Going Digital in Rural America

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Mark Drabenstott has identified five challenges that "will be critical in shaping the rural economic outlook: tapping digital technology, encouraging entrepreneurs, leveraging the new agriculture, improving human capital, and sustaining the rural environment" (Drabenstott 2001, p. 4). At least three of the challenges are closely connected to "going digital": technology, entrepreneurship, and human capital.

In the face of these challenges, rural America looks into the future and sees promise and peril. Among the signs of promise are the following:

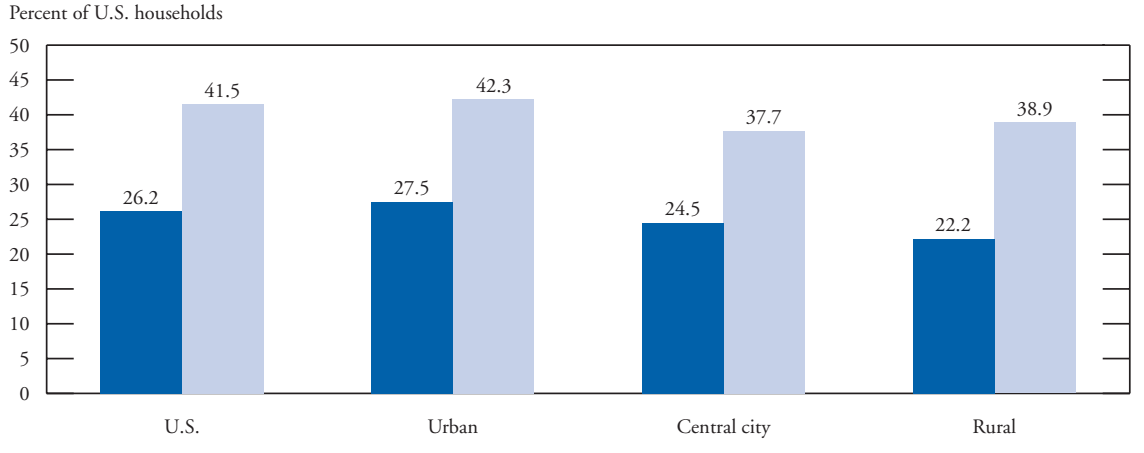
- Flexible manufacturing and smaller plants provide greater possibilities for rural firms against giant competitors.
- Telecommunications technologies and the Internet erase the tyranny of space and distance.
- Continuing population growth in rural areas, both from new migrants attracted by rural amenities and by return migrants, promises a needed upgrade of skills for the new economy.

At the same time, prosperity is not assured.

- Rural residents should not be taken in by the promise of the most recent technology, because newer ones will continue to appear in urban areas.
- Deregulation has diminished the likelihood of universal service for "advanced services," such as Internet access or broadband, in favor of letting "the market" determine what goes where.
- The apparent simplicity of the Internet as a tool for businesses to reach distant markets can cause business owners to neglect long-established "rules" of successful business.

These simple thoughts—pros and cons—provide few guidelines for rural residents or policymakers. More useful is the distinction made by Mikel Landabaso, whose perspective on the development of less-developed regions groups requirements for development into those that are necessary and those that are sufficient. The necessary conditions are basic physical infrastructure and human resources with a minimum level of training. The sufficient conditions are "intangibles" and comprise a much longer list: the ability of regional firms to innovate, the quality of management, a business culture which promotes entrepreneurship, an institutional framework which encourages interfirm and public-private cooperation, a dynamic tertiary sector providing business services and the transfer of technology, a minimum level of R&D capabilities, and financial instruments conducive to innovation and new economic activity (Landabaso, pp. 73-74). In short, telecommunications is not a magic bullet for rural economic development. This conclusion is not new: it has appeared repeatedly in analyses of rural telecommunications (Schmandt et al.1991; Parker et al.; Fox and Porca; Richardson and Gillespie).

Chart 1
PERCENT OF U.S. HOUSEHOLDS WITH INTERNET ACCESS, BY U.S., RURAL, URBAN, AND CENTRAL CITIES, 1998 AND 2000



Following a discussion of the basics—to what extent rural America is digital—the rest of my remarks are organized around two principal topics: supply and demand for "going digital." The supply aspects include issues of both infrastructure and policy. The demand aspects include entrepreneurs (business users) and others with the education and skills to take advantage of digital technologies. Much of the benefit of digital technology involves intangibles—not only products and services of an intangible nature and therefore easily traded via the Internet, but also social well-being and happiness that are enhanced by new modes of information and communication (Soete).

I leave out of this discussion distance education and telemedicine, because they are both in the realm of public services, and have proceeded on their own quite separately. They, along with the wiring of schools and hospitals to advanced services or broadband, have been supported by a number of policy initiatives. This is not without problems, however, as schools have not been able to keep up their investment in new technologies nor, more importantly, to provide access to every classroom (Stellin).

The Basics

Rural America is digital: communities are connected to the Internet (Chart 1). The 2000 report on the "digital divide," *Falling Through the Net*, documented the recent connection:

> Rural households, which historically trailed those in central cities and urban areas, are showing significant gains in Internet access. The gap between households in rural areas and households nationwide that access the Internet has recently narrowed. There was a 4.0 percentage point difference in 1998, narrowing to a 2.6 point difference in 2000. In rural areas this year, 38.9 percent of households had Internet access, an increase of 75 percent from 1998's access rate of 22.2 percent. In October 1997, just 14.8 percent of rural households had online access. Rural Black households, which have historically had the lowest rates of

> Internet access, made significant gains. In December 1998, 7.1 percent of those households had Internet access. By 2000, the figure jumped to 19.9 percent. The growth in rural Internet household access has come at all income levels, with the lowest levels showing some of the highest growth rates. As a result, the Internet access rates for rural households now approximate those of households across the country (NTIA).

