Whitacre (2018) utilized the American Community Survey (ACS) data from 2011- 2015, spatial Durbin error model (SDEM), and the DDI to analyze the impact of

teleworking on median household income. The results from the study show that even when controlling for socioeconomic factors including education, race, age, and employment that impact income, an increase in teleworking increases median household income. Gallardo and Whitacre conclude that traditional work structure is changing with adoption of technology. As broadband internet becomes more available in areas outside of urban communities, opportunities for telework are positively impacting median household income (Gallardo and Whitacre 2018).

2.2.3. Economic Growth

The impact that broadband deployment has on general economic growth across rural communities is also a topic of interest for economists. A paper by Whitacre, Gallardo and Strover (2014) analyzes whether or not broadband adoption and availability have a causal relationship with economic growth. The study utilized data from the FCC on county-level broadband adoption and data on broadband availability from the National Broadband Map. In order to capture a stronger understanding of the economic impact of rural broadband, Whitacre, Gallardo and Strover also utilized data from the Census and the Bureau of Economic Analysis on demographics including race, age, natural amenity ranking, and county dependencies. The data used in this study to analyze broadband adoption and availability was based off of a previous FCC broadband benchmark (4/1 mbps), prior to the 25/3 mbps benchmark set in 2015.

Whitacre, Gallardo, and Strover used propensity score matching to determine the causal difference between groups that met the broadband adoption criteria and those that did not. The study set criteria for high-adopting broadband areas to be those non-metro counties with more than 60% of households adopting broadband. The study also defined low-adopting broadband areas as those non-metro counties with less than 40% of households adopting broadband. In addition, the study set a high availability-threshold for those with more than 85% of the non-metro county having access to broadband and a low-availability threshold for those with less

than 50% of the non-metro county having access to broadband (Whitacre, Gallardo, and Strover 2014).

The results from the study found a few different connections to broadband and economic growth. Whitacre, Gallardo, and Strover found that non-metro counties with higher levels of broadband adoption had larger levels of growth in median household income and slowing growth in unemployment. The study also found the opposite true for lower levels of broadband adoption with these non-metro counties seeing slower growth rates in employment and negative impacts for businesses in rural communities (Whitacre, Gallardo, and Strover 2014).

2.3 Community Interests

2.3.1 Rural Healthcare

Broadband is also an area of interest within the healthcare space. The National Center for Biotechnology Information (1996) defines tele-health as “the use of electronic information and communications technologies to provide and support health care when distance separates the participants.” As the use of technology has continued to increase across many sectors, healthcare providers have been working to find creative solutions to the digital divide in rural America.

Whitacre, Wheeler, and Landgraf (2016) utilized data from the National Broadband Map to analyze connectivity across U.S. healthcare facilities both in rural and urban areas. They found that there is still a large connectivity gap—close to 20 percentage points—between metropolitan and nonmetropolitan counties. The research found that close to 45% of nonmetropolitan counties had download speeds that were less than 10 mbps, as of 2014. This is less than the FCC recommended benchmark of 10 mbps download speed for rural healthcare facilities (Whitacre, Wheeler, and Landgraf 2016).

Another area of interest within the tele-health space is achieving ubiquitous computing technologies. These opportunities to access internet for tele-health anytime and from any

location would be transformative in meeting the needs of patients with chronic illnesses in rural and remote areas (Steele and Lo 2013). A common tool used as a ubiquitous computing technology is a sensor that tracks and logs data about patients, notifying healthcare facilities of the results and status of the patient. Sensors and other tele-health technologies can be helpful for rural patients in cutting down travel time to and from medical appointments, as well as reduce the strain for medical facilities (Steele and Lo 2013).

2.3.2 Rural Education

Adoption of technology, primarily in relation to broadband internet access, is a unique challenge for rural schools and educational facilities due to limited funding and strained budgets (Sundeen and Sundeen 2013). These limitations in funding and resources among rural educational institutions, have caused a lack of technology adoption which results in disadvantages to rural students and families in comparison to those in non-rural areas.

Rural libraries continue to be one of the most common, and sometimes only, hub for internet access in rural areas (Real, Bertot, and Jaeger 2014). Libraries remain a constant location for many who do not own a computer, laptop, or tablet to be able to access the internet for work, education, and entertainment. However, part of the challenge comes from rural libraries not having the resources to meet needs of their patrons at the same rate as libraries in urban communities due to lower quality broadband (Real, Bertot, and Jaeger 2014).

Digital literacy also remains a challenge for broadband access in rural communities, as it impacts the buy-in for consumers. Opportunities for teachers to better understand the technologies through personal development and training may also allow students, teachers and families to benefit from broadband internet resources (Sundeen and Sundeen 2013). From an educational perspective, access to adequate broadband depends on both increased demand and support for digital literacy (Real, Bertot, and Jaeger 2014).

2.3.3 Business Development

Economists have also found that broadband deployment is connected to business development in rural areas. One area of business development that has become of particular interest is the impact that broadband has on rural entrepreneurialism.

USDA Economic Research Service (2014) defines “creative class” employees, as those who generate new systems, ideas, and products. Conley and Whitacre (2015) conducted a study to analyze the impact that broadband availability and adoption have on rural entrepreneurship. The study used county-level business and entrepreneurship data from the Bureau of Economic Analysis of the U.S. Department of Commerce, county-level demographic data from USDA-ERS, and broadband adoption and availability data from the FCC and National Broadband Map (Conley and Whitacre 2015). The research created and utilized cross-sectional spatial models to determine if there is a meaningful relationship between rural broadband adoption and availability and then used a first-differenced regression to determine if there is a causal relationship (Conley and Whitacre 2015). Though Conley and Whitacre (2015) found that broadband availability and adoption was not important over time to rural creative class employees during the 2000-2011 time period, they did find it to be important to them at specific point in time. Conley and Whitacre (2015) also called for more research that could help economists better understand this relationship.

Broadband has also been found to have an impact on business location in rural communities. The study by Mack (2013) created an econometric model utilizing point level establishment data from the North American Industrial Classification System that covered establishment data for the following categories: rural, agriculture, manufacturing, knowledge, healthcare and social assistance, public administrations, and all establishments. In addition, the study used 2010 census tract data on broadband speeds and providers from the FCC. The

econometric models were used to analyze the relationship between broadband speed and business presence.

The results of the research found broadband speed to be significant for all establishments, agricultural establishments and rural establishments, suggesting that broadband speed and availability has an impact on the presence of an establishment (Mack 2013). Mack further concludes that the research suggested that broadband may be a solution for overcoming limited in-person communication opportunities in rural and remote areas. Potential linkages found through the study also suggest that increased broadband quality and speed may be part of the solution to attracting rural businesses.

2.3.4 Rural Real Estate and Property Value

Since the early 2000's access to broadband internet has also been of interest for the selling and marketing of real estate properties in rural communities. As access to internet used to be seen as a luxury or simple value-added service (Young 2000), broadband now can play a pivotal role in a consumer's purchase of a new home and a firm's building location. While real estate businesses typically market a home or building for its location, the industry is seeing that broadband accessibility has begun to impact the marketability of the location (Young 2000).

Mahasuweerachai, Whitacre, and Shideler (2010) found that broadband access might also have an impact on migration. Although urban counties with broadband access see a larger percentage of migration compared to non urban counties, the study found rural counties that had access to cable and digital subscriber line (DSL) broadband also experience migration in comparison to other rural counties without broadband access. These results were based on a spatial econometric model that utilized county-level infrastructure data up until 2000. Because broadband deployment has significantly increased since 2006, the study points out that a more recent impact of broadband on migration to rural and urban counties could be missed in the data.

2.4 Broadband and the Agriculture Sector

2.4.1 Economic Connections for Farm and Ranch Productivity

Access to broadband internet can impact both revenue and cost for farmers and ranchers (Kandilov et al. 2017). Through the use high speed internet, farmers and ranchers gain access to the online global marketplace, allowing them to seek out new markets, customers, prices, and conduct transactions. In addition, the use of broadband internet can allow farmers to compare prices on farm equipment, inputs, products, and other services needed for their operations. Another benefit of high speed internet for farmers is quicker access to technology tools for tracking prices, weather, and latest technologies (Kandilov et al. 2017). These business inquiries for producers can lead to increases in revenue and have potential to reduce costs.

2.4.2 Technology Adoption and the Next Generation

Rural broadband also plays a role in the advancement of precision agriculture and technology adoption among farmers and ranchers. The use of farm equipment that is either dependent on broadband or can be used more effectively with e-connectivity has been a result of technological ingenuity within the agriculture sector. New equipment systems allow farmers to monitor equipment and gather data remotely when utilizing broadband internet (Whitacre, Mark, and Griffin 2014). These technologies, often included in the newest combines on the market, have yield monitoring and global positioning system (GPS) capabilities that make it easier for farmers to gather data on their production (Whitacre, Mark, and Griffin 2014).

