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THEME OVERVIEW: BRINGING BROADBAND TO RURAL AMERICA

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Rural America can be better connected to broadband, or high-speed Internet. With the passage of the American Recovery and Reinvestment Act (ARRA) of 2009, rural America should receive billions of dollars devoted to improving broadband access. ARRA provided:

- the U.S. Department of Agriculture's Rural Utilities Service (RUS) with $7.2 billion for broadband infrastructure projects through its Broadband Initiatives Program (BIP), and
- the National Telecommunications Information Administration (NTIA) with $4.7 billion to establish the Broadband Technology Opportunities Program (BTOP) to increase access and adoption and stimulate demand for broadband.

RUS received $2.5 billion specifically dedicated to expand access to broadband services in rural America (U.S. Department of Commerce, 2010a). But will it be enough? Will rural America finally, fully participate in the global knowledge economy of the 21st Century as does its urban neighbors? Or, will rural America remain synonymous with "the land of dial-up?" So far, the best answer is: maybe, maybe not.

The Maybe

Barnes notes in the first of the theme papers that the United States is spending more on broadband infrastructure than any other country. He also notes for the first time the United States has a National Broadband Plan which was developed for the Federal Communications Commission (FCC), the regulatory agency of the telecommunications industry. The plan outlines several recommendations that should be implemented to improve rural America's position in the global broadband adoption race. He notes some studies have concluded that ARRA funding may move the United States from 22nd to the top ten in terms of broadband speed available to rural and urban adopters; this may be enough for the Obama Administration to conclude the overall investments in broadband deployment were successful. Whitacre also shows how rural broadband adoption has increased in Oklahoma during the 2000s. Lane describes how educational curricula have been developed to support land-grant university extension faculty as they work with rural communities to better connect to the global e-business marketplace. Rural America should benefit from all of this. Maybe broadband is on the way.

The Maybe Not

On the other side, debate continues about rural broadband adoption and how or if such investments will bring broadband to rural America. Dickes, Lamie, and Whitacre show that since 2001 rural America continues to lag urban in broadband adoption by 20%. More importantly, nothing yet has changed this digital divide reality. Stenberg also notes the uneven development of local, state, and national policies could add significant cost to the deployment and use of broadband in rural America. Changes in political environments could influence broadband availability and subsequently rural adoption.

The institutional design of ARRA broadband funding may have missed the mark as well. Building a digital bridge to rural America requires knowing the location of existing broadband infrastructure in the United States. Yet, BTOP and BIP program grant funds were allocated before any nationwide map was developed, which meant broadband infrastructure projects would be funded before any map could be created. Nevertheless, based on Section 6001(1) of the ARRA, NTIA must develop and maintain an interactive nationwide map of where broadband is deployed and available in each state by February 17, 2011. Thus far, the cost for this has totaled $293 million dollars. More monies will be spent to create a nationwide map that utilizes state-by-state data. NTIA has hired ASR Analytics, LLC to develop and maintain the nationwide broadband map. The timing of the funding may prevent the development of an accurate map, but that is not the largest obstacle to development of a nationwide map. Under NTIA grant terms, a state has no formal recourse if broadband providers do not submit data to the organization hired by the state to produce its map. The NTIA state mapping program only asks broadband providers to voluntarily submit data to the organization chosen to create each state map or multi-state maps. If broadband providers do not submit data, then ASR Analytics, LLC will be unable to create an accurate nationwide map. The possible lack of an accurate nationwide interactive map does not bode well for bringing broadband to rural America.

Land-Grant University Faculty Can Contribute

Agricultural economists who conduct research on innovation, adoption, regional economic impacts, institutional change, and transaction cost economics should find ample settings to learn how the injection of $11.9 billion in broadband infrastructure resources affects technology adoption, rural regions, and the type and magnitude of institutional change at local, state, and national levels, as well as the transaction costs of rural adoption. Also, extension faculty who typically work with rural communities will find new ways to work with rural entrepreneurs and regional development organizations. Some examples include:

- Dickes, Lamie, and Whitacre demonstrate how an examination of the factors affecting rural broadband adoption is a useful place to begin. They note that partnerships with rural utilities and building infrastructure in rural areas where no access currently exists would be best served by encouraging competition among broadband providers. Whitacre also shows how a similarly applied analysis sheds light on how rural broadband adoption increased in Oklahoma in the 2000s. He notes that demand-side programs may have much potential for encouraging rural adoption more broadly;
- Stenberg and Lane describe different, yet complementary aspects of institutional change in political and educational institutions. Stenberg highlights the institutional change that has shaped American Internet policy and Lane discusses the characteristics of institutional change that led to the development of the National e-Commerce Extension Initiative (NEEI), an initiative that provides technology based education to rural entrepreneurs and communities through extension faculty engagement;
- Barnes argues using the Internet is similar to adopting an experience good in that high uncertainty of adoption benefits, due to transaction costs, may inhibit rural broadband adoption. He presents evidence of institutional change in rural Louisiana as broadband demonstration projects were implemented through the Louisiana Delta Initiative;
- Lane explains the educational curricula available through the NEEI. Both Barnes and Whitacre explain that part of Oklahoma and Louisiana's rural development models include teaching e-business/entrepreneurship courses that include Facebook, Wordpress, and the like. Barnes explains how extension faculty can work with traditional economic development organizations to bring rural regions together to focus on broadband deployment and use; and
- Dickes, Lamie, and Whitacre; Barnes; Whitacre; and Lane agree extension faculty could help bring broadband to rural America by providing more demand-side education to rural entrepreneurs and others in rural communities.

The ARRA broadband funding will provide new opportunities for research and extension faculty to work together more closely with rural communities. Implementing broadband educational programs and public awareness campaigns in rural communities where broadband infrastructure investments have been made will provide an opportunity to study and work with rural communities that receive infrastructure improvement and education and those that do not; the prime conditions that allow natural economic experiments. Maybe in the near future, faculty will find that broadband not only came to rural America, but it also made an economic difference.

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STRENGTHENING RURAL AMERICA'S POSITION IN THE GLOBAL BROADBAND ADOPTION RACE

James N. Barnes
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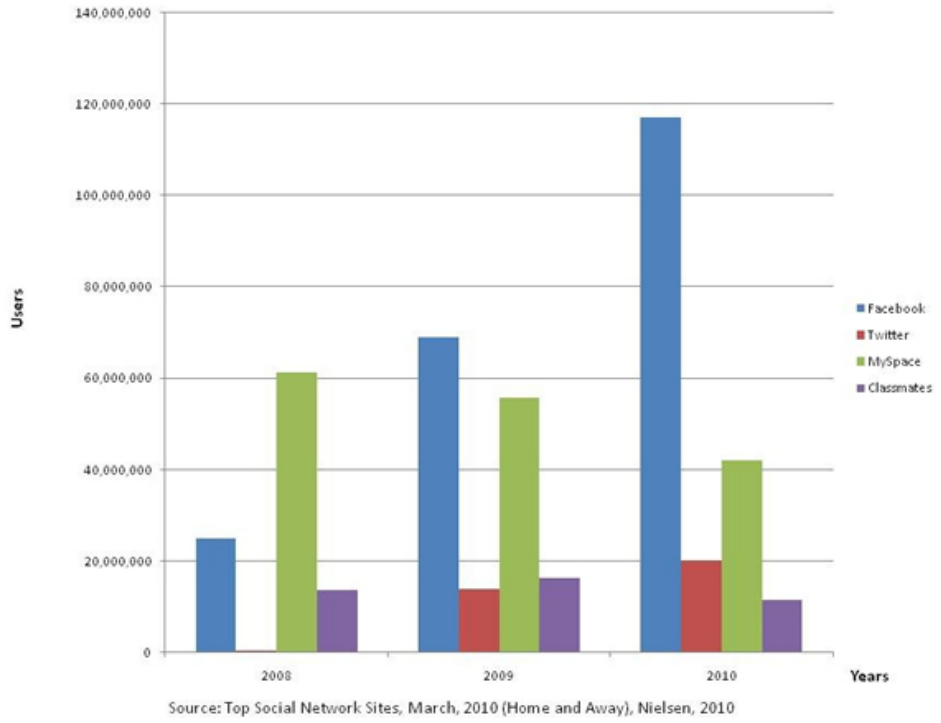
Keywords: Broadband, Rural America, Economic Development, Internet, Rural Regions

The global knowledge economy continues to grow exponentially as the Internet changes our global culture of education, research, business, and family life. Today the Internet digitally connects people and communities through innovations from Facebook, Twitter, Skype, Wordpress, Google, and YouTube, among many others. The Internet is a global network of connecting technologies and infrastructure that provides real-time and delay-timed data telecommunications (Economides, 2006). For example, books, magazines, and other publications can be accessed via the Internet as well as using it for sending and receiving photos, e-mail, video, music, movies, and much more.

Figure 1: Facebook Has Outpaced Other Social Media, 2008-2010



Source: Top Social Network Sites, March, 2010 (Home and Away), Nielsen, 2010

To gain some perspective, compare today's information produced to that of the past. Over 200 years, the Library of Congress in Washington, D.C. has stored and organized information records including: 29 million books and magazines, 2.7 million recordings, 12 million photographs, 4.8 million maps and 57 million manuscripts. But today, this same amount of information can be produced in less time than it takes to eat a

meal or commute to work—only 15 minutes (Internet Innovation Alliance, 2010). This growth has been supported by the fact that, globally, 2 billion Internet users have found new ways to use the Internet to improve their lives. Facebook, the number one social media networking site, has connected more than 518 million people in only six years (Internet World Stats, 2010). Figure 1 shows Facebook has outpaced MySpace, Twitter, and Classmates from 2008-2010.

But not everyone has logged on to Facebook or adopted the Internet more generally. The startling reality is that only 29% percent of the global population currently uses the Internet, and although Facebook has been remarkably successful, 92% of global Internet users have not used Facebook. The global knowledge economy is certainly well underway, yet there is one player that remains "on the sideline" in this global adoption race: rural America.

This article provides an overview of the global Internet adoption race and the factors that drive rural Internet adoption, and suggests that rural communities implement broadband demonstration projects to enable experiential learning. Part one briefly defines high-speed Internet, or broadband, and discusses how to understand broadband speed and the most commonly used broadband technologies in the global marketplace. Part two outlines some key factors driving rural broadband adoption and suggests that broadband adoption benefits need to be more observable in rural communities to encourage adoption. Land-grant university faculty can play an important role by identifying and assisting with implementation of small broadband demonstration projects in rural communities. Broadband demonstration projects would provide community experiential education and simultaneously make adoption benefits more meaningful. Without implementation of such projects, broadband adoption benefits may remain hidden and irrelevant to those living in rural America. The Louisiana Delta Initiative case study is presented as an example of how broadband demonstration projects can be implemented in rural communities.

The Speed of the Race

The term "broadband" refers to high-speed Internet access and the corresponding networks, devices, content, and applications (Baker and De Sa, 2010). Speed is measured in bytes. A "bit" is the smallest unit stored on a computer; 8 bits equals one byte; 1,000 bytes equals a kilobyte; 1,000 kilobytes equals a megabyte; and so on up to Zettabytes (EMC, 2006). But what does "high-speed" mean? According to the Federal Communications Commission (FCC), the lead regulatory and standard-setting institution in the U.S., 768 kilobytes per second (kbps), up from the previous 200 kilobytes per second, is considered high-speed broadband. Basic broadband defines download speeds between 768 kbps and 1.5 megabytes per second (mbps). The larger the Microsoft Word, Excel or PowerPoint file or movie, book or other digital product, the greater the need to have a broadband connection to process the downloading or uploading of such files. This is how information packets are understood in the knowledge economy. Bytes are then converted to numbers and letters which define how large an information packet is and the type of pipeline necessary to upload to or download from the Internet.

This leads to the definition of the most common pipelines, or broadband technologies, used today to share information on the Internet. Initially, phone lines were used to access the Internet using dial-up technology. Dial-up represented a download speed of 56 kbps, far less than the FCC standard of 768 kbps. Dial-up could only be used to download and upload small applications including low-quality streaming audio. Since dial-up falls short of the FCC standard, most of the comparative adoption statistics today have compared the switch from dial-up to broadband technologies. For example, U.S. dial-up adoption in 2001 equaled 41% while broadband adoption trailed considerably at only 6% (Pew Internet and American Life Survey, 2002). In 2010, the trend reversed as dial-up represented only 5% and broadband 66%. With greater speeds, broadband provides more capacity to share larger information packets on the Internet. The other broadband technologies currently used can be placed into two categories: wired and wireless. Wired broadband includes cable, Digital Subscriber Lines (DSL), leased lines (T1), Broadband over Powerline (BPL), and fiber optic cable. Wireless broadband includes fixed wireless, Wi-Fi, Satellite, and Wi-Max (Shufstall, et al. 2009).

To make these broadband technologies meaningful, consider the time it takes to download different information packets from the Internet. DSL connections of 200 kbps and dial-up are generally too slow for the more advanced information packets transmitted today. Satellite, DSL and cable can support download of streaming videos at a speed of 1 mbps. Table 1 shows some broadband speeds and applications.