Why are Americans going digital? More for social reasons than for economic ones. Indeed, e-commerce falls well down the list of uses of the Internet, which is led by e-mail (Duncan, p. 11). Indeed, e-mail has been the surprising "killer ap" (application) that has attracted Internet users since the early days of the network as the Defense Department's ARPANET (Abbate). However, most analyses and estimates of the magnitude of the Internet (e.g. Whinston et al.) ignore these intangible social benefits of the digital economy (Soete).

In large part because of the social benefits of e-mail but also because of the vast abundance of information at one's fingertips, Internet service providers (ISPs) are found nearly everywhere. According to the research of Shane Greenstein (and Downes and Greenstein), the supply of access approached geographic ubiquity because of distance-sensitive telephone pricing. Only 247 of the country's 3,100 counties have no ISP point of presence (POP) in that county or in neighboring counties. More than 92 percent of the U.S. population has access by a local phone call to seven or more ISPs. Most urban (metro) counties have ten or more ISPs. Probing more deeply into rural Internet connectivity, Strover (1999b) found that it is often only the large towns in rural counties that have toll-free dial-up access. In addition, Strover questions the long-term viability of many small ISPs, many of which are operated as side businesses or one of multiple income streams for a rural businessperson.

Greenstein concludes that "the debate over universal service shifted from supply to demand." While this statement may not prompt universal agreement, it does find support in data provided to Strover (1999b) by the Iowa Utilities Board: the costs of establishing Internet service warrant a subscriber base of at least about 200 households, and some small exchanges in the state are too small to yield an ISP penetration base of that size (Strover 1999, p. 7). Extended Local Calling (ELC) or Extended Area Service has been allowed in some states to enable households to connect outside their local calling area for a small monthly fee (e.g., $3.50 for households and $7 for businesses), allowing customers to access an ISP, or several ISPs, toll free. However, policies to permit this capability are not particularly widespread. Allen and Koffler found that only 5 of 13 Southern states had Expanded Area Services.

Strover (1999b, p. 10) concludes that "access is available but at an additional cost" in rural counties. In other words, demand for Internet service is held down in rural areas by higher costs. A second aspect of demand is that "rural citizens often lack the skills or knowledge to realize the importance of digital information and communication and…to assure digital infrastructure in their areas" (Strover 1999b, p. 11). An alternative feasible in some—but certainly not all—rural areas is to attract entrepreneurs wishing to relocate for quality-of-life reasons. These inmigrants typically have the networks and competencies to gain access to core markets (Richardson and Gillespie). Such freelance teleworkers tend to "have well-established market-contacts" (pp. 203-04). For knowledge workers, or "lone eagles and high fliers," their "choice of residential location is dictated only by access to the necessary communications capability" (Halsted).

Unfortunately, the optimism that struck many of us when Beyers and Lindahl announced the discovery of rural "lone eagles and high fliers" has not been so widely fulfilled. Little subsequent research has turned up clusters of mobile teleworkers (Beyers and Nelson). We know they are out there,

including prominent rural telecom experts such as Edwin Parker and Bruce Egan, but they are not present everywhere or in large numbers. So, until proven otherwise, let us assume that rural telecommunications will not be "saved" by lone eagles—and they were probably not going to save most communities anyway.

Supply of Digital Infrastructure

Not so long ago, within memory for many of us, for businesses and households alike, telecommunications networks used to be like electricity, water, and other utilities. Monopoly providers offered plain old telephone service (POTS). Fax machines, a major innovation for many businesses, continue to work on analog POTS networks. Less than a decade ago, Hack was able to note that telecommunications was absent from "every list of plant location factors that has been published in the last 20 years" (p. 71). By 1999, it was widely agreed that telecom infrastructure had risen to among the top five—if not the top three—criteria for locating a facility (Heath). Some studies even found telecommunications to be the leading factor in firms' location decisions (Lawless and Gore).

A great deal has changed. Not only has technology exploded the options available, so that computers, telephones, and portable devices are almost indistinguishable, but deregulation has permitted competitors to enter previously monopolistic markets. In this setting there is little agreement about what is needed to "go digital," at least in part because there is no publicly available database of present infrastructure. There is no federal requirement that firms disclose investment in or implementation of digital technology at individual locations within their systems (GAO and, even at the state level, aggregate firm-level data are considered to fall within the "trade secret" exemption to public records laws (North Carolina Utilities Commission, p. 7).