The impact that access to these technologies has on the next generation is notable, as many of young and beginning farmers have college degrees (Mooney et al. 2010). Increases in technology in farm equipment, tracking devices, and mobile applications are an important when considering the next generation of farmers. With the expectation of more technologically advanced equipment and products for young and beginning farmers, access to broadband will be in higher demand (Whitacre, Mark, and Griffin 2014).

Another area of interest for policy makers is understanding how technology training impacts agricultural productivity and consumers. Tronstad, Teegerstrom, and Osgood (2004) conducted a study on the impact of technology on underserved audiences in agriculture, primarily focusing on computer and internet literacy among Native American and rural communities. The study included workshops conducted by the University of Arizona Extension Service where students learned about computer technology, focusing on internet use and tools to enhance farm and ranch profitability. The study found that in parts of rural Arizona, where there is limited reliable broadband access, farmers, ranchers, and consumers were often intimidated by the use of technologies including both computers and internet. In addition, the researchers found that offering local workshops and providing first-hand opportunities developed a better understanding for the technology and a confidence for using computers and online tools following the course. The workshop participants also provided feedback sharing that the course allowed them to learn new tools for farm and ranch record keeping, accounting, and decision making (Tronstad, Teegerstrom, and Osgood 2004).

2.5 Additional Broadband Challenges

2.5.1 Product Price and Consumer Relevance

Those consumers in rural communities that do have access to adequate, high-speed broadband often find that prices are a hindrance to product participation. Fannin (2012) suggests that pricing broadband based on speed and usage could aid in the efficiency of broadband infrastructure and better match supply and demand for the infrastructure. While conducting a study on the willingness to pay for broadband internet for Kentucky farmers, Jeffcoat, Davis, and Hu (2012) note that broadband infrastructure should focus on producer demographics to make more economically viable decisions. Their study found that that producer age and operation size impact how much the producer is willing to pay for the broadband service.

Barnes (2010) notes that a consumer's perception of broadband product relevance and willingness to pay can depend on whether or not the consumer has experienced the benefits of broadband service. Findings from Stern, Adams and Boase (2011) suggest that some rural communities lack a willingness to adapt to broadband technologies due to potential deficits in digital literacy. A lack of understanding the broadband technologies can often hinder a consumer from participating in the service.

2.5.2 Investment

The challenge of investment in rural broadband infrastructure is connected to many of the challenges addressed throughout the chapter. Lack of investment, whether it be private or public, can impact broadband deployment and stakeholder groups. Fannin (2012) suggests that involvement from public-private partnerships and nonprofit organizations might contribute to broadband deployment across rural communities. Jeffcoat, Davis, and Hu (2012) suggest that public investment in internet infrastructure is needed to offset the expenses to internet services providers.

2.6 History of Broadband Policy

2.6.1 Rural Electrification

Rural broadband policy initiatives are often compared to those from the 1930's when policy initiatives were taking action to bring electricity to rural Americans. Similar to how the internet has brought changes in technology to the 21st century, the deployment of electricity went from being a luxury to a societal necessity. The need for electricity seemed to infiltrate every aspect of the America lifestyle through the second half of the 20th century. However, like broadband internet, rural communities were not the first to gain access to electricity. Legislation was passed to get electric infrastructure out to remote and rural parts of the United States.

Through the Rural Electrification Act of 1936, the United States established the Rural Electrification Administration (REA) to provide loans to companies and groups to finance rural

electric infrastructure (Muller 1944). This policy initiative was crafted as a result of President Franklin D. Roosevelt's New Deal.

However, similar to the challenges of consumer relevance found with broadband today, there was also resistance to electricity adoption in parts of the United States, mainly across the agricultural community (Kline 2002). In addition, stakeholder groups experienced some economic challenges that brought attention to a rural-urban electric divide. Policy makers and electric providers alike found some of the greatest challenges to electricity deployment geographic challenges, infrastructure maintenance, and the challenge of population density (Muller 1944). Rural populations tend to be spread across large areas, resulting in decreased demand per mile of line and increased costs per customer. At the time, there were not enough people to whom to provide service and costs that were too high to make providing electricity a reasonable or profitable business decision for companies (Muller 1944).

The public response to the electrification legislation in the 1930's resulted in a growth of electric cooperatives across rural America (Muller 1944). In areas where private companies were not investing in electric service for rural communities, these cooperatives emerged. The presence of electric cooperatives was instrumental in deploying electricity to rural communities, as groups organized to borrow funds from the REA in order to build and maintain the electric infrastructure for their rural or remote community (Muller 1944). Without the funding opportunities from the REA, many of these electric cooperatives could have ceased to exist and would not have been able to afford the building of electric infrastructure in their rural community, let alone provide the service (Muller 1944).

2.6.1 Legislative History – Federal Communications Commission

The Telecommunications Act of 1996 was the first major work of legislation that addressed broadband access. Section 706 of Telecommunications Act requires that the FCC evaluate and determine if broadband is being deployed to all Americans in a “reasonable and timely fashion” (Kruger and Gilroy 2017). The FCC has released 10 reports since 1999 on the status of broadband. As of 2017, the FCC’s last five reports concluded that broadband was not being deployed to all Americans in both a reasonable and timely fashion, primarily focusing on the digital divide between rural and urban communities (Kruger and Gilroy 2017). It was in the 10th report, released in 2010 that the FCC announced an updated broadband speed benchmark from the 4mpbs/1 mbps to 25 mbps/3 mbps (Kruger and Gilroy 2017).

Also in 2010, the FCC released a report on the National Broadband Plan (NBP), mandated in a provision of the American Recovery and Reinvestment Act of 2009 (Kruger and Gilroy 2017). The NBP focuses on three main parts: innovation and investment, inclusion, and national purposes (Kruger and Gilroy 2017). The NBP (FCC 2010, 9-11) includes 6 main goals:

1. At least 100 million U.S. homes should have affordable access to actual download speeds of at least 100 megabits per second and actual upload speeds of at least 50 megabits per second.
2. The United States should lead the world in mobile innovation, with the fastest and most extensive wireless networks of any nation.
3. Every American should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose.

4. Every American community should have affordable access to at least 1 gigabit per second broadband service to anchor institutions such as schools, hospitals, and government buildings.
5. To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network.
6. To ensure that America leads in the clean energy economy, every American should be able to use broadband to track and manage their real-time energy consumption. (FCC 2010, 9-11)

2.6.2 House Energy and Commerce Committee – Ray Baum’s Act

Recent legislation largely focused on broadband, brought forward by the House Energy and Commerce Committee in the 115th Congress, was passed through the House in March of 2018 and is House Resolution (H.R.) 4986. The bill, more commonly referred to as Ray Baum’s Act, focused on four main goals (Energy and Commerce 2018):

1. Reduction of deployment barriers
2. Improvement of mapping
3. Support of technology advancement
4. Securing resources critical to broadband expansion

The legislation was designed to make updates to the rules regarding broadband infrastructure and deployment on federal property, modernize federal databases to better keep track of the federal property that is supporting broadband and communications-focused infrastructure (Energy and Commerce 2018). Steps were also taken through the legislation to work toward more accurate measurement of broadband coverage, allocating \$7.5 million for mapping efforts for the National Telecommunications and Information Administration’s (NTIA).

Ray Baum's Act also included \$171 million each year for the Rural Health Care Program, which allows patients to access tele-health (Energy and Commerce 2018). Investment into broadband programs was included in the legislation with an allocation of \$690 million to support innovation, as well as loan and grant programs (Energy and Commerce 2018). With the swearing-in of the 116th Congress, it is not yet clear when Ray Baum's Act will be addressed again.

2.6.3 Congressional Agriculture Committees – 2018 Farm Bill

The Agriculture Improvement Act of 2018, H.R. 2, includes a section on rural broadband for agriculture. The broadband provisions from H.R. 4881, Precision Agriculture Connectivity Act of 2018, were added as a part of the Farm Bill Conference Report. With the addition of the legislative language from H.R. 4881, the 2018 Farm Bill requires the FCC to create a task force that will be charged with evaluating the needs of technology and connectivity for precision agriculture in America (Precision Agricultural Connectivity Act 2018). The purpose is to identify gaps in broadband availability across agricultural land. In addition, H.R. 4881 requires the task force develop, promote, and recommend specific policies to address the broadband issue and its impact on precision agriculture, as well as suggest updates to existing FCC rules on broadband based on the findings. H.R. 4881 also set a goal of ensuring reliable broadband on 95% of U.S. agricultural land by the year 2025.