Table 1

Broadband Applications and Speeds

Download Speed	Application	Technology	5 MB Song Download time[1]	500 MB Movie Download time[1]
56-90 kbps	Low Quality Audio	Dial Up	16 min.	1620 min. or 27 hrs., 18 min.
256 kbps	Streaming Audio (VoIP) Vonage	DSL Lite	4 min.	360 min. or 6 hrs., 49 min.
1 mbps	Streaming Video	Satellite, Cable, DSL	1 min.	102 min. or 1 hr., 42 min.
20-30 mbps	High Definition TV	ADSL[2]	2 sec.	4 min., 5 sec.
100 mbps	All the Above	Fiber	1 sec.	3 sec.

Sources:

Turner, D.S. Broadband Reality Check, Free Press, August 2005

Sunstar Media, Available online at http://www.ssmedia.com/utilities/calculator

Notes

[1] Download times estimated by Sunstar Media, available at http://www.ssmedia.com/utilities/calculator

[2] Refers to asymmetric DSL where download speed exceeds upload.

Consider downloading a five minute song (5 mbps). Download times equal: 16 minutes (dial-up equal to 56-90 kbps); one minute (satellite, cable or DSL equal to 1 mbps); and one second (fiber equal to 100 mbps). But as file size increases from a song (5 mbps) to a movie (500 mbps), the download speed requirement also increases and the advantage of broadband over dial-up becomes even more noticeable. The time it takes to download a 500 mbps movie decreases from approximately 27 hours using dial-up to almost seven hours compared to DSL Lite; fiber takes only three seconds, however. From dial-up to DSL to fiber, significant time savings exist. Suddenly, "living in the land of dial-up" in rural America, brings to light a significant reality: full participation in the knowledge economy is not possible with dial-up or many broadband technologies. Modest gains in broadband speeds using cable and DSL are certainly improvements, but the knowledge economy of the 21st Century will require greater speeds than these for the United States., including rural America, to fully participate in the global information economy.

Global Broadband and Rural America's Challenge

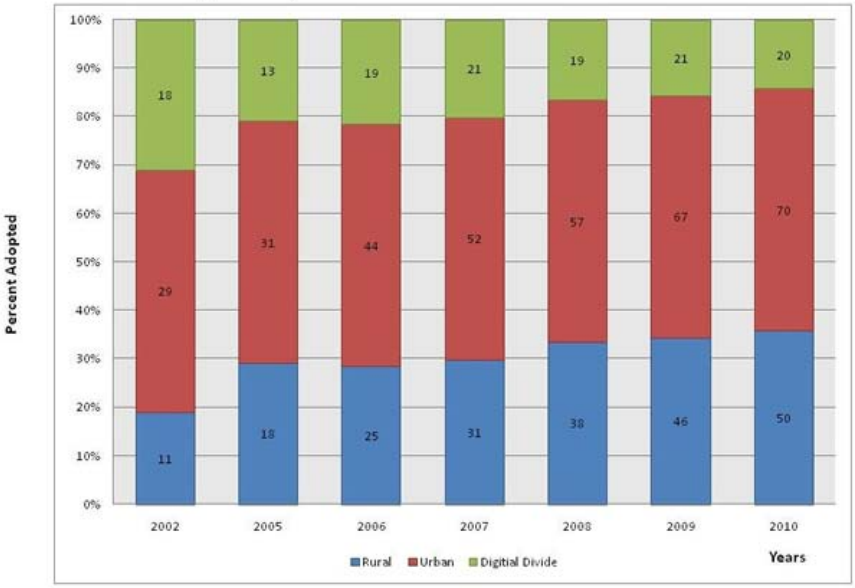
In a global report that measured actual download network speeds per 100 inhabitants across cable, DSL, and fiber, the United States ranked sixth (5.1 mpbs) compared to South Korea (20.4), Japan (15.8), Sweden (12.8), and the Netherlands (11.0) (Communication Workers of America, 2009). On average, the predominant global broadband technology adopted among fixed broadband technologies in Organization for Economic Co-Operation and Development (OECD) countries has been DSL followed by cable and fiber (OECD, 2009a). However, Japan and South Korea represent global exceptions to this trend. A review of subscriber data per 100 inhabitants reveals that in both countries fiber has been more widely adopted than cable and DSL combined. Further, a study by the International Telecommunications Union (ITU, 2006) concluded that adoption of fixed broadband subscribers per 100 inhabitants ranked the United States 16th. Surprisingly, the United States, which created the Internet, continues to fall behind other countries in adoption and broadband speeds available.

Why such paltry U.S. adoption and lower speeds? The ITU report also concluded an important factor is that the United States spends relatively less on telecommunications as a percentage of gross domestic product (GDP) (0.17%) compared to the leading countries, South Korea (1.33%) and Japan (0.48%). Slow speeds and lower adoption should not mean higher prices, but that is the case in the United States. Turner (2005) found that U.S. consumers paid more for slower speeds. The average DSL (1.5 to 3.0 mbps) price paid in the United States equaled $30-50 per month and cable (3-5 mbps) slightly more at $40-50. The average cost of a broadband connection capable of 26 mbps speed equaled only $22. The takeaway from this analysis is the Japanese have 8.5 times the speed at 1/12 the cost.

Lower relative speeds and higher prices paid do not bode well for rural America when striving to improve its position in the global broadband adoption race. What also does not bode well for rural America is the continued presence of a digital divide. The most recent 2010 Pew Internet and American Life Project survey found that 66% of Americans have a home broadband connection, but only 50% of rural Americans have a

broadband connection at home compared to 70% for urban. This creates a rural-urban digital divide equal to 20%. The upshot is rural adoption has increased from 11% in 2002 to 50% in 2010. Figure 2 shows the rural-urban digital divide from 2002 to 2010. Every five years, rural adoption increased about 20%. But despite such adoption growth, rural America continues to trail its urban counterparts by 20%. In 2002 and 2005, rural adoption lagged urban only 18% and 13%, respectively. However, since 2006, the digital divide has persisted, equaling 20% in 2010.

Figure 2: U.S. Rural-Urban Digital Divide, 2002-2010



Source: Pew Internet and American Family Life Project, Home Broadband Adoption Surveys, 2002-2010

There is another side to this digital divide story. Some studies have concluded the difference in adoption has much to do with such demographic characteristics as income and education, making rural location itself far less important as an adoption characteristic. In a longitudinal study of broadband adoption in Oklahoma between 2003 and 2006, Whitacre (2010) found evidence of two important aspects related to broadband adoption and rural adoption specifically. Adoption of broadband was positively related to the presence of adequate broadband infrastructure, something not accounted for in previous studies. Also, after accounting for education, income, age, race, broadband infrastructure supply, and household type, Whitacre found no evidence that rural and urban adoption differed. What does this mean? At least in Oklahoma, economic and demographic factors largely determine broadband adoption, not rural location. This implies that comparing economic and demographic factors in isolation, rather than examining how they interact to understand rural broadband adoption, is not warranted.

Another important contribution made by the Whitacre study is that adoption studies in general and rural in particular should account for the supply and type of broadband technologies available to rural users when modeling adoption of broadband. Failing to do so could bias results toward lower overall rural adoption primarily being driven by demographic factors when in fact some part of low rural adoption could be attributed to inadequate supply of broadband. Lower rural adoption could be driven by rural users simply choosing not to adopt dial-up (56kbps) or slow speed broadband technologies such as DSL lite (200kbps) because they are too slow, irrespective of such demographic factors as income, education, and the like. Consider the newly released study by the Department of Commerce in November, 2010. The national study examined the factors leading to broadband adoption in the United States. It found the rural-urban digital divide gap to be only 7% after accounting for socio-economic and demographic factors. Nationwide, this implies that rural location does affect broadband adoption, but much less so than stand-alone digital divide statistics reveal. However, this study did not account for broadband infrastructure factors similar to Whitacre (2010). The key point is comparative analysis of supply and demand factors should be considered to measure the significance of any rural-urban digital divide. In a phrase: speed matters.

Adoption Benefits May Need to Be Experienced

The previous discussion attempts to answer an important question: Why does living in rural America translate

into lower adoption? As noted, socio-economic and broadband supply factors matter. Also contributing to lower rural broadband adoption could be that consumers do not fully understand broadband adoption benefits well enough to be interested. In a survey released in November, 2010, the Department of Commerce found some evidence of this. Results indicated that 52% of rural households cited “Don’t need it/not interested” as the number one reason for nonadoption of broadband followed by “No computer or computer inadequate” (23%) and “Too Expensive” (16%). Could it be that the benefits of adoption are not clearly understood by rural households, and therefore, benefits seem hidden? Perhaps broadband can be viewed as an experience good which cannot be fully understood until a consumer buys and tries it in their business, household, or elsewhere. Through the experience, the benefits become more clearly identifiable and meaningful. Perhaps with a clearer understanding of broadband speeds and their associated relative costs/benefits, rural citizens may adopt more broadband technologies.

This is certainly not guaranteed, but a recent study by Hague and Prieger (2009) concluded educational work on demand-side programs that demonstrate the value of broadband adoption may go a long way in encouraging adoption in rural America. Further, when local governments become involved, the likelihood of broadband adoption increased because local involvement brought greater knowledge of local barriers to adoption and greater accountability for adoption results. Also, Hauge and Prieger noted in some cases, simply connecting people and communities to broadband did not ensure success. They cited an example case where schools were wired with broadband in an educational outreach program, yet no training was provided to teachers nor were they taught how to incorporate their newfound digital skills in the classroom. A key lesson learned is the benefits need to be demonstrated and experienced, and that takes training and new skill development. In a recent survey of non-Internet users, six of ten nonadopters of broadband stated they would need some personal assistance to go online and use the Internet effectively (Pew Internet and American Life Project, 2010). Taken together, greater local involvement and more integrated training appear to be necessary in any demand-side educational effort that demonstrates broadband benefits in rural communities.

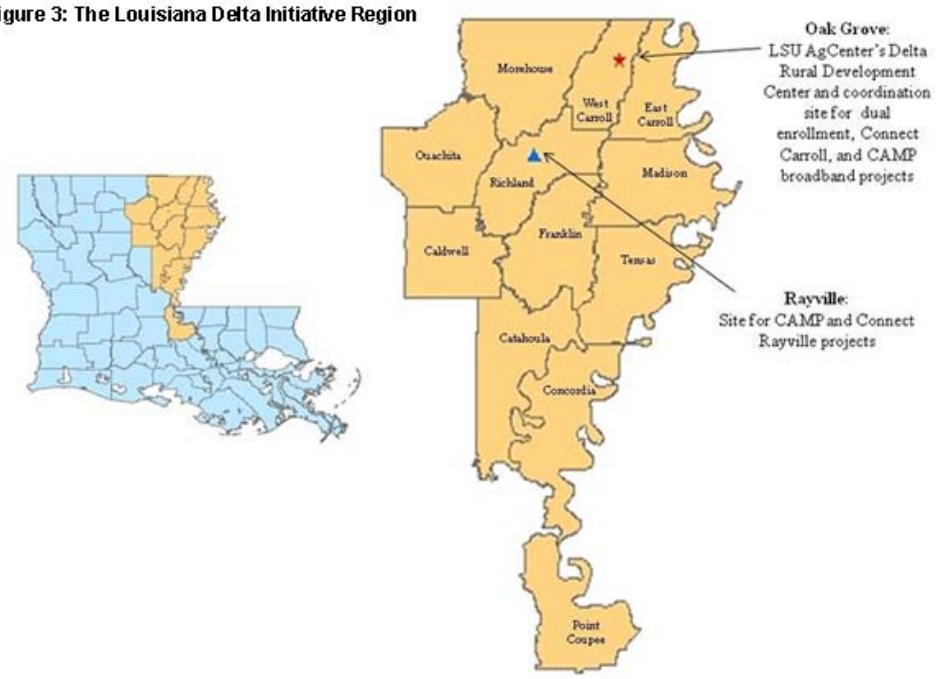
The Louisiana Delta Initiative Case Study

Greater local participation, greater local government involvement and hands-on training for those living in rural America may contribute to increased rural adoption. For example, land-grant university faculty often work with rural communities, so many opportunities exist to supply these critical ingredients to spur rural broadband adoption. For the past three years in Louisiana, several broadband demonstration projects have been implemented to provide an experience of what broadband can do for rural communities. In 2007, several meetings were held in northeast Louisiana whereby the LSU Agricultural Center and the Southern University Agricultural Center faculty brought together traditional economic development groups with community members, nonprofits, local, state, and federal partners in an effort to focus on a twelve parish area. This regional collaboration represented one of the key regional efforts by both universities working through the jointly organized Louisiana Center for Rural Initiatives.

After a review of previously organized rural development roundtables and other surveys indicating community and economic development needs, a common ground emerged across all twelve parishes: communities repeatedly said they needed better access to affordable high-speed broadband. With broadband as common ground, a new regional economic development network formed over the next six months complete with the establishment of a board, development of a strategic plan, and mission statement for the new network called the Louisiana Delta Initiative (LDI). Figure 3 shows the LDI region. The LDI represents a twelve parish region in northeast Louisiana, one of the most poverty stricken regions in the country with an average poverty rate of approximately 21% and a clear need for greater broadband infrastructure development (Barnes, Hatch, and Dixon, 2008).