The importance of broadband

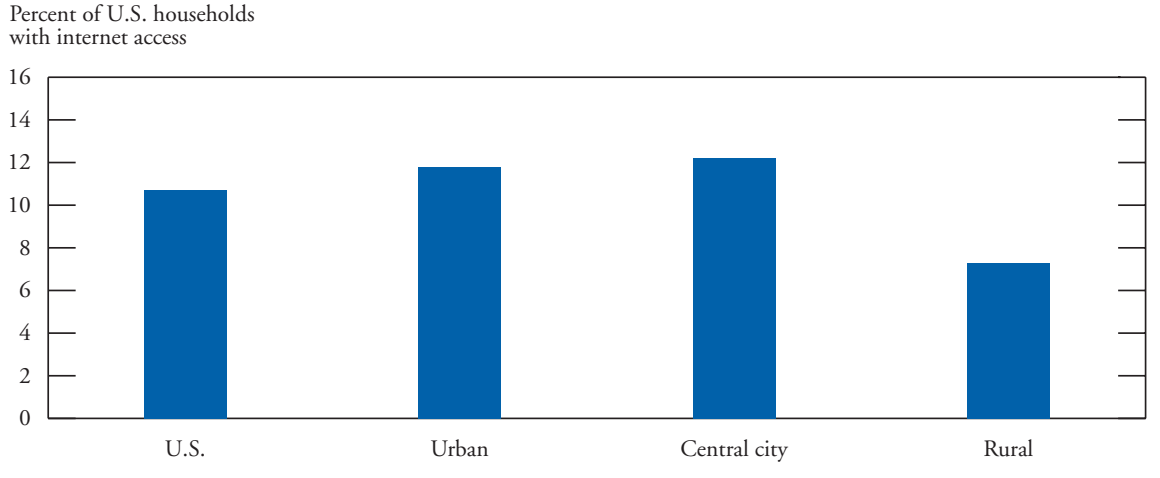
Broadband access is growing as an essential dimension of Internet use. Internet browsers and their graphics slow down considerably at dial-up speeds. Audio (music files, sound clips, as well as radio) and video (clips, video conferencing, and streaming video of live events, and movies on demand) are among the applications that can barely be imagined at dial-up speeds. These are not merely recreational uses of Internet technology. Businesses need to provide pictures of what they sell; video conferencing is an important way for telecommuters to be in other locations "virtually." The wonders of the Internet become real only at broadband speed.

Broadband, also called high-speed Internet access or advanced service, is defined as 200 megabits per second (Mbps) (or 200,000 bits per second) of data throughput. This is about four times faster than a 56Kbps dial-up modem, and about eight times faster than most people's actual download speeds, since many ISPs' modems offer a maximum of 28.8 Kbps (Strover 1999b).

It is in broadband technology where rural America is behind urban America. Rural areas generally are not receiving investment in digital subscriber line (DSL) or broadband cable technology. The 2000 Falling through the Net report (NTIA) found much less geographical uniformity in high-speed access. Broadband penetration differs by location: central city (12.2 percent) vs. urban (11.8 percent) vs. rural (7.3 percent) vs. U.S. (10.7 percent) (Chart 2). Data on the Regional Bell Operating Companies (RBOCs) indicates that more than 56 percent of all cities with populations above 100,000 had DSL available, but less than 5 percent of cities with populations less than 10,000 had DSL service (NTIA; USDA, p. ii). Satellite and wireless broadband service have potential, but are not yet widespread. Johnson summarizes the prospects of isolated rural communities:

Chart 2

HIGH SPEED INTERNET ACCESS BY U.S., RURAL, URBAN, AND CENTRAL CITIES, 2000, AS PERCENT OF U.S. HOUSEHOLDS WITH INTERNET ACCESS



These communities will have telecommunication infrastructure but it will typically be at least one generation behind that of urban and growing rural areas, and it will be more expensive (pp. 18-19).

Universal service

What is universal service? What should it be? The term brings to mind rural electrification and paved highways. Are these fair parallels? When roads were built to accommodate the automobile, cars themselves were not considered part of the infrastructure. Yet, rural Americans did buy cars—or, perhaps more frequently, pickup trucks—and new generations have learned to drive them.

The Internet evolved both from the telephone and from computers, and is perhaps more difficult to learn because the possibilities go far beyond telephones and television (Arnold and Guy). For those of us who lived through the era when using computers meant carrying stacks or even boxes of punch cards, the ease of use and consumer choice represented by the Internet is astonishing. We can learn, communicate, play games, research obscure information, form and cement friendships, shop, make reservations, transact business, consult distant experts, track current news, download government reports, check market prices, and follow public debates. Some of these can be done with telephones and televisions, but on the whole the Internet has opened up a world of readily available information, available 24/7 (all day, any time, any day).

To tap this fantastic array of digital riches, the traditional device (if two decades is long enough to call it traditional) is the personal computer (PC). It has advantages for Internet use, such as color screens, storage for files, and sound capability. Its alternatives, mobile phones, personal digital assistants (PDAs) and their hybrids, lack noticeably in screen and storage characteristics, but compensate by providing the freedom and mobility of the automobile:

no requirement of a fixed location. Mobile phones permit us to phone a person directly, rather than to phone a place in the hope that the person with whom we want to talk is there.

Rapid technological change, including new devices, and the convergence of telecommunications with computers and communication media have made it much more difficult for America to agree about universal service, which was established for voice communication. More importantly, deregulation at the federal level also has changed the context of telecommunications. It has become evident that different results appear when numerous private firms decide whether and where investments will be made from when public providers make those decisions. Early analyses of the Telecommunications Act of 1996 were cautiously optimistic that rural areas would not suffer (Stenberg et al.). Others are less optimistic if current trends continue (Parker).

Much of the problem of defining universal service today involves the far larger array of applications and services that are part of using the Internet. The Internet is much more than just an infrastructure, and the services needed by one user will not be the same as the services needed by others (Gillett). This complicates the issue greatly, much as we see in consumer markets, where customized marketing—if not customized production—is increasingly common (Seybold). Parker et al. suggest that universal service must be "a moving target" in the context of rapid change in both technology and the nature of the telecommunications industry. In the context of Internet use, Gillett suggests that "education and training in effective computer and Internet use is a critical component of any universal Internet service policy" (p. 149). Because users vary in their needs, the demand side is as important as the supply of infrastructure.