2.6.4 FCC Federal Assistance Programs – FCC and USDA

There are two main federal programs available to broadband service providers: the FCC's Universal Service Fund (USF) and the United States Department of Agriculture's Rural Utilities Service (RUS). The USF originally offered a program called the High Cost program, based on providing cost support for telecommunication companies to provide voice service to rural and hard to reach areas. Now, this program is phasing out and is transitioning to the Connect

America Fund Program, which will work to provide cost support for qualifying companies to deliver broadband services to rural communities (Kruger and Gilroy 2017).

The RUS offers three main programs that provide financial assistance designed to deploy broadband in rural communities. The Farm Bill Broadband Loan Program provides financing opportunities for eligible companies, state and local governments, as well as cooperatives to build and maintain broadband services in areas where 15 percent or more of the households are considered underserved and communities that lack less than three current service providers (Farm Bill Broadband Loans and Loan Guarantees, 2017). Another option is the Telecommunications Infrastructure Loans and Loan Guarantee Program which provides financing services for broadband construction and maintenance initiatives in areas that have a population less than or equal to 5,000 people and where there currently is no provider accessible (Telecommunications Infrastructure Loans and Loan Guarantees, 2017). The RUS also offers a program called the Community Connect Grant that provides funding for areas where broadband deployment is not financially feasible for providers and there currently are no broadband service companies present (Community Connect Grants, 2017).

2.6.5 US Interagency Task Force on Agriculture and Rural Prosperity

On October 21, 2017, the USDA released a report to the President on behalf of the Interagency Task Force on Agriculture and Rural Prosperity, chaired by Agriculture Secretary Sonny Perdue. Following a series of state visits and listening sessions across the country, Secretary Perdue and the task force outlined five main calls to action to increase rural prosperity in America (Perdue 2017). The first call to action was E-Connectivity for Rural America. The report highlighted rural broadband as “fundamental for economic development, innovation, advancements in technology, workforce readiness, and an improved quality of life. (Perdue 2017, 2).

Secretary Perdue’s letter overviewed five main objectives that the task force believe should be met in order to increase e-connectivity across rural communities (Perdue 2017):

1. Establishment of executive leadership to expand e-connectivity across rural America
2. Assessment of the state of rural e-connectivity
3. Reduction of regulatory barriers to infrastructure deployment
4. Assessment of the efficacy of current programs
5. Incentivizing private capital investment

The report also suggested that working toward more effective broadband infrastructure in rural communities would be integral in the four additional task force calls to action: improving quality of life, supporting a rural workforce, harnessing technological innovation, and developing the rural economy (Perdue 2017).

2.7 Current Policy Discussions

With the swearing in of the 116th Congress in January 2019, there have already been a few notable bills introduced regarding broadband policy both in the House and Senate chambers. While none of these bills have been passed through either chamber or signed into law, they provide an overview on policy ideas that are in discussion for the 116th Congress. These policy ideas may continue to be discussed within committees, reintroduced on the chamber floors, added to other legislative work, or could not be reconsidered in either chamber.

2.7.1 House Legislation

The Connecting Broadband Deserts Act of 2019 was introduced in the House chamber on January 3, 2019 and referred to the House Committee on Energy and Commerce. The legislation, sponsored by Congressman Bobby Rush (D-IL-1), would require the FCC to do a yearly review on broadband availability and assess whether broadband is being deployed to broadband deserts in a reasonable time period (H.R.55 2019). The bill defines a “broadband

desert” as a census block in an urban area where less than 33% of end-users do not have access to broadband (H.R.55 2019). This bill does not directly relate to rural broadband accessibility, but does focus on broadband deployment and accountability.

The Rural Broadband Permitting Efficiency Act of 2019 was introduced in the House on January 8, 2019. The legislation, sponsored by Congressman John Curtis (R-UT-3) was referred to the House Committee on Natural Resources and the House Committee on Agriculture. The legislation would allow certain permitting authority on a state level to deploy broadband to rural, remote and tribal areas that currently do not have broadband access (H.R.292 2019). The bill focuses on permitting for the building of broadband infrastructure in these remote areas, specifically the construction of broadband in tribal lands and lands that are a part of a national forest.

The Accelerating Broadband Deployment by Empowering Local Communities Act of 2019 was introduced in the House chamber on January 14, 2019. The legislation, sponsored by Congresswoman Anna Eshoo (D-CA-18) was referred to the House Committee on Energy and Commerce. The bill would remove the regulatory barriers for communities from the FCC Accelerating Wireless and Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment (H.R.530 2019).

The Connect America Fund Accountability Act of 2019 was introduced in the House Chamber on January 10, 2019. The legislation, sponsored by Congressman Doug Collins (R-GA-9) was referred to the House Committee on Energy and Commerce. The bill was cosponsored by Congressman Austin Scott (R-GA-8), Congressman Barry Loudermilk (R-GA-11), and Congressman Dan Newhouse (R-WA-4). The legislation would create performance testing reporting requirements for telecommunications providers for the Connect America Fund

(H.R. 427 2019). In addition, the bill adds legislative language regarding the conducting of Connect America Fund audits to ensure program and provider accountability.

2.7.2 *Senate Legislation*

The Move America Act of 2019 was introduced in the Senate chamber on January 16, 2019. The legislation, sponsored by Senator John Hoeven (R-ND), was referred to the Senate Committee on Finance. The bill was cosponsored by Senator Ron Wyden (D-OR). The legislation would amend the Internal Revenue Code of 1986 to provide Move America bonds and Move America credits that are intended to enhance the national economy and focus on infrastructure (S. 146 2019). The Move America Bond title would include rural broadband service infrastructure.

S. 161, A bill to require the Comptroller General of the United States to conduct a study and submit a report on filing requirements under the Universal Service Fund Programs, was introduced on January 16, 2019. The legislation is sponsored by Senator Dan Sullivan (R-AK) and was referred to the Senate Committee on Commerce, Science and Transportation. The legislation would require the Comptroller to conduct and submit a report on the Universal Service Fund program recipients that overviews the financial impact of the program and carriers, as well as makes recommendations on the consolidation of program filing requirements (S. 161 2019). The purpose is to cut down on risk of waste, fraud and abuse from the Universal Service Fund recipients (S. 161).

3. METHODOLOGY

3.1 Needs Assessment

In order to better understand how policymakers can address the rural broadband issue, a rural broadband needs assessment was conducted across different stakeholder groups. The needs assessment was designed to generate conversation with the stakeholder groups on policies and programs that have worked in the past, as well as those policies and programs that stakeholders feel have been successful across a variety of communities, businesses, and geographic regions.

3.2 Participant Selection

The needs assessment began with finding areas across the United States that have been working to overcome broadband issues and had some level of success in their efforts. Michigan and Tennessee were selected for the needs assessment study as stakeholder groups and policymakers have been working in these states on ubiquitous broadband deployment through the use of policies and pilot programs.

The Texas Rural Funders Collaborative have prioritized broadband as a growing concern across rural communities in the state. Their annual report by Connected Nation notes that one out of four rural Texans, close to 1.25 million, do not have access to broadband internet, and over 2.7 million Texas households do not have a fixed broadband connection (Texas Rural Funders Collaborative 2018). Because these challenges have become a priority for Texas policy makers and stakeholder groups and because the state has both the largest rural population and one of the largest rural land areas in the United States, Texas is included as a focus area in the project needs assessment.

The stakeholder groups were selected in order to provide a variety of perspectives that represent the interests of consumers, providers, and policymakers, based on previous studies and input into past and current policy efforts. These stakeholder groups cover four main categories:

1. Rural healthcare
2. Education
3. Internet service providers with a focus on telecommunications and electric cooperatives
4. Broadband initiative stakeholders

These groups were selected due to not only their relevance in policy discussions, but also their reoccurrence in broadband research. They represented areas of economic interest for prior research. In addition, many of the groups were represented in congressional testimony, organization statements, and interviews regarding rural broadband policy discussions. In some of the interviews, broadband stakeholders suggested additional individuals, groups, or stakeholders to reach out to regarding unique perspective on broadband policy challenges and recommendations.

3.3 Interview Questions

A specific set of interview questions was created for each stakeholder group. These questions were organized to generate conversation about the unique challenges of rural broadband deployment from the perspective of each stakeholder in the broadband space.

Tables are provided on the following pages to overview the set questions for each stakeholder interview. Because the business and infrastructure challenges and needs are potentially unique to each stakeholder group, separate questions were asked to internet service providers based on the type of provider. Table 1 outlines the questions for rural electric cooperative stakeholder groups, focusing on specific challenges and needs relative to fiber

broadband infrastructure. The questionnaire also asks about specific policy challenges and needs, as well as experience with broadband programs and partnerships. Table 2 outlines a similar questionnaire for telecommunications providers, but focuses on the specific broadband services carried out by telecommunications infrastructure. Table 3 overviews questions asked to community stakeholders. These questions are primarily for education providers and community partners including libraries, educational institutions, and relevant community broadband stakeholders. Table 4 outlines questions for rural healthcare providers, primarily those with experience in tele-health. These questions focused on how access to tele-health impacts rural consumers and communities. The questions also requested direct insight into how broadband challenges of accessibility impact tele-health opportunities. Table 5 lists questions for additional relevant broadband stakeholders with an emphasis on broadband initiatives. These questions help provide perspective for ongoing policy efforts and community stakeholder needs, as well as upcoming legislative initiatives.

