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

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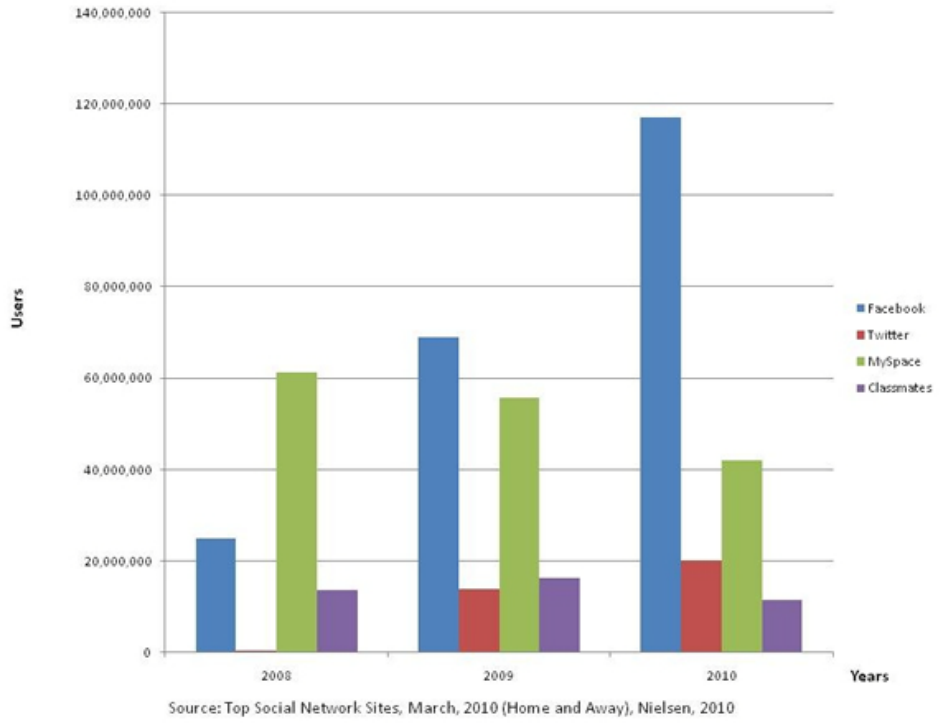
The global knowledge economy continues to grow exponentially as the Internet changes our global culture of education, research, business, and family life. Today the Internet digitally connects people and communities through innovations from Facebook, Twitter, Skype, Wordpress, Google, and YouTube, among 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

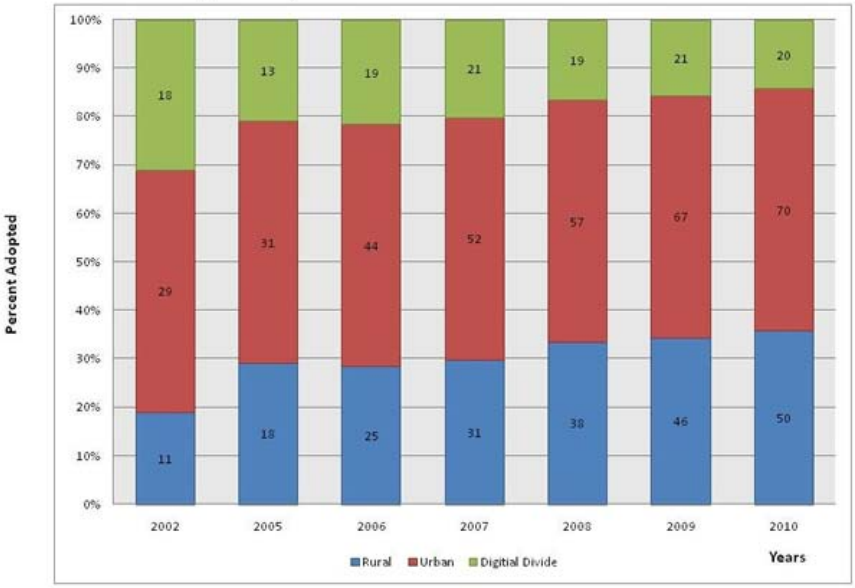
In a global report that measured actual download network speeds per 100 inhabitants across cable, DSL, and fiber, the United States ranked sixth (5.1 mpbs) compared to South Korea (20.4), Japan (15.8), Sweden (12.8), and the Netherlands (11.0) (Communication Workers of America, 2009). On average, the 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.

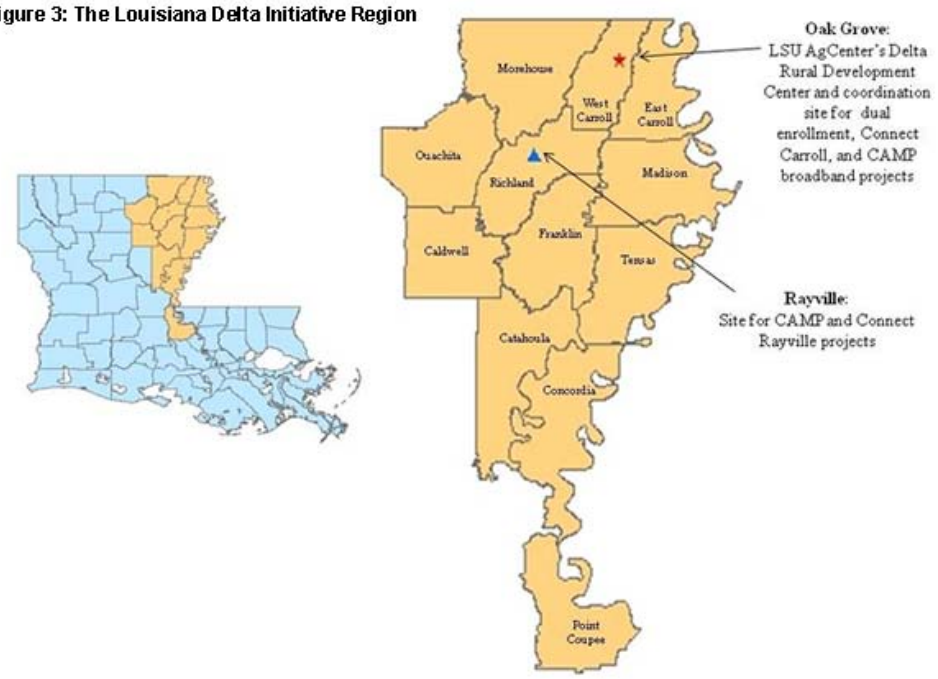
The Louisiana Delta Initiative Case Study

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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