The Telecommunications Act of 1996 has several universal service directives:

> [They] are intended to promote the availability of quality services at just, reasonable, and affordable rates; increase access to advanced telecommunications services throughout the nation; advance the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas. In addition, the 1996 Act states that:…all schools, classrooms, health care providers, and libraries should, generally, have access to advanced telecommunications services (FCC).

The FCC continues to monitor, but not to mandate, the spread of advanced telecommunications to rural areas. Most importantly, businesses and households are not among the users that "should, generally, have access" to broadband. That class of users is restricted to schools, classrooms, health care providers, and libraries.

The status of rural telecommunications infrastructure

Disparities in Internet use are difficult to understand when one looks at a map of fiberoptic cables that crisscross the United States. Although a few places are missed, such as the Four Corners, much of Nevada, and parts of the Ozarks, many rural communities are on the railroad, highway, and pipeline rights-of-way that are the paths for the latest communications technology. As Parker suggests, all too often communities along fiber routes are treated as if they live under an Interstate freeway, but the nearest on-ramp is 100 miles away (p. 288). Even if a point of presence (POP) cannot be negotiated, due to insufficient local demand, they should be proactive to negotiate for "public benefit" fiber and rights of access to splice points along the route. At these splice points, or stubs, remote terminals for DSLAMs can be connected directly to the fiberoptic cable, negating the need for a POP. In urban areas, data traffic is routinely "aggregated" in this way; in rural areas, some threshold demand proba-

Table 1
URBAN AND RURAL POINTS OF PRESENCE OF FOUR TELECOMMUNICATIONS FIRMS, 2000

	Urban	Rural
Total POPs	1,395	316
POPs/million population	6.38	5.84
MSAs or communities with one or more POPs	264	224
Percentage of MSAs or communities with all three major IXCs	65.3%	7.6%

Source: Calculated from MapInfo Corporation's POPInfo dataset, dated May 1, 2000

bly must be met, but that threshold continues to drop as technology improves and smaller demand aggregations are economical.

The situation of rural America regarding points of presence is, like everything else in rural America, uneven. Rural areas have nearly their share of POPs, which are the "access ramps" to the Internet, switches where traffic is routed onto backbone links. While there is no comprehensive database of POPs, Table 1 reports the location of four nationwide carriers (AT&T, MCI, Sprint, and Cable & Wireless).[2] Cable & Wireless, a British firm and investor in the original transatlantic cables, has entered the U.S. market, but has its 35 POPs only in major metro areas, the smallest of which is Richmond, Virginia, just short of 1 million population in 1999. A similar strategy is seen in Williams Communications, only one of whose 118 POPs is outside of a metro area.

Generally, rural communities are lucky to have a POP, but few rural areas have access to multiple networks that provide the redundancy that ISPs and Internet-business firms demand so that downtime on their networks is less likely. There are 20 rural locations with three or more POPs, shown in Table 2, providing urban-scale network redundancy. An additional 44 towns have POPs of two different nationwide carriers.

POPs of the four firms are found in 264 of the 274 metro areas in the country, as well as in 224 rural communities. While this appears to suggest parity, as does the number of POPs per 1 million population, the clusters of rural POPs largely fall into two categories: university towns (e.g., Harrisonburg, Carbondale, Galesburg, Rolla) and state capitals (Helena and Jefferson City). Parker et al.'s examples of demand aggregation, Kearney, Nebraska, and Pullman, Washington, are both university towns (Parker et al.). The other pattern seen in Table 2 is concentrations in the vicinity of Washington, D.C., one of the world's largest Internet hubs.

The situation with regard to other telecommunications infrastructure is somewhat different. Packet gateway switches, an older technology to transmit data packets through the circuit-switched telephone network, also provide access to the Internet.[3] These are found in 86 rural locations in 13 states, largely in the Ameritech service area of the Midwest (Ohio, Michigan, Wisconsin, and Indiana).

Table 2
U.S. RURAL WIRE CENTERS WITH THREE OR MORE TELECOMMUNICATIONS POINTS OF PRESENCE (POPS)

Location	Number of POPs	Number of IXCs
Helena MT	4	3
Harrisonburg VA	4	3
Winchester VA	4	3
Bluefield WV	4	3
Clarksburg WV	4	3
Mason City IA	3	3
Coeur d'Alene ID	3	3
Carbondale IL	3	3
Galesburg IL	3	3
Quincy IL	3	3
Columbus IN	3	3
Richmond IN	3	3
Junction City KS	3	2
Madisonville KY	3	3
Jefferson City MO	3	3
Rolla MO	3	3
Grand Island NE	3	3
Chambersburg PA	3	3
Staunton VA	3	2
Wytheville VA	3	2

Source: Calculated from MapInfo Corporation's POPInfo dataset, dated May 1, 2000

Digital switches are recommended as a minimal infrastructure for business use, since they are needed for enhanced services typically used by businesses (Parker et al., p. 41). Digital switches are less an "access ramp" than an indication that the local telephone infrastructure has been upgraded for business use. Table 3 indicates that rural America is served unevenly by this technology, as it is by packet gateway switches (all of which are digital switches), and interexchange carrier POPs. Each of these indicators of rural telecommunications infrastructure is provided at levels below rural America's approximately 20 percent of the U.S. population. The relatively high availability of POPs—at 13.9 percent rural the highest rural availability of the three technologies—may be illusory as well. Relatively few rural cities (49) where POPs are located are also served by digital switches, which suggests that the POPs may be analog or voice-quality POPs that provide long-distance telephone access but do not serve as state-of-the-art broadband access ramps to Internet backbones. College towns—such as Manhattan, Kansas; Morgantown, West Virginia; Starkville, Mississippi; Salisbury, Maryland; Stillwater, Oklahoma; Indiana, Pennsylvania; and Blacksburg, Virginia—are among the rural places served by both digital switches and one or more POPs.