Over the next two years, faculty worked with partners in LDI to implement several broadband demonstration projects (Barnes, 2010a). First, the emergency preparedness project initiated the Community Asset Mapping Project (CAMP). High school students in rural Oak Grove were trained in Geographic Information Systems (GIS) to create digital maps using ArcView software. Students collected fire hydrant location data which usually meant hundreds of hydrants throughout a parish, filling stations, and other important 911 infrastructure such as hospitals, fire, police, and ambulance stations. Digital maps were created and distributed through workshops and LDI’s blog at http://louisianadeltainitiative.blogspot.com. These maps assist with a more coordinated effort across health, fire, and police units to increase responsiveness to 911 events. The CAMP project has been implemented in two parishes, West Carroll and Richland.

Figure 3: The Louisiana Delta Initiative Region



Source: Louisiana Delta Initiative blog, (http://louisianadeltainitiative.blogspot.com)

Second, the Connect Carroll project began. These same students mapped cellular availability of broadband in two parishes in northeast Louisiana, East and West Carroll Parishes. Using ArcView, students created digital maps showing where Verizon and AT&T had similar and different broadband speeds. In 2011, these maps will serve as the basis to help both parishes better plan for broadband deployment. The rural cellular maps created in the Connect Carroll project also will be given to rural community leaders, including mayors, town councils, and chambers of commerce, and many more. In 2011, these maps will be used to initiate discussions with the two carriers about increasing both the scope of coverage and broadband speeds to allow greater use by rural businesses. Current maps indicate where iPhone and other smartphone applications can be used with optimal service.

While mapping projects represented a good start, rural citizens and LDI were also engaged in other projects that directly provided greater access to broadband, such as the third project, Connect Rayville. The mayor's boardroom, office and the Richland Parish Civic Center, the site of many community meetings, in Rayville, La. were equipped with wireless broadband. Through technical service and training, LSU AgCenter faculty led the installation of new wireless routing equipment to enable wireless access. Fourth, faculty taught throughout the region the basics of e-business. Rural entrepreneurs attended Blogging classes using Blogger and Wordpress, Facebook, Twitter, Google Analytics, PayPal, and eBay courses. Faculty continue to offer these e-business courses throughout the twelve parish region. In some cases, more direct technical assistance given to entrepreneurs led to the creation of new web presences for communities and local business owners, or Facebook and Twitter accounts were created. Both the West Carroll Chamber of Commerce (http://www.westcarrollchamber.com) and the 5 Boys-n-Me Candle Company (http://www.5boysandmecandlecompany.com) created Web sites after attending these courses. Both are located in Oak Grove.

Finally, LDI sought to demonstrate how adopting broadband could improve educational attainment in rural Louisiana. Through a grant provided by the Louisiana Board of Regents, high school junior and senior students from the surrounding area attended virtual classes offered at the LSU AgCenter's Delta Rural Development Center (DRDC) in Oak Grove. Using fiber capable of speeds greater than 100 mbps, students have attended virtual classrooms and earned both high school and college credits through the Delta Community College located in Monroe, La.which is about eighty miles from students in Oak Grove. From 2005 to 2010, more than 250 students have taken such basic courses as English, biology, psychology, and history, to name a few. Estimated direct benefits to students from reduced commuting and therefore part-time employment have totaled almost $400,000 dollars (Barnes, 2010c). More to the point, this rural area has learned how access to broadband, beyond the FCC standard of 200 mbps can improve educational

attainment. Through this experience, the benefits of rural broadband adoption have been made more observable and meaningful to those living in northeast Louisiana.

In the summer of 2009, the LDI partnered with other state agencies in the Louisiana Broadband Alliance and later received an award for broadband infrastructure development through funding from the American Recovery and Reinvestment Act (ARRA). The project will install more than 900 miles of fiber affecting 100,000 households throughout this poverty stricken region in 2011 and 2012 (Barnes, 2010b). In 2010, LDI has also received similar funding to conduct an educational program aimed at increasing rural broadband adoption. Currently, the LDI network is developing a new set of demonstration projects and crafting its strategy for the educational program. LDI plans to use the Connecting Rural Communities curriculum available at the Southern Rural Development Center at Mississippi State University to guide rural communities toward greater rural broadband adoption from 2010-2014.

The Great Rural Experiment of the 21st Century

With the passage of ARRA, Congress and many other U.S. institutions have acknowledged that leaving rural America in its current broadband adoption position is simply unacceptable. Through the ARRA, the United States has committed $7.5 billion to broadband infrastructure, the largest sum of any country. Over the next four years, one of the most historic experiments will take place in rural America as billions of dollars in broadband infrastructure and education funding are simultaneously injected into rural America. Meanwhile, an important step that land-grant university faculty can take to encourage rural broadband adoption is to teach rural entrepreneurs how to use such social media as Facebook, Twitter, Wordpress, Google, and more. Equally important is to teach how to use mobile applications for business. Finally, implementation of demonstration projects similar to the Connect Carroll and Connect Rayville projects could also support rural broadband adoption. But will implementing demonstration projects and injecting billions in broadband infrastructure and education strengthen rural America's position in the global broadband adoption race? Only time will tell.

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AMERICAN POLICY AND THE EVOLVING BROADBAND INTERNET NETWORK

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Broadband Internet technologies are the latest in several waves of communication and information technological change to enter rural America. Like previous technologies, it promises to have a profound impact on the social and economic fabric. Arguably, the Internet has already had a more profound effect on agricultural and rural economies than earlier communication technology introductions. The Bureau of Census annual wholesale and retail trade survey reports online retail sales nationally increased from $31 billion in 2001 to $107 billion in 2007. Also according to U.S. census statistics, online wholesale trade in 2006 was an estimated $613 billion, or approximately 16% of all sales. Online wholesale trade in farm products was an estimated $5 billion or 4% of all wholesale farm product sales in 2006. This article provides a brief history of modern information services and the policies that are shaping their spread and use across rural America.

Rural Communication Services over Time

Communication and information technological changes have come in four basic waves in the United States, each profoundly affecting rural-urban economic and social relationships (Stenberg, 2006). The first was set in motion in 1843 with a $30,000 grant from Congress to Samuel Morse. The grant funded the building of an experimental electric telegraph line between Baltimore, Md. and Washington, D.C. The ensuing rollout of the telegraph—with the railroad's critical contribution—ushered in the original agricultural e-commerce activity 150 years ago. The telegraph made it possible for farm and household goods to be easily ordered from great distances and led to the formation of such 20th century retail giants as Montgomery Ward and Sears, Roebuck, and Co.

The second wave came around 1900 with the onset of the first rural telephone systems. The most notable impact from the first telephone systems was the decline in the need to make day trips from farmstead to towns. Farmers could address some of their farm and household needs with respect to farm inputs, household goods, veterinary and medical services, information, and other services without leaving the farmstead.

During this period, though, telephones were considered a luxury and not available to a high percentage of farms. Later, roughly from the period spanning World War I to World War II, improving technology allowed shared communication lines, thus driving down costs for service to individual farms and households. The diffusion in rural areas during this period was faster than it was in large urban centers though connecting to the national network for long distance service was impeded by the Bell Telephone System's market dominance and the regulatory environment at the time. Telephone systems became much more integrated within their local economies and contributed to the building of rural communities. The era was dominated by local and regional-based economic activity.

The third wave appeared in the middle of the 20th century following regulatory change and the enactment of the Communications Act of 1934. Long-distance communication service improved greatly and declined in price. The era was marked with increasing vertical economic integration into the national economy of regions and corporations and other business enterprises, including increasing farm consolidation. Markets for goods

and services became more national, rather than local, in focus.

The fourth wave began in the late 20th century with new information technology, such as the fax, personal computer, and Internet. This has meant instant access to many parts of the world and is the current era, the Information Age. The Information Age, however, has been built on communication and information technology from all four eras. Farmers still call their local cooperative or other business affiliate. Agricultural businesses still make long distance calls to complete or start business deals. The latest era offers new, and alters some existing, business channels of communication.

Internet and Federal Government Policy

Federal government policy has historically been influential in the development and diffusion of communication and information services in the United States. Federal level rural telecommunications policy has followed three legislative paths: the Communications Act of 1934, periodic farm bills, and occasional nonrecurring legislation, such as the American Recovery and Reinvestment Act of 2009 (ARRA). The Communications Act of 1934, as last amended by the Telecommunications Act of 1996, has not required support for Internet into households, though it allows for regulatory action to mandate it. The Federal Communications Commission (FCC) was given the authority by the Act to include Internet services as part of the Universal Service Program, which partially subsidizes rural and poor household telephone service, but has not yet taken the step. However, the last two farm bills—Farm Security and Rural Investment Act of 2002 and Food, Conservation, and Energy Act of 2008—have led to an increased rollout of broadband technologies into rural communities. The 2002 and 2008 Acts provided grants and mandated a loan program for rural broadband providers and are administered by the Rural Utility Service (RUS), U.S. Department of Agriculture (USDA), with a budget determined by Congress annually.

The Food, Conservation, and Energy Act of 2008 has three provisions and principles to encourage the investment in broadband technologies for rural areas. First, it authorizes $25 million annually in grants, loans, and loan guarantees for the purpose of improving access to broadband telecommunication services in rural areas. Second, these grants and loans are mandated to be for construction, improvement, and purchase of equipment and facilities for rural broadband service in eligible communities. Third, the definition of what constitutes broadband service would be reviewed regularly to take into account changes in technology.

In addition to enhancing technology deployment, the 2002 and 2008 farm bills directly support the development of e-commerce. The 2002 Act brought about the establishment of a rural electronic commerce extension program, the National e-Commerce Extension Initiative, in 2003. The program's goal is to expand and enhance e-commerce practices and technology to be used by rural small businesses and enterprises. The Southern Rural Development Center, in partnership with National Institute of Food and Agriculture, USDA, administers the program. The program addresses factors that dictate the adoption and diffusion of e-commerce innovations in rural areas: whether rural areas have the necessary technology to embrace e-commerce undertakings, how and whether these businesses can benefit from e-commerce activities, and whether extension departments have the resources to provide adequate and appropriate support to small businesses and enterprises.

The farm bills also support the development and use of the Internet in rural schools and health facilities, also administered by the RUS-USDA. RUS's Distance Learning and Telemedicine Program (DLT) is intended to improve education and health care delivery in rural America through loans, grants, and loan/grant combinations for advanced telecommunications technologies. Entities awarded the grants and loans provide education and medical care via telecommunications and include corporations or partnerships, Indian tribes or tribal organizations, state or local units of government, consortia, and private for-profit or not-for-profit corporations.

Since 2002 more than $166 million has been awarded by the DLT program to 3,796 rural educational facilities and 2,226 health care institutions. Funds have been used for the acquisition of capital assets, instructional programming, acquisition of technical assistance and instruction for using equipment, site development and alteration of buildings, land and building purchases, building construction, and acquisition of telecommunications transmission.

The Telecommunication Act of 1996, though not mandating the universal service program to cover Internet service to the household, did provide a program for education and library systems: the E-Rate program. The

E-Rate program, established by the Telecommunications Act with an annual fund of $2.25 billion raised from a fee imposed on all telephone users, subsidizes Internet service for schools and public libraries, gives schools more options for faster Internet service, allows for community Internet service, and helped begin pilot programs for digital textbooks. The program allows schools and libraries to use federal funds to lease unused local communication lines—known as dark fiber—to connect to the Internet, a potentially faster and lower-cost connection than offered through some local telecommunications companies. The E-Rate program, though, came under fire from Congress in 2004 for wasteful spending. Changes in accounting regulations and program rules led to a temporary suspension of new grants that year.

The FCC noted in its National Broadband Plan released in March 2010, that some schools still do not have broadband connections. The company that administers E-Rate received at least 200 requests in the 2009 fiscal year for money to pay for dial-up Internet connections. The program mostly serves schools in poor and rural communities. The FCC is also considering allowing schools to open up their E-Rate funded Internet resources for local community use during after school hours and when schools are not in session. Only school use is currently allowed under E-Rate regulations.

The FCC's National Broadband Plan was mandated as part of the broadband Internet provisions in the ARRA. The ARRA also provided $7.2 billion in grants to the profit and non-profit private sector for the provision of broadband services in rural and urban communities. Of the $7.2 billion, $2.5 billion specifically targeted rural areas and is administered by RUS-USDA. The rest of the outlay, $4.7 billion, went to both urban and rural areas, and is administered by U.S. Department of Commerce's National Telecommunication and Information Agency. The grants have been awarded and the systems they funded are currently under construction.

RUS-USDA had authorization to use the ARRA funds as grants, loans, and grant/loan combinations. By Sept. 30, 2010 there were 320 awards obligated for a total $3.5 billion in grants and loans made in 45 states and one territory. Among these awards were 285 last-mile projects that totaled over $3 billion, 12 middle-mile awards for $172.6 million, four satellite awards for $100 million, and 19 technical assistance awards for over $3.4 million. Last-mile line is the connection from communication lines going directly to a household or business from the communication network, a middle-mile line is the connection from a national communication line to towns and villages. The awards are expected to provide broadband Internet access for 2.8 million households, 364,000 businesses, and 32,000 anchor institutions across more than 300,000 square miles. The projects partly cover 31 tribal lands and 125 persistent poverty counties.