While the needs assessment questionnaires remained the focus of each interview, additional questions emerged. In most cases these questions were almost always follow-ups to a point that was brought up by the stakeholder being interviewed. These additional questions asked about the specifics of programs and policies that helped or challenged the stakeholder group. The interviews took place between November 1, 2018 and January 4, 2019. Each interview lasted 35 to 60 minutes, depending on the depth of explanation by the interviewee. The needs assessment conversations yielded key themes on broadband challenges across the majority of stakeholder groups. Following the interviews, the main points from each needs assessment interview was compiled to analyze similarities and competing interests. This information was

then categorized by both policy challenges and stakeholder groups. The protocol was approved by the TAMU Institutional Research Board (IRB) under IRB 2018-1428.

Table 1. Rural Electric Cooperative Stakeholders Questionnaire

How does your organization deploy broadband to the rural region?
In relation to rural consumers, where do you see the status of rural broadband deployment in your region?
What challenges are causing delays in broadband deployment in your rural areas? <ul style="list-style-type: none">• Are there physical/geographical challenges?• Are there regulatory challenges?• Are there policy challenges?• Any others?
Are there any specific broadband grants or policies (federal, state, and/or local) that have made a difference in providing opportunities or encouraging rural electric cooperatives to deploy broadband?
How have these policies impacted costs for providers and prices for consumers to access broadband?
After deploying rural broadband, does your rural electric cooperative receive push back from any other providers? Competitors or telecommunications providers?
Are there any policy ideas (tax incentives, grant programs, etc.) that would support partnership between rural electric cooperatives and telecommunications providers in your region to more effectively deploy broadband?
What is the outlook for broadband deployment in the rural region from the perspective of a rural electric cooperative?

Table 2. Rural Telecommunications Stakeholders Questionnaire

How does your organization deploy broadband to the rural region?
In relation to rural consumers, where do you see the status of rural broadband deployment in your region?
What challenges are causing delays in broadband deployment in your rural areas? <ul style="list-style-type: none">• Are there physical/geographical challenges?• Are there regulatory challenges?• Are there policy challenges?• Any others?
Are there any specific broadband grants or policies (federal, state, and/or local) that have made a difference in providing opportunities or encouraging telecommunications providers to deploy broadband?
How have these policies impacted costs for providers and prices for consumers to access broadband?
After deploying rural broadband, does your rural electric cooperative receive push back from any other providers? Competitors or telecommunications providers?
Are there any policy ideas (tax incentives, grant programs, etc.) that would support partnership between rural electric cooperatives and telecommunications providers in your region to more effectively deploy broadband?
What is the outlook for broadband deployment in the rural region from the perspective of a telecommunications provider?

Table 3. Education and Community Stakeholders Questionnaire

Where do you see the status of broadband in your community relative to addressing educational needs in the rural region?
How does lack of internet in rural communities impact opportunities for distance education?
Are there any specific broadband grants or policies (federal, state, and/or local) that have made a difference in providing educational needs to rural communities?
When discussing broadband programs or ways that internet could be made more accessible in your region, what would better meet the needs of rural students and educational institutions that provide resources, courses, and services to rural students?
From a policy perspective, do you have any suggestions of types of programs that would make broadband internet more available to rural students and educational institutions in your areas?
What opportunities would come from increased access to internet in rural regions as it relates to education, opportunity and educational facilities?
Are there any opportunities for your institutions to partner to provide community broadband opportunities? What about community hotspots?

Table 4. Healthcare Stakeholders Questionnaire

Where do you see the status of broadband in your community relative to addressing medical needs in the rural region?
How does lack of internet in rural communities impact opportunities for providing medical services for rural patients?
Are there any specific broadband grants or policies (federal, state, and/or local) that have made a difference in providing medical needs to rural communities?
What ways does access to broadband impact: <ul style="list-style-type: none">• Tele-health programs?• Best practices?• Directives?• Ability to keep and maintain health records?
When discussing broadband programs or ways that internet could be made more accessible in your region, what would better meet the needs of rural patients, medical facilities, and healthcare providers?
From a policy perspective, do you have any suggestions of types of programs that would make broadband internet more available to healthcare providers in your region?
What opportunities would come from increased access to internet in rural regions as it relates to providing healthcare to patients across the rural region?

Table 5. Broadband Initiative Stakeholders Questionnaire

How does your organization work to influence or push for broadband policy at the federal, state and/or local level in your state?
What challenges are causing delays in broadband deployment in your rural areas? <ul style="list-style-type: none">• Are there physical/geographical challenges?• Are there regulatory challenges?• Are there policy challenges?• Any others?
Are there any specific broadband grants or policies (federal, state, and/or local) that have made a difference in providing opportunities or encouraging rural electric cooperatives to deploy broadband?
From a policy standpoint, what are some challenges that cause roadblocks to implementing broadband policy on a federal, state and/or local level?
What creative ways have you seen or worked to see implemented to help close the digital divide between rural and urban communities?
Are there any policy ideas (tax incentives, grant programs, etc.) that would support partnership between rural electric cooperatives and telecommunications providers in your region to more effectively deploy broadband?
From a policy and broadband initiative perspective, what is the outlook for broadband in terms of policy, programs, and deployment?

4. FINDINGS

4.1 Needs Assessment Findings

The results of the needs assessment interviews covered topics and issues that seemed to be consistent across stakeholder groups. These issues focused on three main challenge areas for stakeholder groups: data mapping, funding, and regulation. Although these challenges were found to impact each group for different reasons, these three policy topics came up in conversation in almost every interview. Table 6 provides an overview of each individual included in the needs assessment. In addition, Table 6 includes the organization and state perspective each individual represented as well as the stakeholder group and topics each discussed.

It is important to note that there was more contact with direct stakeholders in Texas and Tennessee. This was generally because of available research and statements from broadband stakeholders in these states. However, in conversations with those stakeholders who represented broadband groups national, questions were carefully directed regarding broadband challenges in Michigan and across additional geographic areas outside of Texas and Tennessee. This spoke to some of the challenges that have come from not having a designated broadband office or spokesperson in many parts of the United States, which was a policy suggestion of groups outlined in the results. For agriculture and healthcare stakeholders, statements and testimony from groups and individuals were utilized where relevant to supplement perspectives provided in interviews.

Table 6. Interviewees, organizations, topics, and regions.

Name	Organization	Stakeholder Topics Discussed	State/Region
Katherine Bates	NTIA/Broadband USA	Community, Government	Texas, Tennessee, Michigan, National
Jacob Boone	University of Tennessee Extension, Hancock County	Education, Community	Tennessee
Lindsay Conrad	Connected Nation	Internet Service Provider, Community, Policy Initiative	Texas, Tennessee, Michigan, National
Francisco Enriquez	Glasshouse Policy	Policy Initiative, Community	Texas
Dr. Walt Magnussen	Internet2 Technology Evaluation Center, Texas A&M University	Community, Education	Texas
Amanda Martin	Tennessee Department of Community and Economic Development	Community, Government	Tennessee
Larry McManus	Texas Department of Agriculture	Agriculture, Community, Government	Texas
Michael Parks	Brazos Valley Council of Governments	Community, Government, Education, Healthcare	Texas
Chris Pedersen	Connected Nation	Internet Service Provider, Community, Policy Initiative	Texas, Tennessee, Michigan, National
Tom Stephenson	Connected Nation	Internet Service Provider, Community, Healthcare	Texas, Michigan
Dr. Sreedhar Upendram	University of Tennessee, Department of Agricultural and Resource Economics	Education, Community	Tennessee
Thomas Visco	Glasshouse Policy	Policy Initiative, Community	Texas
Jonathan West	Twin Lakes Telephone Cooperative	Internet Service Providers	Tennessee
John Windhausen	Schools, Health & Libraries Broadband Coalition	Healthcare, Education, Community, Policy Initiative	Texas, Tennessee, Michigan, National

4.2 Healthcare Stakeholder Findings

Healthcare stakeholder groups rely on broadband access to carry out telemedicine programs and services to clients in rural areas. However, the broadband infrastructure needed to carry out tele-health programs can be costly, due to the need for higher speeds and longer term solutions to run these programs. The needs assessment covered interviews with stakeholder groups that have perspective on the unique broadband challenges for healthcare providers. In addition, the needs assessment included information from healthcare stakeholder groups that have released statements on challenges and suggestions for broadband policy. There are also comments and statements that tele-health stakeholders have made during congressional hearings through committee testimonies included within the results.