The rural areas of several states are well-served by digital switches. Nine states have ten or more rural wire centers with at least one digital switch (Table 4). At the other extreme, 14 states, mainly in the Mountain West and Northern Great Plains, had no rural digital switches in April 2000 (Table 5). Overall, the data presented here illustrate the tremendous variability among states: some are well-provided with technology infrastructure; others are not. The reasons are a combination of state regulation and service provider decisions.

Newer technologies

If fiberoptic cables are unlikely to reach every village and rural home, there is the promise of newer, wireless technologies, including multipoint multichannel distribution systems (MMDS), local multipoint distribution systems (LMDS), and broadband data satellite systems (NTIA; RUS, pp. 14-17). These technologies have their advocates. The National Rural Telecommunications Cooper-

Table 3
RURAL LOCATIONS OF DIGITAL SWITCHES, PACKET GATEWAY SWITCHES AND POPS, 2000

	U.S. total	Rural total	Percent rural
Wire centers with digital switches	2,598	321	12.4
Wire centers with packet gateway switches	784	86	11.0
Wire centers with POPs	1,610	224	13.9

Sources: Based on data in the Local Exchange Routing Guide, April 1, 2000, and in POPInfo, May 2000

Table 4
STATES WITH TEN OR MORE RURAL LOCATIONS SERVED BY DIGITAL SWITCHES, 2000

State	Number of digital switches
Tennessee	61
Ohio	50
Michigan	34
Wisconsin	21
Virginia	17
Pennsylvania	15
Oklahoma	13
Texas	11
Kentucky	10

Source: Based on data in the Local Exchange Routing Guide, April 1, 2000

Table 5
STATES WITH RURAL LOCATIONS NOT SERVED BY DIGITAL SWITCHES, 2000

State
Arizona
Colorado
Georgia
Iowa
Idaho
Minnesota
Montana
North Dakota
New Mexico
Nevada
South Dakota
Utah
Vermont
Wyoming

Source: Based on data in the Local Exchange Routing Guide, April 1, 2000

ative (NRTC), whose membership includes more than 1,000 rural utilities and affiliates in 46 states, has teamed with satellite providers (DirecPC and StarBand) to bring wireless broadband to rural communities (NRTC 2001).

The National Telephone Cooperative Association (NTCA), which calls itself "the voice of rural telecommunications," is a nonprofit association representing more than 500 small and rural telephone cooperatives and commercial companies. Telephone coops illustrate the low-density environment of rural America. NTCA members' highest customer density, approximately seven subscribers per line mile, is in the rural Southeast. One Texas company serves, on average, one person per ten line miles. By contrast, the Bell operating companies, on average, serve 130 customers per line mile. NTCA in 2001 has 502 member telcos: 250 cooperatives and 252 locally owned and controlled commercial companies (NTCA 2001). Despite the presence of these two organizations, each rural community, firm, and coop acts on its own and in its own local circumstances, generally providing a higher level of service to their rural customers than the large telecom providers have done.

It is very unclear whether wireless broadband will "work" for rural Americans, particularly rural businesses. Experience thus far is simply too limited, the technologies too new and varied, and security concerns too great, to know for sure not only what works but what works best.

Rural Demand for a Digital Economy

Rural America is already digital. The question is whether it is digital enough. In this discussion, I will focus on business users of the Internet and other telecommunications technologies. I suspect, but without sufficient data, that farmers and ranchers use the Internet more than do nonfarm rural residents. Serving distant customers in dynamic or even volatile commodity markets has reinforced this use of the Internet.

Demand for telecommunications is more than simply the number of customers within some distance or radius, although that provides a basis for comparison with urban settings (Egan 1996a). There is, of course, a virtuous circle in which strong demand for advanced telecommunications produces innovation and high levels of service, which in turn increase the level of demand (Grimes). Cornford, Gillespie, and Richardson summarize a sequence of steps or "translations" that must be made for remote regions to demonstrate effective demand for telecommunications. Infrastructure investment is merely a first step, which must be followed by appropriate services and applications. These will spark awareness of users who then must actually adopt and make effective use of information technology, translating this to the final step: creating a competitive advantage. "None of these translations can be relied upon to take place automatically" (Grimes). Indeed, they are echoed by Strover's (2000) view that most of the debate on universal service fails to address what she calls a "first-mile perspective" that addresses issues beyond infrastructure.

Let me begin the discussion of demand with a frequently cited telecom success story: LaGrange, Georgia (Youtie; Starner). LaGrange, located 60 miles southwest of Atlanta (population 25,000; Troup County 2000 population 55,000) has a city-owned fiberoptic network that serves more than 40 large commercial, institutional, and industrial customers. The city's telecommunications network features an OC-12 SONET ring with 32 nodes that has POPs of five interexchange carriers (IXCs) (AT&T, MCI, Sprint, WorldCom, and DeltaCom) (City of LaGrange). The evolution of LaGrange's network did not happen overnight, nor did it happen by chance. Indeed, Read and Youtie (1995) believed that the outcome of LaGrange's "'build it and they will come' infrastructure strategy" could not yet be judged in 1995, after the first POPs were installed.