The federal regulatory environment continues to be a major element shaping the broadband Internet market in rural areas. While many regulatory issues exist, two highly contentious regulatory issues are considered seminal in the rural Internet's advancement: open access rules and net neutrality. Open access are the rules by which incumbent providers must open their physical systems to other providers of broadband Internet service. Net neutrality refers to the rules by which information is treated by service providers as it moves across the Internet. Both set of rules impact the cost to businesses and consumers of using the Internet and the profitability of service providers, often with direct, but not necessarily one-to-one, tradeoff in costs between user and provider.

Internet and State and Local Government Policy

The federal government is not the sole generator of policy initiatives. State and local governments also play a major role in the future of broadband Internet access, though their role is constrained by the federal government. If federal law and state and local legislative actions conflict, federal law takes precedence. Federal limits became even more a fact of life after the enactment of the Telecommunications Act of 1996. Nevertheless, state and local governments have had a great deal of latitude. State and local policy initiatives fall into three basic categories: (1) demand enhancement, (2) rule, regulation, and tax, and (3) finance and infrastructure policies.

Demand Enhancement Policies

Limited local broadband availability may be a result of real or perceived lack of demand. The lack of demand, as a consequence of either low level or fragmented demand, discourages private investment. If demand is low or fragmented, local governments may step in. The source of demand insufficiency leads to different sets of policy prescriptions. When low demand has been the case, demand has often been stimulated through

extension programs, often business training in the use of information and communication technologies. Increasing business acumen in these technologies, it is argued, leads to increased use by businesses.

When fragmented demand is the perceived problem, local governments have often adopted programs that will aggregate demand. Local government, in this case, acts as a monopsonist—single seller—and governments follow one of two policy prescriptions. They act either as an anchor tenant or a group pricing facilitator. When local governments act as an anchor tenant they negotiate with a provider to get the service. The provider then may offer the service to others. When local governments act as an agent for a group of potential users to obtain the service, they may either directly negotiate or assist in the development of a group to negotiate with a service provider.

Rule, Regulation, and Tax Policies

Reform of rules, regulations, and tax policies has been another mechanism for encouraging investment in local broadband services. Governments, in this case, adopt reforms that reduce the cost or shorten the period to gain positive returns from an investment. The two most common reforms affect access to local facilities or are industry specific regulations. Access reforms address such issues as zoning and right-of-ways. Industry specific regulations include franchising and licensing.

Overlaying the rules and regulations are taxes and fees designed for telecommunication companies and levied by local governments. They include:

- Franchise taxes
- Telecommunication taxes
- License fees
- Utility taxes
- Local 911 tax
- Access line tax
- Telephone relay surcharge
- Public service taxes
- Infrastructure maintenance fees
- Right-of-way charges

Taxes and fees may be adjusted to affect household and business access rates to local facilities.

Finance and Infrastructure Policies

State and local government use finance policy to encourage private investment. Finance policy includes grant and loan programs, tax incentives to providers, equipment and services to users, and planning grants, training, and nonprofit deployments to community groups.

Infrastructure policy involves governments making their own investments in infrastructure by establishing government run companies. Direct local government investment, however, has been quite controversial in the United States. On one hand, local government sponsored broadband deployment may diminish competition by crowding out private investment. On the other hand, local government provided infrastructure may be the only way to provide competition, or in some cases the only recourse, where unfavorable economics discourage private investment.

Concluding Comments

Four major waves of communication and information technology advancements have taken place over the last 150 years. In the fourth wave, broadband technologies have increasingly become available and used in the rural and farm economies. Old communication channels, however, remain open and continue to be used by rural and farm businesses in their everyday activities. Communication and information technology continues to change and improve in capability while costs decline.

Federal policy has tried to encourage the development and diffusion of communication and information technology into rural communities through loan and grant programs while attempting to adjust the regulatory environment appropriately. Unfortunately, not all regulatory issues have a clear cut win-win solution and will continue to be contentious. State and local governments have a multitude of policies that must be carefully considered as the policies both support as well as add costs to broadband service rollouts and operations.

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THE STRUGGLE FOR BROADBAND IN RURAL AMERICA

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JEL Classifications: L96, R11, R58
Keywords: Broadband, Digital Divide, Economic Development, Infrastructure, Rural Development

"Policy in touch with today's rural America would focus on issues related to efficiency and new competitive advantages, as well as equity and public goods. It would be place—rather than sector—based. It would support investment in human capital, entrepreneurship, risk taking, and advanced communications infrastructure".
(Salant and Stauber, *Choices*, 17(4), 2002)

Rural America stands to be left behind much of the developed world without substantial investments in advanced telecommunications infrastructure. Communities require core infrastructure to attract and retain firms and to meet the needs of local businesses and entrepreneurs. Today, communities should consider robust and affordable Internet access a critical component of core infrastructure along with more traditional elements of water, sewer, power, transportation networks, and educational services. The rapid pace of technological change and globalization has forever changed the necessary infrastructure requirements for businesses and individuals to stay competitive. Competitive businesses and productive people increasingly need access to the most up-to-date, high-speed telecommunications networks to ensure on-demand access to suppliers, customers, branch plants, and others. As a result, communities and businesses without the most up-to-date advanced telecommunications infrastructure will likely suffer economically and socially. Improving the supply of, and demand for, broadband Internet access in rural America is crucial for future economic development opportunities. This article highlights some of the main issues concerning current and future investments in advanced telecommunications infrastructure; emphasizing the geographic and socio-economic digital divide, the benefits of rural broadband, and policy options for improving both the supply of and demand for broadband technology.

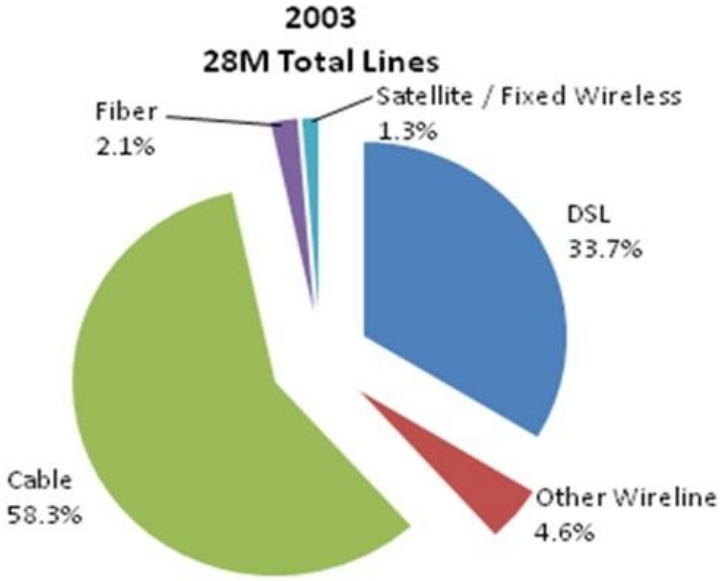
"Broadband" refers to high-speed data transmission over the Internet. It is important to differentiate between broadband "access," or supply, and broadband "adoption," which is one measure of demand. The Federal Communications Commission (FCC) has historically defined broadband access as providing 200 kilobits per second (kbps) of data transmission; roughly four times faster than older, dial-up connections. However, the desire for higher standards was recently acknowledged by the FCC which now defines "basic broadband" as 768 kbps, and also defines faster tiers ranging up to 100 megabytes per second (mbps) (FCC, 2008). Figures 1 and 2 display the different types of technologies that make up all U.S. broadband connections as of 2003 and 2008. While cable connections and Digital Subscriber Lines (DSL—provided by phone companies) are still dominant sources, mobile wireless connections have dramatically increased over this five-year period; in fact, they were not even measured in 2003. The total number of U.S. connections increased 260% from 2003 to 2008; from 28 million lines to over 102 million lines. This significant increase in the supply of broadband connections underscores the increasing importance of broadband in American lives.

A Digital Divide?

While the latest survey data suggest over 63% of the general U.S. population has a broadband connection at home, there are substantial state and regional broadband gaps across America (NTIA, 2010). High speed broadband availability is nearly universal across most American cities' and suburbs, but the evidence of regional and demographic digital divides persists. While traditional telecommunications providers uphold that they have expanded nationwide broadband coverage five-fold from 2001 to 2006 (Stoel and Ernst, 2008), the

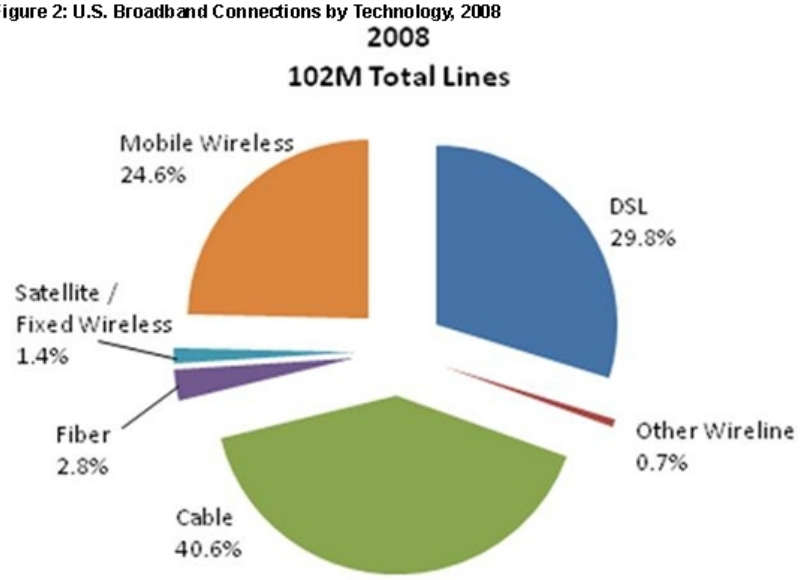
gap in broadband adoption rates between rural and urban areas has continued since the early 2000s. Table 1 illustrates the dramatic increase in household broadband adoption from 2001 to 2009 (Economics and Statistics Administration, 2010). It also confirms a sizeable difference in rural/urban broadband uptake. Table 1 illustrates only slight variation in regional differences of broadband adoption rates.

Figure 1: .S. Broadband Connections by Technology, 2003



Source: High-Speed Services for Internet Access: Status as of December 31, 2003. FCC: Industry Analysis and Technology Division, Wireline Competition Bureau. June 2004.

Figure 2: U.S. Broadband Connections by Technology, 2008



Source: High-Speed Services for Internet Access: Status as of December 31, 2008. FCC: Industry Analysis and Technology Division, Wireline Competition Bureau. February, 2010.

However, Table 2 provides evidence of a much wider variation among individual states (Economics and Statistics Administration, 2010). This table illustrates the 10 states with the highest average household

broadband usage and the 10 with the lowest. The percent of average home broadband usage ranges from a low of 45% in Mississippi to a high of 73% in Utah. It is worth noting that most of the states with low adoption rates are relatively more rural.

Table 1

Broadband Internet Adoption Rates by Region and Urban and Rural Location, 2001 and 2009

	2001	2009
All Households	9.2	63.5
Region		
Northeast	11.3	67
Midwest	7.2	62.2
South	7.9	60
West	11.7	68
Urban/Rural		
Urban	10.5	65.9
Rural	3.8	51

Source: U.S. Census Bureau, Current Population Survey (CPS) and CPS School Enrollment and Internet Use Supplement, October 2009, CPS and CPS Computer And Internet Use Supplement, September 2001, and ESA calculations.

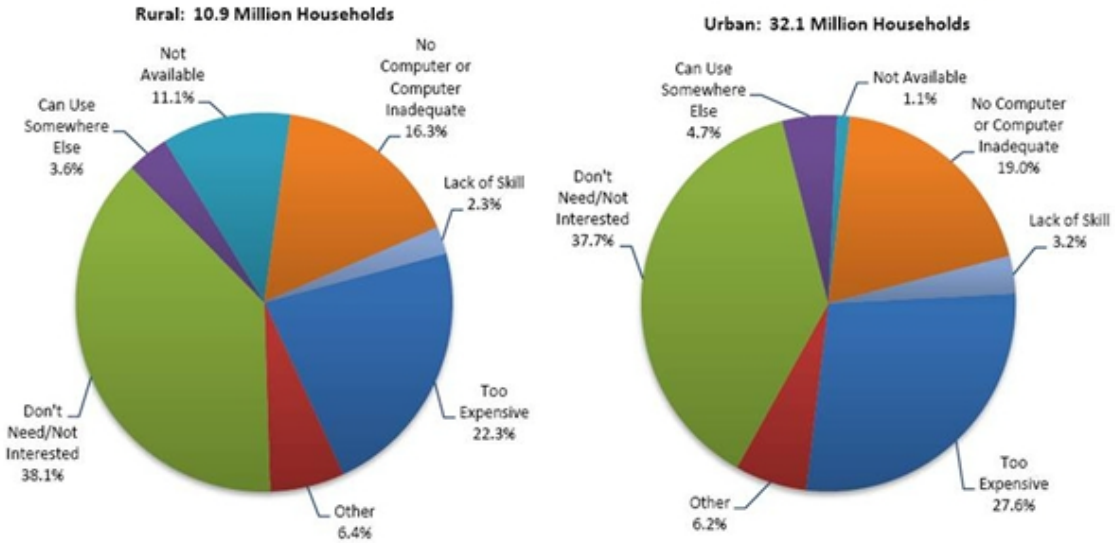
Table 2

Top and Bottom Ten States Ranked by Broadband Internet Adoption, 2009

Top Ten States		Lowest Ten States	
States	Percent	States	Percent
Utah	73	Mississippi	42
New Hampshire	73	Alabama	48
Alaska	73	Arkansas	51
Massachussetts	73	West Virginia	52
New Jersey	72	South Carolina	53
Washington	72	Kentucky	54
Connnecticut	71	New Mexico	55
Oregon	70	Tennessee	55
Hawaii	70	Oklahoma	56
Maryland	70	Indiana	56

Source: U.S. Census Bureau, Current Population Survey (CPS) and CPS School Enrollment and Internet Use Supplement, October 2009.