One area where healthcare stakeholders are particularly seeking solutions is regarding broadband speed. As hospitals are considered anchor institutions—a necessary or “anchoring” part of the community, but the speed needed to operate the healthcare network and equipment is often higher than average residential broadband speed (Windhausen 2018). This can present a challenge for healthcare stakeholders who feel that the FCC benchmark speeds, often used as minimum target for grant and pilot programs, do not always meet the needs for their institutions.

In addition, healthcare stakeholders also shared concerns that inaccessibility of broadband infrastructure is currently and will continue to inhibit routine medical operations, best practices, and technology adoption (Word 2018). In July 2018, Jenni Word, Registered Nurse, Associate Administrator and Chief Nursing Officer at Wallowa Memorial Hospital in Enterprise Oregon testified before the House Energy and Commerce, Subcommittee on Communications and Technology regarding the importance of broadband to telemedicine. The statements made by Word, on behalf of telemedicine and healthcare stakeholders, overviewed challenges faced by rural healthcare providers and residents who lack adequate broadband service. In addition, Word

highlights a few notable stories of success that have come from utilizing broadband service to provide vital healthcare services in rural communities.

Word's testimony included barriers to tele-health across rural communities. While her testimony highlighted policy changes to Medicare payments and licensing requirements, Word also shared that a lack of funding is impeding the adoption and promotion of telemedicine services in rural communities.

The Schools, Health, and Libraries Broadband (SHLB) Coalition shares similar concerns (Windhausen 2018). SHLB Coalition stakeholder members work together for the common goal of advancing broadband infrastructure accessibility. While these stakeholder groups have found telemedicine grants helpful, they have seen a need for increased funding for programs with a focus on higher speed broadband infrastructure to help put these tele-health programs into place across communities (Windhausen 2018).

Broadband mapping is also a challenge faced by tele-health stakeholder groups. Mapping inaccuracies can cause challenges for disbursement of broadband tele-health program funds (Martin 2018). For stakeholder groups involved in tele-health services, FCC broadband maps could be inaccurately portraying the differences in accessibility for urban versus rural hospitals (Windhausen 2018).

4.3 Education Stakeholder Findings

Education related broadband stakeholders are mostly schools, libraries, and relevant educational organizations. Similar to the broadband interest from healthcare groups, education stakeholders often find that internet speeds are important to their patrons. Education providers also fit into the "anchor institutions" category, providing services that are often seen as a necessity for community stakeholders.

Because of the necessity of educational institutions within rural communities, stakeholder groups depend on e-connectivity. Hard to reach areas, such as Hancock County in Tennessee, have struggled to find solutions to making sure rural residents are able to connect to the internet for school projects, working from home, and even paying bills (Boone 2018). A lack of access to internet in rural and remote areas, such as East Tennessee, has led to families having to work late in fast food chains and coffee shops to finish homework assignments that cannot be done at home where there is not access to internet (Boone 2018).

In 2018, Hancock County (Tennessee) Extension received a grant to work with the county library in providing a mobile hotspot program. The hotspot, available for families to check out for up to two days at a time, allows patrons to access internet from their homes to work on school projects and homework. Hancock County has one hotspot through the program, but is working to use the data in order to show that there is a demand for internet and cellular access in the area in hopes of adding more hotspots in the future (Boone 2018).

The University of Tennessee is carrying out this grant program in three different counties: Hancock, Bledsoe and Wayne. These three counties are known to be experiencing the largest digital divide in the state, among other socioeconomic challenges (Upendram 2018). In addition, these counties have an approximate average household income of \$25,000 (Upendram 2018). While the hotspot program may not provide a long-term solution to the broadband digital divide, it has been seen as helpful to patrons who have participated in the program (Boone 2018).

While the purpose of libraries has historically been to check out books, study, and view research, the use of rural libraries is changing. Today, library staff are often trained on computer services, programs, applications, and internet (Pedersen 2018). Educational stakeholders shared that federal programs, like the Broadband Technology Opportunities Program (BTOP) and the E-

Rate Program from the Universal Service Fund, have been quite successful for broadband deployment to schools and libraries (Windhausen 2018).

The Schools, Health, and Libraries Broadband (SHLB) Coalition also has an interest in broadband access from their members concerned with the educational institutions and libraries. As SHLB works to advocate for solutions to the challenges that their members face, access to broadband for educational continues to be a priority. One of the greatest challenges that SHLB members believe to inhibit the deployment of broadband is funding. While several of the current federal programs have helped provide access in many rural and remote areas, they typically are designed for residential, lower speed bandwidth broadband infrastructure (Windhausen 2018). SHLB would like to see opportunities that focus on higher speed bandwidth broadband that meets the needs of anchor institutions like schools and libraries.

In addition, mapping challenges came up in conversation with education stakeholders. The most common challenge faced by education stakeholders from the needs assessment was the impact that broadband mapping inaccuracies have on the opportunity to apply for or receive grant and loan programs. While maps from the FCC provide an opportunity to better understand the digital divide, some stakeholder groups believe that it does not represent the whole picture, particularly when looking at access for schools, libraries, and healthcare facilities.

4.4 ISP and Infrastructure Stakeholder Findings

The needs assessment findings for internet service providers (ISPs) gave a unique perspective on the digital divide, in terms of internet services and the building of broadband infrastructure.

Regulatory inconsistency was repeatedly mentioned as a challenge for telecommunications providers. One of the most common reasons discussed throughout the needs assessment interviews was that providers will plan and work under one set of regulatory

guidelines and then they change (West 2019). As a result, it can become difficult for providers to apply for grant programs, loans, and make business decisions due to these inconsistencies (West 2019). Regulatory requirements often serve as a guide for Internet Service Providers (ISPs) follow when building and implementing broadband infrastructure. With changes in federal, state and local leadership, new ideas about broadband infrastructure can shift these regulatory requirements making it difficult for ISPs to keep up (West 2019). In addition, this can be a cause of delays in grant program disbursements.

A specific area of regulatory difficulty for telecommunications providers is regarding poll attachments and permitting challenges. Jonathan Spalter, President and Chief Executive Officer for US Telecom – The Broadband Association, testified on broadband infrastructure before the House Committee on Energy and Commerce, Subcommittee on Communications and Technology in January 2018. Spalter’s testimony specifically overviewed issues permits. Permitting delays on both the federal and local level have caused delays in broadband deployment (Spatler 2018). Spalter shared that the 2018 executive order by the Trump Administration that covers deployment of broadband infrastructure on federal lands to be helpful for ISPs.

Regulatory challenges also impact electric cooperative stakeholders, specifically in terms of building broadband infrastructure. Curtis Wynn, President and Chief Executive Officer of Roanoke Electric Cooperative testified on behalf of National Rural Electric Cooperative Association (NRECA) before the House Committee on Agriculture on July 19, 2017. Wynn’s testimony requested regulatory reform on behalf of NRECA members working to deploy broadband infrastructure in rural communities. Specific regulatory challenges mentioned by Wynn included the need for electric cooperative to be able to “promote the development of rural

infrastructure” through the reform of the National Environmental Policy Act (NEPA) and the Endangered Species Act (Wynn 2017). According to Wynn’s testimony, these regulations present challenges for streamlining best practices, safety, and management on federal lands.

Another challenge that was brought up within the needs assessment by ISPs was data mapping for numbers of service providers and broadband accessibility data. Similar to the challenges faced by anchor institutions, some internet service providers have found FCC data maps to be incompletely or inaccurate. Due to the self-reported nature of the FCC maps by internet service providers, it can be difficult to view what areas have no access at all versus coverage that could be unintentionally exaggerated (West 2019). This means there could be areas of the FCC broadband maps that are marked as served where there still is not broadband access. In addition, there have not historically been accountability measures in place to make sure that these maps are accurate, further contributing to a lack of understanding of where the digital divide is really located (Conrad 2019). However, in December 2018, the FCC announced the launch of an investigation into the digital divide in order to check the accuracy of the reported broadband maps. The results of the investigation have not been announced.

Funding is another challenge that needs assessment respondents shared. Many ISPs have applauded the grant and loan programs that federal, state, and local governments have provided to streamline the deployment of rural broadband out into rural communities. However, ISP stakeholders shared that opportunities to enhance and continue these programs would be helpful in continuing the efforts to get broadband infrastructure out into the community (Wynn 2017). Electric cooperative stakeholders shared that grants and programs from RUS are particularly helpful in the building and expansion of broadband infrastructure (Wynn 2017).