Joe Maltese, LaGrange's director of community and economic development explained the situation:

> We went to the Fortune 500 companies that are based here, asked them what they need, and they told us.…They told us that the city needed to be able to provide digital switching, a point of presence (POP) as an entry ramp onto interstate carriers, and the deployment of broadband cabling. We have since implemented all of that (Starner, p. 44).

LaGrange had a choice in the early 1990s: "Either build this network itself or get bypassed by the New Economy." The "big telecom companies in Atlanta" had decided not to provide broadband service in LaGrange and BellSouth refused to partner with the city (Starner, p. 45).

LaGrange is not the only rural community with a municipally owned utility getting into broadband. Not all rural communities will be able to be so entrepreneurial; most will not have a roster of Fortune 500 companies on hand to provide local demand. But rural America remains competitive in manufacturing, and is increasingly so in warehouses and distribution (Isserman). Moreover, many (perhaps most) large firms bypass the local network with their own private networks, and thus do not contribute to the potential pooled demand (Parker et al.). Without the corporate level of demand (even if it is barely utilized), it is virtually essential to demonstrate that a demand for broadband capability exists, and this generally requires aggregating demand. Aggregating customers is common in urban areas, where providers compete to hook office buildings and other nearby clusters of "data customers" to Internet backbones. It is more difficult in rural communities; yet not to do so virtually guarantees that rural demand will remain "off the radar screen" of large telephone providers. Much more common than examples like LaGrange are stories of towns that get neither attention nor investment in upgrades from their large service providers. An exception to this generalization, Kearney, Nebraska, served by GTE (now part of Verizon), was able to justify demand for an AT&T POP (Schmandt et al. 1991; Parker et al.).

Most rural communities do not have a municipally owned utility, as LaGrange does. However, those that do are regularly on the lists of the "most wired towns," the latest of which includes Abingdon, Virginia, Ashland, Oregon, and Murray, Kentucky (Knopper). This cannot happen everywhere, since several states have prohibited or placed restrictions on municipal utilities regarding telecommunications services (Strover 1999a). Indeed, Strover's list of municipal networks working with private-sector partners includes mainly very large cities (Anaheim, Los Angeles, San Diego, Austin, and Seattle), but she also provides a larger list of city-initiated networks with data services, including rural communities in several states.

The benefit of public-private partnerships, although a growing phenomenon in urban areas, is overlooked by many rural communities; yet it could be the answer to overcoming the problem of insufficient demand. Kathleen McMahon and Priscilla Salant believe that systematic strategic planning is needed in order to focus local efforts on increasing demand for advanced telecommunications and on demonstrating that adequate demand exists. It is not uncommon for an initial local telecommunications inventory to "discover" several users or networks that use private leased lines for access to the nearest POP, in effect duplicating each other at considerable expense. Such inventories of both supply and demand are rarely done, even in metropolitan areas, because they are time-consuming and typically require costly outside expertise (Parker et al.; Schmandt et al. 1990). However, only by conducting such an inventory can any community, small or large, know what it has and what it needs, and present its case of adequate aggregate demand to telecom providers. Communities served by a large provider, rather than by a municipal utility, independent carrier or cooperative, are especially likely

to gain from a thorough inventory and analysis of local demand. Data resulting from such an effort will be the only way to attract the attention of large, deregulated providers whose attention and profits appear to be focused in urban areas.

Can rural infrastructure improve in a deregulated environment? There is evidence that many communities are harmed by a number of government policies and actions. For example, Parker reports that the FCC's accounting separation rules make it difficult for large telephone companies with both rural and urban territories to provide advanced services to rural communities remotely. Communities without a municipal utility or a civic-minded rural cooperative may well be unable to wrest a POP or broadband service out of a deregulated telecommunications provider. While deregulation opened up the telecommunications market to new competitors, most of these have targeted urban markets, and especially the largest urban areas (Malecki 2000).

Parker makes a similar observation:

> Many federal and state government agencies have data networks that reach into rural communities, but are dedicated exclusively to government use. In many rural communities the combined demand of federal, state and local government agencies is a high percentage of the demand for data networking services in those communities. Those networks do serious harm to the economic health of rural communities. Because the government demand is met by a dedicated network that is not accessible to local businesses and residents, the remaining demand in the community is insufficient to make the investment in a different data network for the rest of the community economically viable. If those government networks were instead "virtual private networks" instead of physically private networks, then similar services could be made available to rural businesses and residents who could use it to improve their rural economy. Government networks should be the "anchor tenant" in multi-purpose rural broadband networks, not the spoiler that makes it impossible to have a network at all. Every unit of governmental data traffic in rural communities that is diverted to a government-only network harms rural communities by making it less likely that a multi-purpose shared network can be afforded in that community (pp. 286-87).

The usual situation in rural areas, by contrast, is one of "stovepipe" access for large users, whose leased lines effectively remove them from the broader community (Strover 2000). Egan echoes the need for demand aggregation:

> [N]ew telecommunications technologies can be very efficient, but that efficiency depends on two critical factors which are often non-existent in rural areas of the country, economies of scale and end-to-end service capability. The first factor operates on the supply side of the equation and simply says that technologies such as digital fiber optics require relatively large scale operations to achieve the low unit costs which are ultimately available. End-to-end service operates on the demand side of the equation and simply says that unless advanced network functionality is adopted on a very wide scale, demand drivers will be unable to speed up the technology adoption process. It is no good to have [a] capability unless the other party to the call also has it. Thus, the critical issue for efficient technology adoption in rural telecommunications is sharing of network facilities, both to achieve scale economies and to stimulate demand drivers (Egan 1996b, section 8).