Figure 3: Main Reason for No Broadband Internet Use at Home, by Rural/Urban Residence, 2009



Source: National Telecommunications and Information Administration, 2010

The national average rural-urban gap in broadband adoption rates is measured at 12 percentage points in 2009 (Table 1). Sometimes referred to as a rural-urban “digital divide,” the gap is likely due to many reasons, including lack of available infrastructure, cost, lack of a computer, or simply absence of perceived need for broadband access. Surprisingly, even among rural areas, not having available broadband service ranks only

fourth on the most recent list of reasons why households choose not to adopt (Figure 3). The number one reason, by far, is a lack of perceived need for broadband access. It is uncertain whether these perceptions would change as a result of educational programs designed to clarify the benefits of broadband. However, if these perceptions are due to a lack of information on the part of rural residents and/or businesses, as opposed to lifestyle or preference issues, rural education programs could conceivably produce important benefits for these communities. Such programs could entail demonstrating the benefits of agricultural-oriented websites to farm households, promoting Internet sales as a way to capture larger markets for rural businesses, or introducing community websites as a way to stay connected locally.

Another commonly cited reason for lack of broadband access among rural households is price. Recent research suggests that competition among broadband providers can vary greatly from state to state, but approximately half the states are characterized by duopolistic, (two dominant providers) rather than truly competitive markets (Elliott and Settles, 2010). Improving competition among providers should lead to lower prices and higher reliability, positively impacting adoption rates in rural areas.

While lack of availability only comes in fourth as the main reason rural households do not adopt broadband, this reason still rates significantly higher than in urban areas. And, for some especially difficult-to-reach areas, availability is certainly a more pronounced issue. This means that closing the rural-urban broadband digital divide will continue to rely heavily on strategies to develop infrastructure in these areas.

In order to more clearly understand the extent and status of the digital divide, several states have begun to collect their own data on statewide broadband access and diffusion. Twenty states now have some sort of state broadband task force, commission, or advisory board (National Conference of State Legislatures, http://www.ncsl.org). California's Broadband Task Force, Connect Kentucky, and E-NC (North Carolina) are examples of state-level organizations actively involved in increasing their states' understanding of which regions have access to broadband, what types of services are available, and at what price. California's task force found that in the northern, rural Sierra region of the state, only 57% of households had access to broadband service. They also found that approximately 2000 communities did not have any broadband service availability across the state (The California Broadband Task force, 2008). A 2008 analysis of Connect Kentucky's data indicated that over 85% of households in most areas of the state have broadband access (Renkow, 2008). A recent message from Connect Kentucky's executive director argues that Kentucky's broadband availability has increased from 60% to 95% of all residents (ConnectKentucky, 2007). However, their own 2007 residential survey indicates that 73 Kentucky counties have below or significantly below average access to broadband at home (ConnectKentucky, 2007). Population density and other geographic drivers appear to be the primary deterrents to broadband infrastructure investments in rural communities across America. If education and income levels do not make up for the penalty of distance, existing telecommunications providers often do not find it profitable to provide advanced services to lower density populations without additional subsidy.

Benefits of Rural Broadband

Why should communities across the nation care about this ongoing digital divide? Substantial research documents the positive economic and social benefits derived from access to high quality broadband service. For example, Stenberg et al. (2009) provide examples for enhanced community interactions, telemedicine, distance education, and telework when discussing the relationship between rural area development and broadband. For rural businesses, broadband enables both cost savings and increased revenue potential. Cost savings come through such things as increased worker productivity, reduced marketing costs, and access to a more robust supplier network. Increased revenues are generated through access to larger and potentially global markets, better exposure to marketing channels, more efficient customer relations, and the ability to make secure transactions virtually anytime the purchaser desires (Barkley, Markley, and Lamie, 2007).

In the health care arena, broadband technologies represent critical cost-saving and health care enhancing services for rural communities. Telemedicine applications rely on high speed, high quality telecommunications networks to provide rural communities with "virtual" access to urban health centers and their related medical specialists and services. One recent review of 10 different studies on the potential benefits of telemedicine services with heart failure patients found significant cost savings for the consumer as well as hospitals and physicians (Seto, 2008). Similarly, Whitacre et al. (2009) documented annual community-level savings of nearly $500,000 to rural communities who participated in telemedicine. The FCC has recognized the potential benefits of telemedicine services and recently provided $417 million to the Rural Health Care Pilot Program, which

encourages the development and use of broadband networking services by rural health care providers.

Government and educational services are other potential areas for rural communities to effectively leverage broadband infrastructure investments. E-government services have the potential to streamline local government management and service provision, enhance customer service, improve community information, increase civic participation, and reduce government costs. Broadband networks allow for improvements in public safety, transportation networks, and public utility service and delivery. There are also potential benefits for citizens as they spend less time dealing with government bureaucracy and feel more informed about their community. Broadband service of some kind is almost universally available to American public school students. As a result, there is tremendous potential to leverage broadband technology for the enhanced delivery of adult education and college-level courses in public school systems across rural communities. Superior educational and job training resources also have the potential to improve rural labor resources and thereby enhance rural economic development prospects.

Rural consumers can also derive important benefits from improved access to information and goods and services not readily available in their local community. Atkinson (2007) argued that nationwide broadband access will generate “network effects,” whereby the benefits of broadband multiply with additional customer and business use. A nationwide study by researchers at the Massachusetts Institute of Technology and Carnegie Mellon Institute (Gillett et al., 2006) provided estimates of the economic impact of broadband deployment at the zip code level. Even while controlling for other factors affecting economic growth, they concluded that broadband deployment has a significant impact on local economies. Similarly, Kolko (2010) concludes that there is a positive relationship between broadband expansion and economic growth.

The corollary of this research implies there are potential negative consequences for communities lacking adequate access to broadband infrastructure. In today’s economy many firms consider broadband a critical input into the production process. Some firms, like call centers and customer support firms, are completely dependent on this infrastructure for the effective operation of their business. As a result, firms may not locate in rural areas without proper broadband access or may relocate out of these rural communities as they grow and demand access to better service. Without access to high-speed, high-bandwidth Internet service, rural communities already suffering from the economic effects of industrial restructuring and the current economic crisis may continue to find their communities increasingly less competitive. This situation creates a vicious cycle that serves to widen the rural-urban digital divide.

Overall, it appears that access and diffusion of high quality, high speed broadband networks is a critical economic and community development tool for all communities in the twenty-first century. The question is how to ensure that the rural-urban digital divide does not widen and that all communities, if they choose, can have up-to-date access to this technology, a choice of service providers, and the ability to effectively use broadband service.

What to Do?

A recent report by the Berkman Center for Internet and Society at Harvard University (2009) upholds that nations, states, and localities must have access to ubiquitous, seamless, high-capacity telecommunications networks to meet the needs of a global, technologically advanced society. Ubiquitous and seamless connectivity refers to having high speed networks that are always on and able to connect with anyone, anywhere, anytime. The definition of high speed varies, but generally refers to the ability to effectively handle “next generation” technology applications. Most developed nations have set specific technology goals to meet current and future delivery and service options of universal service. In any description of U.S. universal service, better deployment of technology, greater access to different technology choices, and higher rates of consumer and business adoption would all be critical goals for rural communities. However, one of the ongoing public policy questions is whether universal service means 100% access or if there is some cut-off point where subsidies no longer make economic sense. What is clear is that if advanced telecommunications is a prerequisite to national, state, and local economic and community development, then broad policy measures will be necessary to achieve the appropriate level of telecommunications access and service.

A key question is how do rural decision makers ensure these services are organized and delivered to their constituents? Unfortunately, the status quo system of broadband providers is unlikely to offer service to the most rural communities or enhance existing service in already underserved rural areas. Current suppliers operate under a complex array of government regulations, subsidies, and market protection, which provide little incentive for these firms to alter the status quo structure. Furthermore, incumbent firms are profit motivated and

are therefore reluctant to deploy infrastructure and provide service in areas that do not meet specific, identified expectations for revenue generation. If there are additional constraints, such as having a higher proportion of lower demanding elderly and low income populations, geographic barriers, or others, rural communities are even more unlikely to have or gain access to the most up-to-date broadband service. While some research has suggested the normal pattern of diffusion is leading to higher adoption rates in lower-income households, lower education households have not seen the same pattern (Whitacre, 2008a). The status quo system of broadband service and delivery has not resulted in comparable rural/urban access and/or adoption. Better understanding the reasons behind these differences and whether policy measures are necessary to improve rural broadband service is an important focus for future research.

In the current political climate, federal and state policymakers have a window of opportunity in which they can improve the technology status of rural businesses and consumers. The American Recovery and Reinvestment Act (ARRA) of 2009 provided $7.2 billion to raise levels of broadband infrastructure across the nation, with a particular focus on rural areas. From a policy perspective there are three primary targets in improving rural technology delivery and service:

1. Rural technology infrastructure deployment;
2. The provision of high quality telecommunications service; and
3. Improving rural consumer and business broadband subscription and use of service.

Focusing on these three target areas emphasizes both the supply of service through infrastructure deployment and service provision and the demand for service through improving broadband adoption rates.

Several areas of recent research focusing on supply side policies of infrastructure deployment and/or service deserve further consideration. The FCC's national broadband plan proposes reforming the Universal Service Fund—currently not designed to support broadband directly—into a funding mechanism to maximize broadband availability (FCC, 2010). Other options include strategies that work in conjunction with rural utilities, which can be important partners and/or leaders in the deployment of broadband infrastructure (Feld et al., 2005). Another critical component in determining funding should be the model of service delivery considered by the communities. Those with poor or no service have an opportunity to move away from traditional duopoly models of service towards models that emphasize a more competitive, open access approach (Berkman Center for Internet and Society, 2009). An open access model is one that builds out the infrastructure for a community but allows multiple competitors to simultaneously lease access to the network for service delivery. This model alleviates the necessity of waiting until providers see enough profit potential to build out the network and has the potential to bring more competition to rural communities, lowering prices and improving service provision.

The demand side of the broadband policy equation is equally important. If rural consumers and businesses do not subscribe or do not know how to effectively use the technology in place, the infrastructure investment is of little use. Land-grant university Extension programs can play a critical role in educating rural constituents about the potential benefits of broadband (Whitacre, 2008b). Funding for programs like the National e-Commerce Extension program could also be encouraged (Southern Rural Development Center, http://www.srdc.msstate.edu). In rural communities, schools, libraries, and community colleges may also be important assets for the diffusion of resource knowledge. Rural communities may also consider developing community spaces where broadband is easily accessible at little or no cost to the user, such as in a popular coffee shop or diner. In general, efforts that help rural communities build civic infrastructure around these technology issues will be important tools for overall community success.

Concluding Comments

As most research on the subject indicates, positive economic and social spillovers from broadband use in rural areas are likely. Additional work in quantifying the economic and social impacts of broadband adoption would be useful to shaping expectations of rural communities. However, it seems as though the broadband genie is clearly out of the bottle, meaning that rural areas must find the means, on their own or with outside support, to ensure that their communities have the access and service the future demands.

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NATIONAL E-COMMERCE EXTENSION INITIATIVE FOR RURAL ENTREPRENEURS

Shannon Lane
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As the role of technology has continued to evolve and shape the work conducted by land-grant university Extension faculty in rural America, Extension leaders have taken note of the well publicized digital divide between rural and urban areas. The digital divide primarily refers to the difference in broadband technology adoption. Currently, home adoption of broadband or high-speed Internet, in rural America lags urban by 20% (Pew Internet and American Life Project, 2010). But Extension leaders also recognized land-grant University Extension has a network that connects to rural America. Through the National Institute for Food and Agriculture (NIFA), a new direction was sought to utilize this network and connect rural America to educational curricula to encourage greater adoption of e-Commerce strategies. The new direction became the National e-Commerce Extension Initiative (NEEI) (Southern Rural Development Center, 2010).