4.5 Community and Government Stakeholder Findings

Community and government stakeholders had unique perspectives, often focused on serving as a liaison between all other stakeholder groups and the local, state, and federal government. Conversations from the needs assessment covered a variety of challenges and stories of success faced by this unique group that often works to serve as a resource when planning for broadband infrastructure. Many of the challenges brought up in the needs assessment were not unique in that challenges faced by stakeholders in one area were also common in others. However, the challenges that differed, typically were different regarding state and local statutes that allow or prohibit stakeholders to provide broadband infrastructure in different ways.

An example of this difference is that in Tennessee and Michigan, state statute is conducive to partnerships between telecommunications providers and electric cooperatives to provide broadband access to communities (Stephenson 2018). Amanda Martin, Broadband Director for Tennessee Department of Economic Development, referred to this as the “sweet spot” where providers can leverage their unique skillsets to minimize the digital divide (Martin 2018).

One of the partnerships mentioned in the needs assessment interview with Martin (2018) was between the Twin Lakes Telephone Cooperative and Volunteer Energy Cooperative. Both of these cooperatives work together, with the electric cooperative building the fiber infrastructure and the telephone cooperative providing the service to customers. Jonathan West (2019), General Manager for Twin Lakes Telephone Cooperative, shared that this partnership has been very helpful to providing reliable and affordable broadband internet service for Middle Tennessee. The partnership allows each cooperative to utilize their assets and skillsets in order to get broadband out into area at a reasonable price for customers (West 2019).

From the perspective of state government, Texas Department of Agriculture also has an interest in rural broadband across the state of Texas, working as a liaison with local governments to meet the needs of rural communities involved in agriculture. The Texas Department of Agriculture views broadband infrastructure as an area of rural development that is of priority across the state of Texas (McManus 2018).

In Texas, stakeholders find that there is a challenge of finding cost effective solutions to providing internet services in the community (Magnussen 2018). Michael Parks (2018), with Brazos Valley Council of Government (BV COG), located in Bryan, Texas, shared the importance of federal grants in ensuring that prices are low enough for communities to participate in broadband services. These programs provide opportunities for the communities to access healthcare and educational services that they would not have been able to access (Parks 2018). The utilization of broadband grants that are specifically for healthcare and education have been beneficial to getting broadband infrastructure to schools across the Brazos Valley in Texas at more reasonable costs and speeds (Parks 2018).

The National Telecommunications and Information Administration and Broadband USA, through the Department of Commerce, provide information and resources for broadband stakeholder groups across the nation. The BTOP program, mentioned by several stakeholder groups throughout the needs assessment interviews, is carried out by NTIA to help close the digital divide. NTIA has found these programs to be useful for state and local stakeholders working to deploy broadband across communities (Bates 2018).

4.6 Agriculture Stakeholder Findings

The needs of broadband from the perspective of precision agriculture and technology adoption remain at the forefront of commodity groups and agribusinesses who have shown

increased interest in the issue. These perspectives are included from statements from congressional record, press releases and organization reports.

In July of 2018, John May, President, Ag Solutions and Chief Information Officer for John Deere testified before the House Committee on Energy and Commerce, Subcommittee on Technology and Communications about the need for rural broadband deployment. According to May's testimony, broadband internet access is vital to the continued adoption of precision agriculture technologies. Reliable broadband is needed for farm tools, tractors, inputs, and applications used to meet the growing global demand for agricultural output (May 2018). In addition, May's testimony urged the use of geographic metrics over population-focused mapping to ensure that broadband is deployed to places where it is needed the most.

The American Farm Bureau Federation (AFBF) has taken the position that rural broadband is essential to the United States food production, as well as quality of life for rural Americans (American Farm Bureau Federation 2019). The AFBF is supportive of legislation that provides funding for programs, including the Universal Service Fund, that work to expand broadband to rural communities (American Farm Bureau Federation 2019).

In 2017, the Tennessee General Assembly passed the Broadband Accessibility Act, providing \$45 million over three years in grants and tax credits to aid in the deployment of rural broadband across the state (Tennessee Farm Bureau Federation 2017). Tennessee Farm Bureau Federation released a statement following the passage of the legislation sharing that it will "improve digital literacy skills and maximize the benefits of rural broadband" across Tennessee (Tennessee Farm Bureau Federation 2017).

Michigan Farm Bureau Federation's (MFBF) statement on rural broadband indicated that the organization is supported of public-private partnerships to deliver broadband out into rural

communities (Michigan Farm Bureau Federation 2012). In addition, MFBF's statement includes potential exploration of offering high-speed internet to members as a membership benefit (Michigan Farm Bureau Federation 2012).

Texas Farm Bureau, a member of the Ag Broadband Coalition, joined in applauding the provisions in the Precision Agriculture Connectivity Act of 2018 that were later included in the 2018 Farm Bill (Texas Farm Bureau Federation 2018). The statement shared that the legislation will aid in the facilitation of broadband internet for farmers and ranchers across the state of Texas.

The National Farmers Union (NFU) also has also supported rural broadband legislation. The NFU Policy explains that the organization is in support of legislation for competitively priced and high-speed internet service for rural communities (Nation Farmers Union 2018). As this issue impacts farmers and ranchers across the country, it remained a policy priority during the 2018 Farm Bill process. These views also represent the ideals and policy stances of NFU members in Michigan and Tennessee. Texas Farmers Union did not explicitly release policy suggestions or stances on broadband for the 2018 Farm Bill. However, they did urge Congress to continue the programs carried out by the RUS with adequate funding for loan programs, which covers broadband loan and loan guarantees (Texas Farmers Union 2018).

The Rebuild Rural Coalition, comprised of agriculture and rural community stakeholder groups, has prioritized broadband deployment as a key issue impacting rural communities. The coalition believes that robust broadband infrastructure is key to the deployment of broadband internet (Rebuild Rural 2017). In addition, Rebuild Rural supports the standardization of program application processes to minimize delays and complications in accessing broadband

financing opportunities, as well as sufficient funding for the Rural Utilities Service's high-cost program (Rebuild Rural 2017).

4.7 Additional Findings

Interviews with stakeholder groups involved in rural broadband policy initiatives provided a perspective into policy work and programs that have been carried out already. Many of these conversations provided views on broadband challenges that have been shared with them by other stakeholder groups in the form of town halls and listening sessions. The information collected from the needs assessment of policy initiative stakeholders often included stories of both successes and challenges in response to policies and programs both locally and federally.

In Texas, Glasshouse Policy has worked to better understand the needs of rural Texans through conducting town hall and listening session events across the state. Coordination between federal, state and local municipalities is one of the greatest challenges that Glasshouse Policy has found to be inhibiting the deployment of broadband, from a policy perspective (Visco 2018). In addition, from the Glasshouse Policy listening tours, they also found mapping to be an issue for stakeholders in applying for broadband programs and accessing funds (Visco 2018). From these sessions, they have crafted legislative language in hopes to see broadband policy passed in the Texas Legislature in spring of 2019 (Enriquez 2018).

Connected Nation has also been involved in broadband policy work, through providing resources and support on broadband deployment across the United States. Connected Nation has found that many of the issues faced by consumers, providers, and other broadband stakeholders is similar across Texas, Tennessee, and Michigan (Stephenson 2018). Understanding the demand issue for broadband is another finding of Connection Nation's work. With low populations in rural communities and high costs to consumers, Connected Nation has found there to be significant challenges to deploying ubiquitous broadband internet (Conrad 2018).

Regulatory challenges, funding opportunities, and mapping of broadband availability are at the forefront of challenges that Connected Nation recognizes as inhibitors to broadband deployment across rural communities (Conrad 2018).

4.8 Generalizability

Due to the consistency of key themes across stakeholder responses, congressional testimony and statements by organizations, the results of the needs assessment seem to be fairly generalizable. It is important to note that funding, mapping challenges, and regulation reform are issues that have been discussed in many ways, across many stakeholder platforms, on federal, state, and local levels. In addition, the economic implications and challenges were consistent with broadband research and literature. Not only are these findings generalizable by stakeholder group, but also to rural communities based on prior research findings that are outlined in the literature review.

5. DISCUSSION

5.1 Similarities in Stakeholder Needs

Across each interview within the needs assessment, all groups shared views regarding challenges faced by their patrons, customers, clients, and stakeholder contacts. As outlined throughout the chapter on stakeholder findings, the information collected was very similar from each interviewee. The consensus was that there are distinct challenges that are inhibiting the deployment of broadband internet services across rural communities. From stakeholder input, and the literature, these difficulties are most commonly related to funding, regulatory, and mapping legislation. While these issues varied slightly from state to state, the main issues that were raised in the needs assessment from interviewees remained the same regardless of location and of stakeholder groups.