In the absence of demand aggregation, "achieving broadband communication capability in rural areas is a very costly proposition at about $4,000-$5,000 per rural subscriber" (Egan 1996b, p. 1). The demand that attracts the attention of telecom providers is usually business demand. The attractiveness of an area for aggregation of data transmission can be approximated by the number of PCs per unit area (square foot or square mile). In this calculation, downtown office buildings and suburban office parks have been the first targets for new POPs

and for new firms entering the industry. Rural areas have to demonstrate that they have sufficient demand to be an attractive market. Businesses, when joined with government and other large users, are going to be the "pull" that will get a market-based response.

Doing Business Digitally

Are rural businesses digital? There is less evidence here, since most tallies have looked at household use. Success in the digital economy will depend on the role of entrepreneurs, which is the focus of the paper by Brian Dabson. We cannot look at entrepreneurship in isolation from the demographics of rural America. In essence, entrepreneurship is a human capital issue—and a social capital issue.

When I looked at the issue of rural entrepreneurs over a decade ago, it was clear that low levels of education and outmigration were among the principal barriers to rural development (Malecki 1988). After a dozen years, these remain barriers, but they also have a flip side. Migration trends suggest that educated Americans, including relatively young retirees, find rural America appealing. As the baby boom population enter their golden years, it is increasingly clear that migration is not a "one-shot" event, but a process that includes "shopping around" not only for environmental amenities, but also for high-quality local hospitals and schools. In general, many Americans prefer to live away from urban areas and their problems, and they do this through not a snap decision or single "migration event," but a prolonged period comprised of numerous vacations and short-term stays. Similarly, retirees make frequent moves into and out of the labor force (Beyers and Nelson).

Overall, despite persistent rural outmigration, Robert Gibbs and John Cromartie suggest that inmigration tends to balance outmigration in all but a few rural counties. Leistritz et al. found in a recent survey in North Dakota and Nebraska that "the educational level of new residents was substantially higher than that of the resident populations." Most of the new migrants, but particularly retirees, provide a significant "cerebral input" to rural areas (Landabaso). Equally important to rural communities is the return migration of their educated young people. The brightest educated young people leave for college, many permanently, but about one-half return after gaining both an education and experience (Gibbs). Return migration is an increasingly common but underresearched phenomenon and, like retirement and migration generally, has an "event history" that suggests it is difficult to predict with accuracy, complicated by the prevalence of two-earner households (Bailey and Cooke; Beyers and Nelson).

The importance of understanding migration trends is that jobs tend to follow people, rather than the other way around (Vias). In nearly all cases, the jobs are created by new (or returning) residents who bring enhanced human capital with them—i.e., they are skilled and experienced. Many, even if not all, start their own businesses, often in niche manufacturing or services, utilizing established contacts in urban areas (Beyers and Nelson). Entrepreneurs in producer services, with an understanding of niche marketing, were the people originally identified as "lone eagles and high fliers" (Beyers and Lindahl).

Lindahl and Beyers have extended that research in order to understand how such businesses create their competitive advantage. The bundle of attributes includes price, but also goes well beyond price to include quality, creativity, innovation, flexibility, timeliness of delivery, and scope of services provided. These criteria have become normal for all businesses, and if rural enterprise is to survive and prosper, it requires adherence to global standards and selling to global markets. Suzanne Mitchell and David Clark suggest that this occurs most frequently (in areas of little inmigration) when a firm's customers have "pulled" the business toward high levels of telemat-

ics use. Furthermore, the firms that have done so also tend to have a far more widespread geographic market, including not only the initial principal customer but also others in export market locations.

Niche producers who know both urban and international market norms and expectations are also those that use telecommunications links. A local inventory will identify them; a sufficiently large number of such users, when aggregated, can justify a broadband link. In general, the firms that use telecommunications and computers are those whose horizon of sales and input purchases is national or international in scope, rather than local (Mitchell and Clark). Education and familiarity with computers and the Internet are part and parcel of this, as are business knowledge and experience, which also are more likely to lead to successful entrepreneurship (Beyers and Nelson; Grimes). The distant connections and markets of successful businesses are only positive, providing an export base for local economies.

It is increasingly evident that not all firms are capable of competing at this level but, equally, it is increasingly clear that those that are capable use technology in many areas of the business (i.e., they have "gone digital") and rely on widespread sources of information. There remain, inevitably, other, more introverted businesses that continue to struggle without such links, with correspondingly lower prospects for success (Malecki and Poehling; Mitchell and Clark). An array of contacts and business links, whether amassed over a long career or pulled together more recently, can be the basis for a "virtual megafirm" (Van Horn and Harvey). The recommendation for places with few "digital" firms is a combination of upgrading existing businesses through education and technical assistance—a step beyond retention and expansion—and recruiting and retaining people with technical expertise (Duncan and Culver).

The power of networks extends beyond business firms. It also must include institutions and organizations in the private sphere, the public sphere and, increasingly, public-private collaborative organizations (Malecki and Tootle; Murdoch). Sometimes these are sparked by newcomers or outsiders who bring needed new skills and knowledge that spill over to benefit others in the community. "Economically viable communities" provide support for those starting new businesses, monitor public sector activities at all levels, have a community strategic economic development plan, and in other ways show an openness to new ideas. The "supportive structures" in such places include both community development organizations and external support organizations (McDowell; Shaffer; Wilkinson and Quarter). Perhaps most importantly, the institutional structures must be able "to evolve successfully as political and economic systems change" (Barkley, p. 1257). This "adaptive learning" is a key to rural development (Kraybill and Weber). Stu Rosenfeld's paper provides other examples of successful networking.