NEEI's purpose is to connect rural America to educational curricula that demonstrate how business owners, governments, health providers and others can benefit from using broadband technology to gain access to global markets. Because a core of the Extension mission is community education and Extension's existing physical presence in most rural communities nationwide, adding the topic of technology adoption to Extension's outreach mission seemed like a natural fit. What was then critical to the expansion of a technology-based educational effort within the land-grant system was a coordinated program that would support Extension educators who could deliver the educational curriculum as well as play a role in the production of curriculum to expand the technological know-how of the communities served.

The addition of a focused effort on technology education is not only intended to increase personal computer skills but also to be a means for Extension to influence economic growth through the adoption of e-commerce strategies by local businesses leaders and organizations. In simple terms, e-commerce means electronic commerce, which is defined as the buying and selling of products or services over electronic systems such as the Internet (Chaudhury and Kuilboer, 2002). What is critical here is that the Internet allows rural businesses or organizations24-hour exposure to an always open and international marketplace. Further, because exchanges of goods and services are done completely electronically or with contracted mail providers, electronically based commerce removes the remoteness of rural location as a determinant for business growth. Thus, rural community education programs focused on the subject of technology are added in hopes that personal use of technology will increase along with the adoption of e-commerce strategies as a means to intensify economic development efforts.

Origins and Educational Curricula

The NEEI began through a 2003 grant from the Cooperative State Research, Education and Extension Service (CSREES) which is now NIFA. The Southern Rural Development Center (SRDC) at Mississippi State University received the grant. The NEEI functions under the guidance of an active and highly involved advisory board made up of known Extension specialists who have actively adopted e-commerce into their program offerings, have excelled in technological awareness, and thus are seen as key leaders in Extension on the subject. A bi-monthly newsletter, coupled with national training offerings, regional coordination of training efforts, and a schedule of presentations keep active engagement of the Extension community at the

Table 1

Some Curricula Available Through the National e-Commerce Extension Initiative (NEEI)

e-Commerce Curriculm	Author(s)/ Institution(s)	Website Address
Connecting Rural Communities	William Shuffstall, Pennsylvania State University; Rae Montgomery, University of Minnesota	http://srdc.msstate.edu/ecommerce/curricula/connecting_communities/
Strengthening Competitive Advantage of Rural Businesses with E-commerce and Experience Economy Strategies	Miyoung Jeong, Ann Marie Fiore, Cheryl O. Hausafus, Linda Niehm and Haemoon Oh, Iowa State University	http://srdc.msstate.edu/ecommerce/curricula/exp_economy/
Internet Strategies to Improve Farm Businesses Management	Sarah A. Roth and Jeffrey A. Hyde, Pennsylvania State University	http://srdc.msstate.edu/ecommerce/curricula/farm_mgmt/
Helping Artisans Reach Global Markets	Pamela J. Brown, Texas A&M University	http://srdc.msstate.edu/ecommerce/curricula/artisans/
Marketing Food Specialty Products Online	Stan Ernst and Neal H. Hooker, Ohio State University	http://srdc.msstate.edu/ecommerce/curricula/rural_retailing/
E-Commerce as a Strategy for Improving Business Vitality: Lessons Learned from Small Rural Businesses	David L. Barkley, Clemson University; Deborah Markley, RUPRI Center for Rural Entrepreneurship, University of Missouri-Columbia; R. David Lamie, Clemson University	http://srdc.msstate.edu/ecommerce/curricula/case_studies/
A Beginners Guide to e-Commerce	Kimball P. Marshall, Alcorn State University	http://srdc.msstate.edu/ecommerce/curricula/beginners_guide/
Electronic Retailing: Selling on the Internet Curriculum	Julie Sexton, Brian McCann, and Merrill Warkentin, Mississippi State University	http://srdc.msstate.edu/ecommerce/curricula/electronic_retailing/
Security Squad: Keeping Your Equipment and Information Safe	Marilyn Schlake, Connie Hancock, Diane Becker and Mark Hendricks with video production by Mike Kamm, University of Nebraska.	http://srdc.msstate.edu/ecommerce/curricula/security_concerns/
Going Global: A Guide for e-Commerce Expansion	Rae Montgomery, University of Minnesota	http://srdc.msstate.edu/ecommerce/curricula/global_expansion/
Web site Basics: A Primer for Hispanic Small Businesses	Brian Whitacre, Oklahoma State University	http://srdc.msstate.edu/ecommerce/curricula/hispanic_business/

Source: Southern Rural Development Center. (2010). The National e-Commerce Extension Initiative. Available at: http://srdc.msstate.edu/ecommerce/.

forefront. Additionally, a workshop-based mini-grants program is awarded to Extension educators who wish to host a workshop where one or several of NEEI's online learning products is spotlighted. Lastly, the NEEI seeks to maintain and expand upon partnerships with other land-grant Universities through the use of online curriculum, assistance with technologically based Extension programming, and advisement on how best to incorporate technological skill and e-commerce education into future statewide broadband adoption efforts.

Early in NEEI's inception the key goal was to build a pool of Extension professionals who understood the opportunity that technology education presented to rural communities in terms of economic development through the adoption of e-commerce strategies. Therefore, feedback was collected from Extension educators and specialists on which e-commerce educational topics would meet the needs of their clients and what types of programming support would best enhance their work plans with rural audiences on ways to successfully adopt technology. From these needs assessment efforts, not only were key topics indentified but it was determined that the NEEI would retain a goal of actively seeking to build the Extension communities' awareness as to their potential to facilitate needed technology-based educational efforts. Table 1 shows the different types of curricula available through NEEI.

These curricula also include the competitive advantages of using technology, further demonstrating how rural business owners can benefit from adoption. While *Internet Strategies to Improve Farm Business Management* provides an overview of how using broadband can benefit profitability in the operations of agricultural based businesses. Offered in both English and Spanish, *Web Site Basics: A Primer for Hispanics Small Businesses* gives both the bilingual entrepreneur and those seeking to reach Spanish speaking markets news ideas on web presences and marketing techniques. *Marketing Food Specialty Products Online* and *Helping Artisans Reach Global Markets* are also featured. Because teaching rural communities about the benefits of technology education is central to NEEI's mission, The *Connecting Rural Communities* curriculum shows communities an action plan to assess and better develop broadband infrastructure to increase rural connectivity and adoption of broadband specifically.

Connecting with Extension Faculty

The primary NEEI goal focused on engaging Extension to add technology to educational outreach efforts to encourage adoption of e-commerce strategies. This effort began by supervising an educational resource grants program. The competitive grants process is aimed at producing e-commerce related learning curricula for Extension adoption. To do this, the NEEI solicited and continues to solicit project proposals from land-grant University faculty who desire to develop a research agenda around topics of Extension interest related to e-commerce. The educational resource grant applicants have the additional task of identifying ways to create a curriculum from the research findings that allows for easy Extension facilitation

Table 2

National e-Commerce Extension Initiative Program Summary, 2010

Curriculum Name	State(s)	Number of Counties	Average County Population[1]	Average County Unemployment Rate[2]	Average County Poverty Rate[3]	Number of Participants[4]
A Beginners Guide to e-Commerce: Easy Tools for Profit	Alabama	1	80242	13.2*	19*	21
Helping Artisans Reach Global Markets	Tennessee	7	45004	8.9	11	128
Strengthening Competitive Advantage of Rural Businesses with e-Commerce and Experience Economy Strategies	Oklahoma, Michigan, and Missouri	17	35718	7	12	182

Sources:

[1] US Census Bureau (2009)

[2] U.S. Bureau of Labor Statistics (2009) (Mean Unemployment Rate for the United States 9.3)

[3] U.S. Census Bureau (2008) (Mean Poverty Rate for the United States 13.0)

[4] Reported by Funded Extension Facilitator

*Denotes Higher than National Mean

and meets the needs of audiences served by Extension educators and specialists. Educational materials, once developed, peer reviewed, and piloted to a targeted population are then edited, designed, and formatted into an online learning module format.

The resulting Internet based e-commerce learning curriculum is then made available for all interested learners to use on the NEEI web site. With its competitive educational resource grants program still ongoing, sixteen educational resource development projects have been funded that have thus far resulted in eleven online learning curricula as shown in Table 1 and one complete, customized curriculum evaluation tool. At present there are four other educational resource projects in various stages of development with three new online learning curricula scheduled for release in winter and spring of 2011.

One way of keeping the Extension community engaged is by publishing eNews, an SRDC produced bi-monthly newsletter, available at http://srdc.msstate.edu/ecommerce/enews. Further engagement occurs through the training of Extension personnel regarding what online learning modules the NEEI has to offer for Extension programs and how best to position e-commerce learning within current community educational offerings. To date, the NEEI has conducted national training sessions for Extension specialists and educators in 2006, 2007, and 2009.

To further the goal of the Extension communities' awareness of the potential for e-commerce adoption and what curriculum the NEEI has for Extension programs, the culmination of the 2009 NEEI's summer training workshop in Atlanta, Georgia was the creation of four regional teams of Extension educators to oversee increased regional exposure of online learning resources. To increase the likelihood of greater regional success, each identified e-commerce action team was awarded funding to make program resource presentations at existing Extension training workshops and conferences, develop their own regional training seminars for Extension educators, and allow educators to incorporate invited e-commerce experts into these offerings. As of fall 2010, all four teams of Extension educators and specialists were working to identify avenues for presenting NEEI resources and finalizing training plans that meet the needs of the Extension community within their slated regions.

The Role of Mini-Grants

The last Extension engagement programming effort in technological education aimed at e-commerce business strategy adoption of the NEEI is the workshop-based mini-grants program. The program provides

seed funding to Extension applicants and their community partners who have enough exposure to the online learning curricula to allow for an effective presentation of the materials. Applicants must show a clearly identified instance where e-commerce education is predicted to increase economic or operational activity within rural organizations, small businesses, or individual proprietorships. Delivered in either a face-to-face workshop or webinar format, these mini-grant funding efforts not only get the educational materials into communities that could benefit from specialized e-commerce learning but also create an internal method for evaluating the impacts of NEEI curriculum on e-commerce skill adoption and whether or not e-commerce strategies are being implemented into organizational goals. The evaluation of workshops offered by funded Extension personnel not only assist the NEEI in the ongoing identification of best e-commerce training and technology education practices, but also allow for needed specific curriculum updates and changes that further streamline Extension's adoption of these educational tools.

Since its inception in 2009, the mini-grants program has been responsible for funding ten multiple workshop efforts in various states throughout the Cooperative Extension System. Table 2 shows the adoption of the NEEI's e-Commerce curriculum across the U.S. as well as such community characteristics as average county population, unemployment and poverty rates. *A Beginner's Guide to e-Commerce* has been taught in Alabama. While *Helping Artisans Reach Global Markets* was showcased in seven counties in Tennessee. But the largest adopted NEEI curriculum for mini grant workshops has been *Strengthening Competitive Advantage of Rural Businesses with e-Commerce and Experience Economy Strategies* that has been taught to 182 entrepreneurs in rural communities in Oklahoma, Michigan, and Missouri.

The NEEI also coordinated an introductory Webinar to showcase the *Connecting Rural Communities* curriculum to an audience of Extension Professionals. Mini-grant Workshops are also currently scheduled for Kentucky, Mississippi, and Idaho. Idaho will be the first to offer e-commerce workshops for Hispanics.

Connecting to ARRA

As part of the American Recovery and Reinvestment Act (ARRA) of 2009, the National Telecommunications and Information Administration (NTIA), the U.S. Department of Agriculture and the Department of Commerce efforts have allocated $11.9 billion for broadband deployment and education. The purpose is to expand the availability of broadband access to those areas without hard-line based services. Incorporating educational offerings that follow this type of infrastructure expansion is viewed as a necessary component to increase the individual rural broadband adoption rates (LaRose et al., 2010). Under the direction of SRDC, the NEEI gained exposure as a resource for Extension based e-commerce and technological educational efforts in areas slated for broadband infrastructure expansion. Extension administrators applying for Broadband Technology Opportunities Program (BTOP) funding opportunities are being awarded based in part on the utilization of NEEI learning resources. Approved funding proposals further solidify the understanding that, as a result of remaining focused on the engagement of the Extension community, the National e-Commerce Extension Initiative has built a coalition of Extension Professionals who will occupy essential roles within national broadband adoption planning.

To date, there are three specific examples of how the educational resources developed by the NEEI educational resource grants program have proven to be instrumental in securing major BTOP funding. First, the SRDC and Mississippi State University Extension Service (MSUES) captured $2.4 million in funding to advance digital literacy in identified areas where high speed hard-line infrastructure will be developed within Mississippi. This will be done by fusing the educational materials of both the MSUES Department of Agricultural Communication and the NEEI in an effort to ensure all learning needs with regards to technology education are addressed. MSUES was a natural choice for advancing digital literacy programs since it had a strong and trusted community presence in those areas identified for broadband development within Mississippi.