Regulatory challenges were widespread across stakeholder groups. Electric cooperatives shared about how regulatory permitting can be burdensome to laying broadband fiber infrastructure. Telecommunications providers shared that ever-changing regulatory guidelines cause challenges for planning and carrying out of broadband services. In addition, city and local governments have a difficult time planning and seeking broadband program opportunities when regulations are inconsistent.

Mapping of broadband services was also a challenge that impacted stakeholder groups, but in different ways. Internet service providers argued that the current mapping information from the FCC is not fully complete or accurate and, as a result, makes it difficult to plan or access and apply program funding. These struggles were similar in discussions with tele-health and education providers, who shared that mapping inconsistencies can cause delays in broadband planning due to how it impacts their opportunities to plan for their organizations and access

program funding. Community and government stakeholders shared that mapping inconsistencies and inaccuracies impede stakeholders from being able to even apply for broadband programs, due to maps marking areas incorrectly as fully served.

Funding challenges were also brought up by stakeholder groups. Internet service providers have shared the need for funding opportunities, including enhanced grant, loan and loan guarantees, that help get broadband infrastructure to areas that are currently unserved. Education and healthcare providers shared that funding programs are needed that focus on higher speeds for anchor institutions that require greater bandwidth than that needed for residential broadband services. Agriculture groups have shared that funding specifically for precision agriculture is needed to help deploy broadband across U.S. land that is intended for production. In addition, policy initiative groups echoed to needs from other stakeholders that increased investment from the public and private sectors are needed to deploy broadband out into the areas that need it the most.

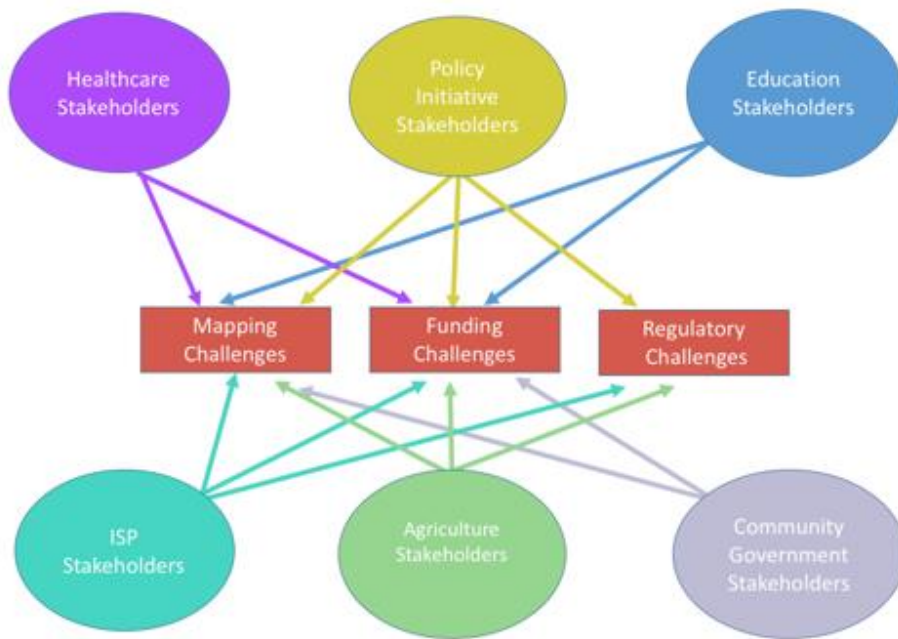
Almost each interview from the needs assessment covered these regulatory, mapping, and funding challenges. Each stakeholder group faces these three topics, although specific interests and concerns vary between groups. These findings draw attention to commonalities among stakeholder groups and areas for policy focus and research in the future.

5.2 Key Themes

The three main themes that were the focus of conversations with stakeholders were funding, mapping, and regulatory challenges. Figure 1 illustrates how the needs assessment results are related to the three main challenges. An observation of the needs assessment is that these challenges impact each stakeholder group differently. This highlights another challenge for policy makers: there is not a one-size-fits all solution to the rural-urban digital divide. However, there is room for common ground around these key themes that provide a starting

point for finding solutions to a lack of broadband accessibility in rural America. Finding how these policy solutions can be cooperative between federal, state and local governments is key to solving these challenges. This is often because stakeholder groups back in the community are well-versed in how these challenges are impacting the daily lives of rural consumers, their stories of success, and lessons learned.

Figure 1. Common themes among stakeholder groups.



5.3 Competing Interest Challenges

It is also important to analyze a few areas of competing interests among stakeholder groups. While broadband stakeholders understandably are interested in improving broadband in ways that are specifically beneficial to their organizations and patrons, these goals can sometimes conflict. This can make it even more challenging for policy makers to find solutions

to broadband challenges, as some programs, policies, and regulations have potential to benefit one group at the disadvantage of others.

One competing interest is between stakeholders that are interested in generally deploying broadband and those that have specific broadband needs. For example, based on the needs assessment findings, community stakeholders and internet service providers were often focused more generally on getting broadband internet access out to patrons and consumers in rural and remote areas that currently do not have access. However, anchor institutions such as healthcare, educational, and library stakeholders were more focused on finding policy solutions that focus on better broadband speeds that will be beneficial to institutions that require greater bandwidth to run their operations. These two missions, while similar, require different policy asks, solutions, and investment. This is a specific challenge area that policy makers have to consider when working toward broadband legislation and regulatory guidelines, both locally and federally.

Another area of competing interest is for telecommunications providers and electric cooperatives that each play different roles in the broadband deployment process. Regulatory challenges for each of these groups are different. Many of these challenges are dependent on state and local statute that determines whether there is opportunity for partnership between the two groups or, for example, if electric cooperatives are allowed into the broadband market at all. In addition, current policy programs for each are very different and offer solutions to differing goals each organization. Because of the complexity of relationships between the two groups, often differing from state or geographic area, ensuring that the policy needs are met can be difficult for policy makers to consider on a local, state and federal level.

There is also competing interest from state and local policy in relation to federal legislation. As with any policy challenge, broadband policies and ideologies can compete

between policy makers in Washington, D.C., state capitals, and community leaders in rural areas. This can cause even more inconsistency and be an issue that inhibits the deployment of broadband altogether. In addition, competing interests between those writing the legislation and those who know the needs of rural communities creates policy challenges for rural broadband.

5.4 Stakeholder Policy Recommendations

5.4.1 *State-Level Broadband Offices*

One policy recommendation from broadband stakeholder groups is to create state-level broadband offices. These recommendations have come primarily from the work done by policy initiative stakeholder groups, including Connected Nation and Glasshouse Policy. In Texas, Connected Nation recommends that the office serve as a key point of contact for any broadband-related work in the state (Texas Rural Funders Collaborative 2018). Work from Glasshouse Policy has also recommended a state broadband office and believes that, based on their listening sessions, it would promote greater coordination in broadband deployment efforts throughout rural communities (Visco 2018). According to stakeholder groups and broadband grassroots campaigns, these offices could have the opportunity to streamline broadband work including mapping, federal policy, and broadband program application on the local level (Texas Rural Funders Collaborative 2018).

5.4.2 *Broadband Data and Mapping*

Several of the needs assessment interviews noted broadband mapping challenges and suggested improved maps were critical to rural broadband deployment. While there were no concrete solutions given by broadband stakeholders on how to address the problem, there were a few areas that were recommended for policy makers to explore in the future. The most common recommendation was addressing the census block data used for mapping. According to stakeholder conversations, this self-reported data used to create FCC broadband maps is not validated (Conrad 2018). Because of the self-reported nature of the data, groups feel that it could

be misrepresenting rural communities and their access to broadband (Conrad 2018). Making sure that these broadband maps are more complete and accurate, as well as up-to-date could make sure that there are fewer delays in broadband program and loan disbursements in the future (Martin 2018).

5.4.3 *Broadband Program Enhancement and Investment*

Another recommendation from the needs assessment results was working to enhance current broadband programs that have been beneficial to rural communities. For anchor institutions, like schools, healthcare facilities, and libraries, stakeholders recommend programs that focus on higher capacity bandwidth to meet the broadband speeds needed to operate (Windhausen 2018). There was also an interest in programs focusing on digital literacy and training. These programs, whether on the local or federal level, could potentially help schools, libraries and other institutions that depend broadband accessibility to meet the needs of their patrons (Pedersen 2018). Overall, stakeholder groups shared a need for funding and investment from both the private and public sectors to be able to work toward addressing the rural-urban digital divide.

5.4.4 *Regulatory Improvement*

A final recommendation that came up in several needs assessment conversations is ensuring consistency of regulatory requirements for laying broadband infrastructure and providing broadband service for rural and remote areas. Inconsistency of permitting and regulation for broadband stakeholders over short periods of time creates challenges for project planning, funding, and completion (West 2019). Electric cooperative stakeholders are also requesting regulatory reform to eliminate policies that they perceive as being burdensome and delaying the deployment of broadband infrastructure (Wynn 2017).

5.5 Economic Implications – Density, Price and Relevance

In relation to rural broadband deployment, the rural-urban digital divide is closely connected to economic theory. The economic basis for why broadband is not being deployed to rural communities is a very distinct density problem. This relates back to microeconomic theory regarding producers, in this case internet service providers, and consumers. Providers are less likely to provide service to areas where there is drastically lower population density than urban communities where this density is much higher. Providers' costs per mile of line and per customer are lower in denser areas and higher in low-density rural areas. Economists also have to take into account the cost of building and maintaining the broadband infrastructure, as well as the permitting and regulatory costs that are needed to provide broadband service to these areas with significantly less people than in the urban communities.

From the perspective of the consumer, the economic challenge is their personal willingness to pay. In areas where there is only one service provider with significant market power, like many rural areas, the price is set by the provider. In areas where there are multiple service providers, the price of service is set by the consumer, because they will pay for the service that is less expensive, creating competition among providers. In addition, there is a relevance problem for consumers, many of whom are accustomed to life without broadband. If there is no buy-in from the consumer or an interest in the product, then the result is a demand challenge.

Both of these forces work together to cause challenges in rural broadband deployment that many stakeholders consider a market failure. The deployment of internet service takes both supply and demand. There must be internet service providers offering service at a reasonable price for consumers, and a willingness to pay from consumers to buy in to the service. Because there is a much lower population density in rural communities, making it a questionable business

decision for providers, there is a supply problem. Because there is a relatively small willingness to pay by consumers in rural communities, there is a demand problem. Both of these present economic challenges that could further inhibit the spread of broadband in rural communities.

Because of these supply and demand challenges and the quasi-public nature of the broadband infrastructure, many policy makers and stakeholders suggest that broadband be seen as a public good. Similar to other infrastructure needs, like electricity, this could be economic reasoning for certain policy solutions moving forward that push for public investment and intervention. In addition, this may encourage conversation regarding the role of public-private partnerships to deploy broadband infrastructure out across rural communities.

Moreover, investment from broadband programs on the federal, state, and local levels may engage more service providers which, as a result, could drive down the price for consumers. Programs that provide services to anchor institutions like schools, libraries, and healthcare facilities can bring to light the relevance of the service to rural consumers, perhaps influencing demand. The needs assessment results overviewed the impact that broadband programs have had on rural communities. As investment continued to be mentioned as a request from stakeholder groups, it could serve as a way to engage more providers and provide opportunities to lower prices for consumers while also showcasing the relevance of broadband through deployment to anchor institutions.

6. CONCLUSION

6.1 Practical Implications of Results

Findings from the needs assessment provided a perspective on the policy challenges for each broadband stakeholder group. The results from the study found that these challenges were focused on the areas of funding, mapping, and regulations. While each of these three challenges impact the broadband stakeholders in different ways, they each came up in almost every interview throughout the needs assessment. In addition, the needs assessment results provided better understanding of how these issues can cause stakeholder groups, and often policy makers, to have competing interests that potentially inhibit the deployment of broadband.

As technology continues to increase, the digital divide will likely continue to be an issue in rural communities, potentially impacting many sectors. From opportunities for rural consumers to access healthcare through the use of telemedicine, to young and beginning farmers planning for technology adoption on their operations, broadband will likely continue to be a topic of interest. Broadband accessibility also has an impact on education in rural communities, the planning of cities and municipalities, and the operations of public libraries. Understanding how the digital divide will impact each of these stakeholder groups in the future could provide information for solutions to the challenges of each group and broadband deployment.

6.2 Policy Implications

Rural broadband is a policy topic that will likely continue to arise in discussions in the House and Senate chambers for the 116th Congress. The 2018 Farm Bill's inclusion of the Precision Agriculture Connectivity Act of 2018 has established a goal of deploying broadband across 95% agricultural land by 2025. Within the 116th Congress, there could be additional legislation that works to deploy broadband across other remote, rural and tribal lands where

broadband access is lacking. However, given the distribution of power by political parties in the Senate and House chambers for the 116th Congress, there could be potential delays in comprehensive broadband legislation passing in both chambers and being signed into law. As for the executive branch, the Interagency Task Force on Agriculture and Rural Prosperity will likely continue to work toward better understanding broadband challenges and how to address them in coordination with the Trump Administration's policy priorities.

Another implication for policy makers regarding broadband will be balancing legislative power between federal statutes and state and local statutes. Some stakeholder groups argue that broadband issues should be addressed federally, while others would like more coordination between federal and local governments. In addition, some stakeholder groups, especially those interested in community initiatives, would like to see broadband policies that consider the unique challenges of each community, both economically and geographically. These policies could be addressed differently from state to state and through different state or community-wide initiatives depending on how the governments are designed.

Finally, it is important for policy makers to take challenges of funding, regulation, and mapping into consideration when making plans for new policies federally, statewide, and locally. These issues are of concern for each broadband stakeholder group and relate directly to the policy recommendations stemming from stakeholder interviews. When making funding decisions, it is important for policy makers to recognize the impact that federal programs have on both the supply and demand challenges, providing opportunities to engage more providers and lower prices for consumers. Policy work will also have to consider the impact that regulation has on a provider's ability to build and deploy broadband infrastructure. In addition, legislative

work must also find solutions to mapping challenges that allow providers and policy makers to understand where the problem is in order to find feasible solutions to broadband inaccessibility.

6.3 Further Research

This research is limited in that it presents the views of interviewed stakeholders and stakeholders with public testimony or statements about broadband. Potential bias is a limitation of many small sample interview-based studies. However, findings are consistent with the literature and across stakeholder groups, and results are expected to be generalizable. This study also recognizes the challenges presented by questions surrounding the definitions of rurality and broadband service, both in terms of how stakeholders define broadband (e.g., fiber versus Wi-Fi) and how service is measured (Mbps). Improving these definitions would be a useful avenue for future research.

The results of the needs assessment highlight areas that call for further research on rural broadband. One of these areas is estimating the cost of closing the digital divide in the United States. While there have been some studies done, and congressional proposals discussed, there have been differing estimates for the cost of addressing broadband accessibility from the perspective of federal investment. Research on the cost of addressing broadband accessibility across differing groups including agricultural land, remote areas, and tribal lands could also be useful in crafting policy solutions to existing challenges. Another area that the results pointed out for further needed research is the economic implications of public-private partnerships, and partnerships between telecommunications and electric cooperatives to provide broadband service to rural consumers.

Continued research on how access to broadband versus inaccessibility impacts rural stakeholder groups will be helpful for better understanding the digital divide. Addressing important questions like the impact that broadband has on a rural consumer's socioeconomic

status, financial opportunities, access to resources, and educational opportunities could also be of interest for economists to research moving forward. These research endeavors regarding rural broadband and the impact it has on the rural economy and its consumers could provide insight for policy makers to find feasible solutions to the digital divide in the future.

6.4 The Future of Rural Broadband

The results of the needs assessment provided unique insight into challenges faced by those working for the betterment of rural healthcare, education, farm and ranch productivity, and agribusiness. The information gathered also included specific policy asks for internet service providers, focusing both on rural telecommunications groups and electric cooperatives. Unique solutions, opportunities and programs that have made a difference in broadband deployment were also discussed during conversations with the stakeholder groups.

The results provide a framework to understand the impact of existing broadband legislation, policies, and programs on federal, state, and local levels. Interviews were used to provide a better understanding of how limited access to broadband impacts community stakeholders. In addition, they were used to overview the policy desires of different stakeholder categories, their partnerships, and the challenges of competing deployment, business, and policy goals. The results of the needs assessment provide a picture of not only deployment challenges for stakeholder groups but also policy needs for each group. The results were used to analyze current policies and programs for the impact they have on meeting the needs of each stakeholder group. The needs assessment findings also helped find areas where research may be lacking, and highlighted areas where economists might research broadband challenges in the future.

In 2019, the digital divide persists with rural communities across the nation. This inaccessibility impacts a variety of stakeholder groups – consumers, providers, anchor institutions, farmers and ranchers, and many more. Almost every stakeholder group is

experiencing three similar challenges regarding mapping, regulation, and funding. However, it is important to note that these challenges impact each stakeholder group differently in terms of the way they provide service, access program funds, or access broadband in general. The needs assessment findings present insight into policy needs that, from the views of stakeholders, are not being adequately met in order for broadband to be deployed to rural communities. Until rural broadband policies are implemented on federal, state, and local levels that are conducive to the deployment of service, while providing feasible solutions to both the challenges of supply and demand, it is unclear as to how long the rural-urban digital divide will remain. There remains a clear gap in broadband accessibility between rural and urban communities that will potentially have challenging economic and societal implications.

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