Secondly, the University of Wisconsin Extension Service was also awarded a $2.4 million dollar grant to support education and outreach in an identified four community area and in the Menominee Indian Nation. Wisconsin Extension educators will be using several of the NEEI's online materials to support their "Sustainable Broadband Adoption Project." Professor Andy Lewis, project director of Extension's broadband effort in Wisconsin, recently cited several reasons why Wisconsin opted to base some of their educational efforts on the e-commerce learning resources offered. The two main points of his acknowledgment were that NEEI based resources are developed by some of the most knowledgeable people in the land-grant University system and that all educational materials have been peer reviewed by key Extension faculty.

Lastly, the LSU Agricultural Center's Delta Rural Development Center (DRDC) located in rural northeast Louisiana in Oak Grove will implement the *Connecting Rural Communities* curriculum from 2011-2015 as part of a rural broadband educational effort through the Louisiana Delta Initiative (Barnes, 2010). DRDC received a broadband awareness education grant from the Department of Information Technology within the Louisiana Division of Administration (LDA) to work in sixteen, high-poverty parishes. Several other states have also chosen to implement the NEEI curricula into their broadband educational outreach plans, including Pennsylvania, Minnesota, Nebraska, South Carolina, Oklahoma, and Tennessee.

Leadership Matters

From the onset, the key to success for the National e-Commerce Extension Initiative has been an active and available advisory board. Put in place in 2004, the advisory board is composed of Extension specialists representing all four regions of the country. Their role is determining the training needs of Extension associates that would best streamline the addition of technological and e-commerce education to current program offerings. This is done by the advisory board identifying research topic areas that can be developed into Extension learning curriculum which would be well received and easily facilitated by Extension educators. Therefore, the advisory board oversees the development of identified topics through an educational resource grant program. To this end, each advisory board member is called upon to review and make funding recommendations for all grant applications received both from the educational resource and mini-grant workshop applicants. Advisory board members are also highly effective in program promotion through various presentations and networking efforts.

Connecting to Rural America

Research to date has found that significant economic development benefits can accrue to communities when broadband infrastructure is improved. Katz and Suter (2009) found that employment increased in communities where broadband investments were made. Gillett, Lehr and Sibu (2006) found this same result in rural communities. But the challenge for educational initiatives is to provide enough public awareness about rural broadband benefits to encourage rural adoption. LaRose et al. (2010) provide some of the best evidence that educational initiatives, similar to the NEEI, do make a difference in how people understand the benefits of broadband in rural communities. Case study research results indicated that improved access to broadband infrastructure certainly can enhance the perceived benefits of broadband in rural communities and encourage rural adoption. More to the point, this research also suggests that educational initiatives that complement broadband infrastructure projects in the same area can have a greater impact on increased rural adoption. This is good news for the NEEI, and rural America.

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RURAL BROADBAND AVAILABILITY AND ADOPTION IN OKLAHOMA

Brian E. Whitacre
JEL Classifications: R22, D12
Keywords: Broadband Adoption, Rural Broadband Availability, Broadband Infrastructure, Broadband Digital Divide

Rural areas generally lag behind their urban counterparts in terms of broadband Internet access, a discrepancy commonly known as the "digital divide." Nationally, the divide was approximately 12 percentage points as of 2009, with 54% of rural households adopting broadband access compared to 66% in urban areas (NTIA, 2010). A large body of work has attempted to uncover the underlying causes of the divide, with the implication that shrinking the gap will positively benefit rural communities economically and socially (Strover, 2001; Malecki, 2003; Whitacre, 2010). The policy prescriptions resulting from this work have focused on one of two sides: supply—the availability of broadband infrastructure, such as cable Internet lines or Digital Subscriber Lines (DSL)—and demand—increasing adoption rates when broadband is available. In particular, the American Reinvestment and Recovery Act (ARRA) included funding both for broadband infrastructure grants/loans and for programs to encourage sustainable adoption.

This paper uses the state of Oklahoma as a case study in examining both the availability of broadband access and adoption rates in rural vs. urban areas in three distinct time periods: 2003, 2006, and 2009. As might be expected, wired broadband availability first clustered in urban areas across the state, but diffused rapidly over time and became nearly equal by 2009. Similarly, adoption rates increased dramatically across the state, and although a significant rural-urban gap still exists, it has noticeably decreased as infrastructure and Internet awareness becomes more prevalent in rural areas. The paper concludes with a discussion of policy implications, noting that future efforts to close the rural-urban digital divide should emphasize demand-side policies rather than the traditional supply-side focus.

Supply Data

The federal government's primary source of data regarding broadband infrastructure is the Federal Communication Commission's Form 477. However, these data reveal where broadband subscribers currently exist and not necessarily where the infrastructure itself exists. Since Form 477 collects data from all providers of broadband access and asks them to report ZIP codes where they have customers, a single satellite subscriber in a rural area could give that ZIP code the illusion of having "wired" access. This is one reason why Form 477 indicated that as of December 2005, 99.9% of the most populated ZIP codes had broadband access, and even showed that 96.2% of the least-populated ZIP codes had broadband access. Thus, using this data source might suggest that there is little problem with broadband availability in rural America.

However, the noted issues with this data suggest that alternative sources should be used to attempt to map out the existence of broadband infrastructure. In particular, the two dominant sources of residential broadband infrastructure have been cable Internet and DSL, together making up over 80% of the residential market (FCC, 2009). Maps of the availability of cable Internet access are documented in Warren Publishing's annual *TV and Cable Factbook*, which lists every cable system in a state, denotes the communities served, and indicates whether or not cable Internet is offered. Similarly, the National Exchange Carrier Association Tariff #4 Dataset lists all telephone central offices in a state, the communities they serve, and whether or not they offer DSL access. These sources can be mapped to ZIP codes to document the existence of wired broadband infrastructure across a state. Data were collected from these sources in 2003, 2006, and 2009.

The use of ZIP codes is not a precise representation; no publicly available information exists on the exact locations passed by either cable Internet or DSL lines in Oklahoma. In particular, some large ZIP codes depicted as having access may not be fully served, particularly for the more rural portions. However, in the absence of service provider maps, the data used is the next-best alternative.

Figure 1 displays a map of the rural and urban ZIP codes in Oklahoma, taken from approximations to rural-urban commuting area (RUCA) codes provided by the U.S. Department of Agriculture's Economic Research Service. Codes 1-3 of this categorization are considered urban, while codes 4-10 are considered rural. Maps displaying the availability of broadband infrastructure in 2003, 2006, and 2009 are shown in Figures 2—4.

Figure 1: Rural and Urban ZIP Codes in Oklahoma

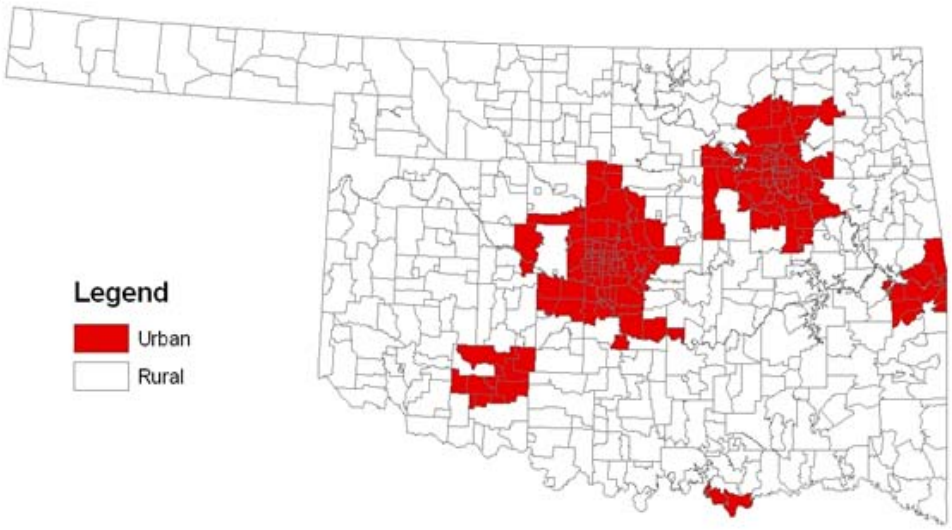
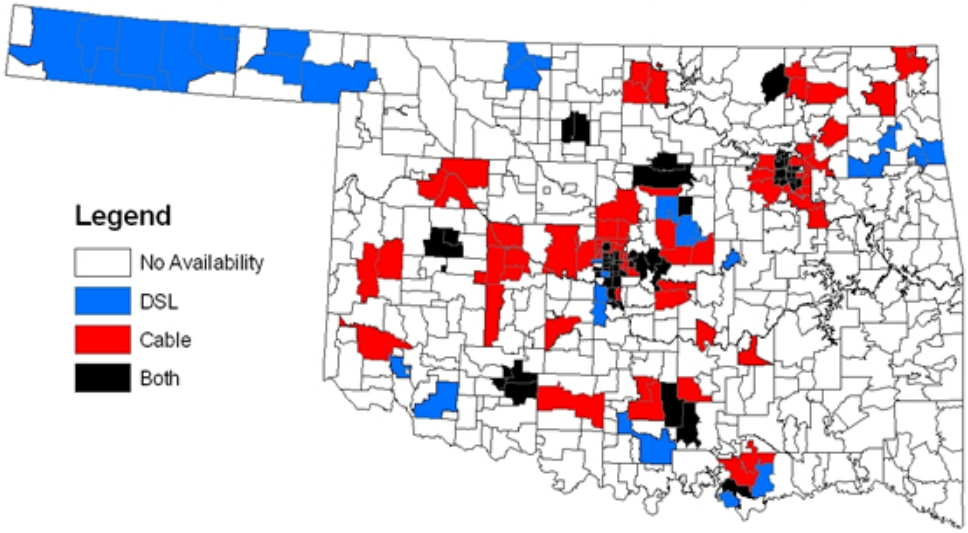


Figure 2: 2003 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)



As these figures indicate, the initial placement of broadband infrastructure by DSL and cable providers was focused on the more urban locations across the state. However, a notable exception is the western panhandle, which is extremely rural and yet was serviced by DSL in 2003. Broadband infrastructure diffused notably over the years and became much more available by 2009, although the heavily forested southeastern part of the state remains mostly unserved. Figure 5 shows the percentage of rural and urban

residents with broadband infrastructure available to them in each of the three years.

Clearly, urban residents had significantly higher levels of infrastructure availability in 2003. By 2006, however, the gap had shrunk significantly; and by 2009, availability was nearly equal. It is worth noting that the Oklahoma legislature passed a broadband parity bill in 2002, which was widely credited with increasing DSL deployment across the state. This bill ended the requirement for incumbent telephone providers to share their lines with competitors across the state, and the percentage of telephone central offices offering DSL increased dramatically: from 10% of all offices in 2003, to 21% in 2006, and to 66% by 2009.

Figure 3: 2006 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)

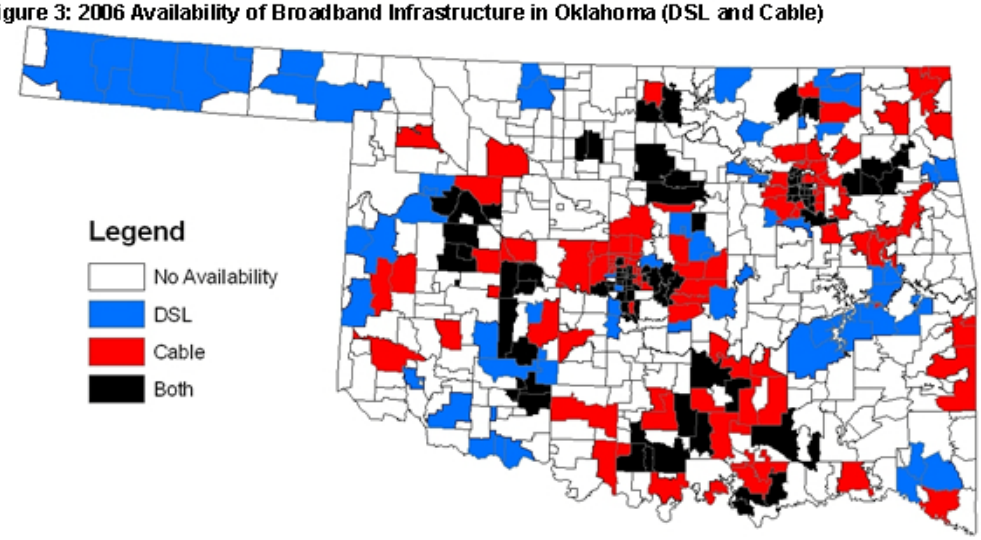
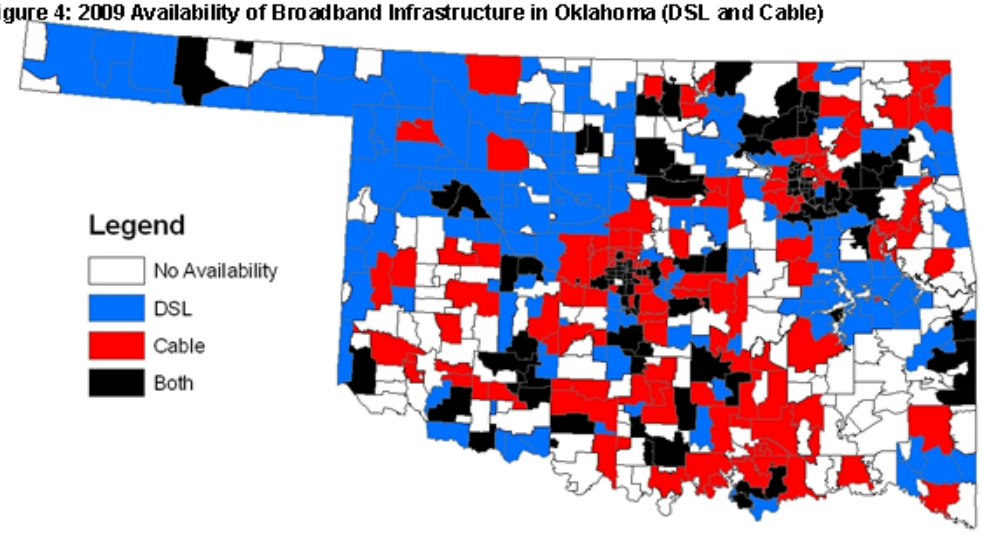


Figure 4: 2009 Availability of Broadband Infrastructure in Oklahoma (DSL and Cable)

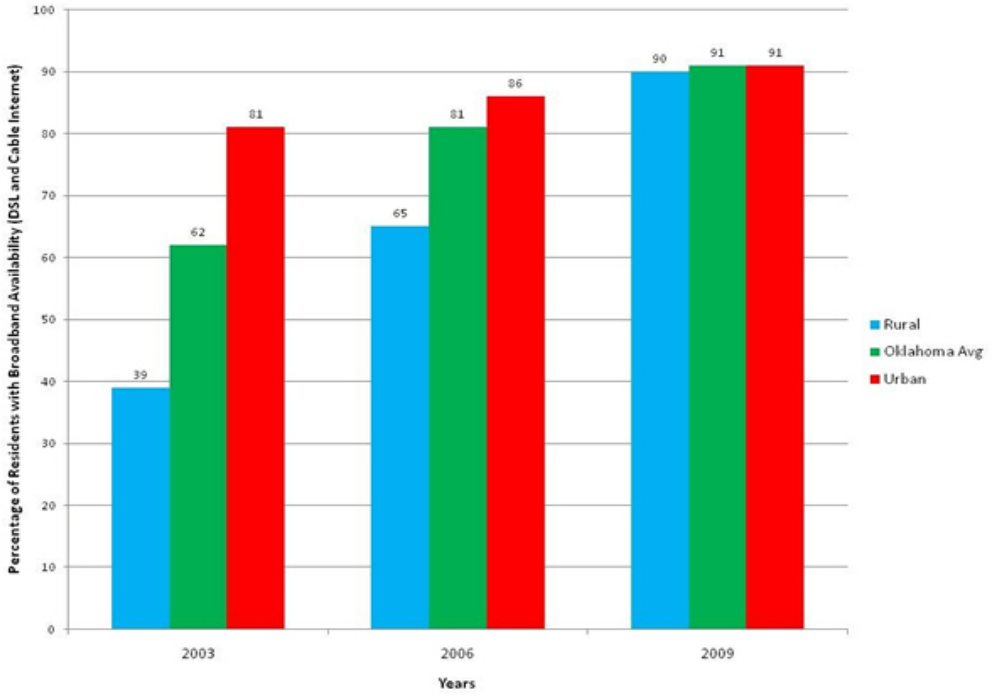


Demand Data

Data on levels of broadband adoption came from three distinct surveys. In 2003 and 2006, the Bureau for Social Research at Oklahoma State University conducted telephone interviews of approximately 1,200 households across the state. The households interviewed were not the same in both years, but were representative of the state when survey weights were applied. In 2009, the Current Population Survey

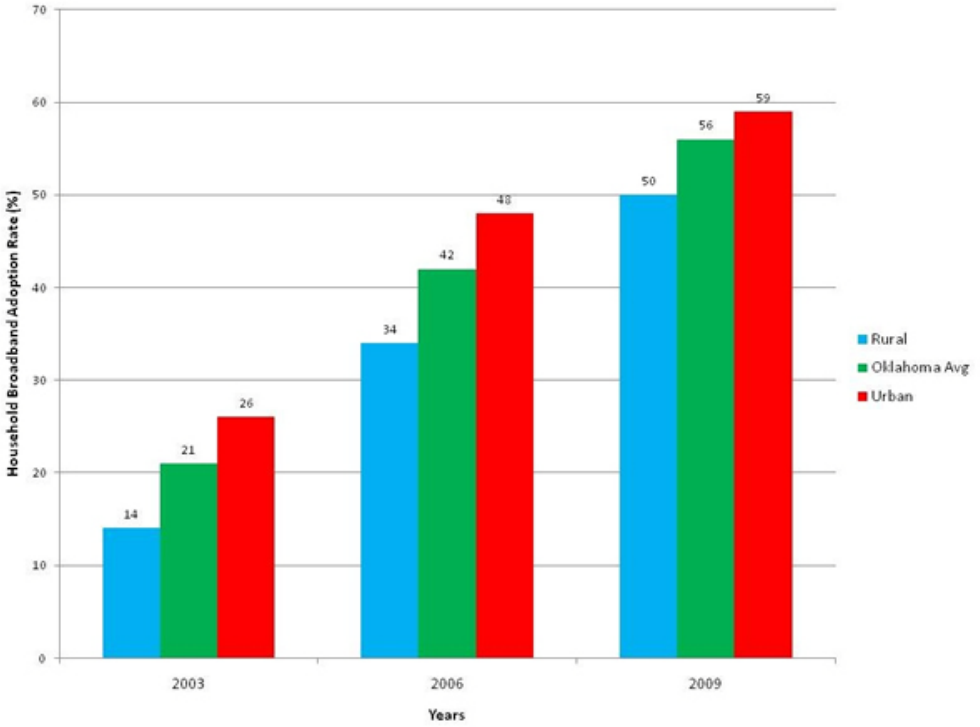
conducted a national level telephone survey regarding broadband adoption, and in doing so contacted 1,500 households in Oklahoma. Respondents were asked demographic questions in addition to inquiries into their use of broadband Internet from home. “Rural” households were determined by ZIP-code level RUCA approximations in 2003 and 2006, and traditional Office of Management and Budget definitions in 2009. Both definitions use the same cutoff point of population less than 50,000 for determining whether a location is rural, so the results are comparable. Figure 6 shows the rural, urban, and state averages for broadband adoption rates over the three years.

Figure 5: Percentage of Rural and Urban Oklahoma Residents with DSL or Cable Internet Availability, 2003 – 2009



The general pattern of increased adoption rates for the entire state speaks to both the increased availability of infrastructure and higher levels of awareness about the benefits of broadband access (Whitacre, 2010). While the rural-urban gap in adoption rates slightly increased between 2003 and 2006 from 12 percentage points to 14 percentage points, it shrunk to 9 percentage points in 2009. This is similar to what has occurred nationwide, with the rural-urban broadband digital divide decreasing from 15 percentage points in 2007 to 12 percentage points in 2009 (NTIA, 2010). Another interesting point from the NTIA report is the decreased reliance on dial-up Internet access in both rural and urban areas. Nationally, use of dial-up Internet service was cut in half over the period 2007-2009—from 19% to 9% for rural areas and from 9% to 4% for urban centers .

Figure 6: Household Broadband Adoption Rates for Rural and Urban Oklahoma Residents, 2003 - 2009



Policy Implications

Both the maps of infrastructure availability and the household adoption data suggest that broadband access is increasing in popularity across Oklahoma. While a significant rural-urban digital divide remains, it decreased over the period 2006-2009. Assuming that policy makers have a goal of increasing broadband adoption rates in rural areas, what are the best steps forward?

To date, most federal policies dealing with rural broadband have focused on the supply side of the picture. In particular, Community Connect grants and rural broadband loans from the U.S. Department of Agriculture have funded new broadband infrastructure in rural and underserved areas, providing over $1.5B in funding since 2002 to projects impacting more than 1,500 communities. However, the vast majority of broadband infrastructure investments was made by private companies providing cable and phone service, and resulted from their own response to market conditions. Since 2002 the state of Oklahoma has received numerous federal grants related to broadband infrastructure. Twenty Community Connect grants are on record; but nearly all of these were for wireless systems associated with relatively small numbers of recipients. Most rural Oklahomans received infrastructure improvements as a result of their cable or phone companies' investments.

More recently, the American Reinvestment and Recovery Act (ARRA) included approximately $7.2B for rural broadband efforts, and again focused mostly on the provision of infrastructure. This funding was split between the Rural Utilities Service ($2.5B) and the National Telecommunications and Information Technology ($4.7B). $350 million was included in the NTIA funding to develop and maintain comprehensive maps of existing broadband service capability and availability. These maps should be constructed at a lower level of detail than the ZIP-code level maps created in this article, and should help with future allocation of infrastructure funding by showing exactly where such infrastructure is lacking. The ARRA funding included some explicit demand-side programs, such as the $250 million allocated to the NTIA to encourage sustainable adoption. This represents less than 3.5% of the total broadband-related funding included in the act. A review of the available empirical evidence, however, implies that prioritizing supply-side funding is misguided.

Most academic research on the topic suggests that policies seeking to raise rural broadband adoption rates should focus primarily on the demand component. When asked why they did not have broadband access from home, the dominant response for rural households was “Don’t need/not interested” (NTIA, 2010). “Not available” ranked as #4 on the list of reasons, behind “too expensive” and “no computer.” Introducing rural individuals to broadband access and demonstrating why it is useful for them will likely have the largest impact on broadband adoption rates in rural areas. At least two recent papers have focused on existing demand-side programs and discuss many potential solutions, including subsidizing access and digital literacy programs (Hauge and Prieger, 2009; Atkinson, 2009). Hauge and Prieger (2009) also point out the need for rigorous program evaluation, since most efforts fail to compare their results to a counterfactual—what would have happened in absence of the program. This is particularly important as knowledge about broadband continues to diffuse to the general population, regardless of whether or not a demand-side program is in place.

Of some concern to rural advocates is the recent goal set by the FCC of “100 Squared”—100 million homes using 100 megabits per second (Mbps) service by the year 2020 (Genachowski, 2010). This goal is part of the National Broadband Plan developed by the FCC. The current average U.S. broadband speed is only 3.9 Mbps. While not a formal policy with any funding behind it, this goal nevertheless indirectly suggests that a disparity in the speed of service provided is acceptable. If driven by market conditions, as the initial broadband roll-out was, there is little doubt that the 100 million homes served would primarily be found in urban areas. By pushing for only 100 million homes and not ubiquity, the FCC is essentially encouraging a next-generation digital divide where rural areas cannot accomplish the same online tasks as their urban counterparts.

Education to Improve Rural Broadband Adoption

Since most Extension faculty at land-grant universities across the nation interact with rural constituents, they and others can play a significant role in encouraging rural broadband adoption. For example, many farm assistance programs offer courses on QuickBooks or other financial programs. These could easily be extended to how to use the Internet to do simple tasks like using eForms to complete and submit a Farm Service Agency program form, monitor prices on their products, or order inputs. Those involved in health education can show residents what trusted sources of medical information are out there, and discuss best practices in using the information. This would include using online information in conjunction with, not as a substitute for, a visit to the doctor. Videos discussing impending medical procedures can be particularly useful. Similarly, individuals involved in rural development often interact with small business owners who can benefit from courses on basic website setup or selling their product using online retailers. Many programs have already been developed under the Southern Rural Development Center’s e-commerce curricula, discussed elsewhere in this issue, and are ready for implementation. Regardless of the program, the focus should be on demonstrating to a rural resident why they should make the investment in broadband—what is the benefit to them?

In Oklahoma, Extension personnel have implemented an extensive e-commerce curricula focusing primarily on small business owners. Individual workshops are hands-on in nature, typically performed in a computer lab with broadband connections. A multitude of concepts are demonstrated that small business owners might find useful, from planning and actually building a website to search engine optimization and incorporating social networks into a business plan. Other workshops promote general knowledge about the benefits of broadband, such as “social networking for everyday people” which attracts retirees wanting to learn about Facebook, provides examples of how Twitter can be used professionally, and demonstrates how Internet forums can connect people with shared interests. Future plans include taking Hauge and Prieger’s suggestion to heart, and performing detailed program evaluation that demonstrates the benefits provided to the rural communities engaged.

Ultimately, improving broadband access rates in rural America requires that broadband infrastructure be available, and that the benefits to rural citizens exceed their costs. Data from Oklahoma suggest that the availability of two dominant sources of broadband infrastructure has made dramatic improvements during the 2000s, and rural availability rates are now similar to those in urban areas. Future supply-side policies will likely be required to address individual cases of neglected communities, aided by availability maps that are created on the census block level. More important, however, are demand-side policies that encourage adoption. While debates will likely continue over the best programs to influence adoption—including increased competition, subsidized access, or computers—land-grant faculty and others can play a role by

disseminating knowledge about the benefits of broadband in the context of their current programs.

For More Information

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