Without "intelligent government," it is at least difficult, and maybe impossible, to address the overlapping and nuanced connections needed to become digital. Local leaders who lack will tend to favor traditional, "easy to manage" policies such as infrastructure and neglect the more sophisticated policies needed to address demand-related issues (Landabaso, p. 82). This is why successful places are typically those where not only local interaction and synergies are high, but also where there are links to outside knowledge (Camagni; Flora and Flora; Flora et al.).

Digital Businesses

As I write this, the dot.com boom has ended and many are questioning the existence of a digital economy. What has become apparent is that niche marketing still works in the Internet era, and it works for rural and urban entrepreneurs alike, in manufactur-

ing and in services. Imitation of what Gary Hamel calls "strategy convergence" is less likely to be profitable in the Internet age than it was before the Internet. Copycat strategies and imaginary customers were, as much as anything, the demise of many Internet start-ups. Porter makes the case succinctly:

> The key question is not whether to deploy Internet technology—companies have no choice if they want to stay competitive—but how to deploy it…The Internet per se will rarely be a competitive advantage…The Internet makes strategy more essential than ever (p. 64).

At a minimum, a business needs a web site, or else many consumers (and not only young ones) will believe that the company does not exist. But there are many aspects of business that remain possible only with a real presence with real people in a physical facility. The Internet is complement to, not a substitute for, conventional business activities (Porter).

At the same time, the Internet has changed the rules of business is some ways. Electronic exchange, particularly of intangible products, has radically altered if not eliminated three essential structural conditions for the functioning of markets: excludability, rivalry, and transparency (Soete). The "copy at will" nature of the Internet makes it difficult for many producers to prevent a buyer from copying and reselling, leading to enormous attempts to encrypt, watermark, trace, and monitor in order to control property rights. The winner-take-all quasi-monopoly nature of network economies also alters normal market outcomes as well as conventional welfare implications. Third, despite seemingly freely available information in unprecedented quantities, the enormity of the quantity of information has made essential a set of intermediaries that exploit the information assymetry that results from the sudden to overabundance—having more information than one can readily use and comprehend without an intermediary to sort and filter it (Soete). With the Internet, "consumers can compare prices, shop the globe, and get knowledge for next to nothing." The result, however, in the absence of a market niche, is that "margins are bound to fall" (Hamel, p. 176)

In addition, the relative newness of the Internet has distorted conventional market signals, such as revenues and costs, because of subsidies (sales tax exemption), experimentation interpreted as actual demand, and unrealistic and unsustainable pricing (Porter). As a result, an examination of the impact of the Internet for most industries leads Porter to conclude that "the trends are negative." Several categories of Internet commerce have become commodities, such as widely available data (stock quotes, weather and news), search engines, and comparative shopping information. Across a wide variety of businesses, buyers and consumers have unprecedented power to comparison-shop, to customize their purchase, and tap the global marketplace that no longer protects local markets (Porter; Seybold).

Other categories are able to add value by giving each of us what we want, whether that is a customized data analysis or selections of music or video (Borrus). The vast amount of information on the Internet also opens up new opportunities. First, there is far more information than most users can digest on their own, so there is a role for intermediaries to filter and customize information. Second, the costs of customizing information and personalizing service are much cheaper and can be made available to more people, matched to buyer preferences (Borenstein and Saloner). Whatever the product or service, consensus makes a clear suggestion:

> For most consumers, nonpecuniary aspects of the purchase experience (such as trustworthiness, after-sales support and service, reliability of delivery, likelihood of in-stock and accuracy of in-stock forecast) can create a logical and emotional attachment between consumer and site (Borenstein and Saloner, p. 10).

Even though consumers are far less constrained to local merchants, they remain loyal to those businesses that provide a "relationship" that matches (and anticipates) their needs. Increasingly, the evidence suggests that customers are more likely to place priority on a variety of long-term, trust-based factors in defining their loyalty (Urban et al.).

Conclusions

"Going digital" means opening doors to the nearly unlimited possibilities to exchange information on a scale never before imagined. Luc Soete believes that access to the new variety of immaterial goods and services, often exchanged as part of leisure, household, and other nonwork activities, have enhanced social interaction and democratic expression. They represent, he believes, part of "the new wealth of the 21st century" that cannot be monetized and so has been largely ignored.

Seen from this perspective, it is more clear why "telecommunications technology is not capable of leading growth" in rural America (Glasmeier and Howland, p. 137). It is, to repeat, a necessary but not a sufficient condition for rural growth (Fox and Porca). A more fruitful approach is to build and enhance the capabilities of local firms and to attract a share of experienced entrepreneurs, not all of whom want to live in urban areas. This means there is no quick fix. Migration of retirees, of entrepreneurs wanting off the treadmill, and of returning children will not happen overnight, and for each group rural areas still must compete with the attractions of urban areas. Healthy rural communities will continue to be attractive to these groups, and many will become entrepreneurs. Together, these enterprises are likely to represent demand for broadband infrastructure. High-amenity tourism locations have an edge on other rural communities in some respects, but more than amenities is needed.

Just as "chasing smokestacks" has not been a route to local development, attracting migrants should be complemented with education and training of people in existing businesses. Building networks to encourage interaction among entrepreneurs, and between entrepreneurs and other local leaders in education and government, rather than isolation, will increase information-sharing that might not take place otherwise. Informed businesses are more successful businesses. If businesses thrive, their expansion can provide attractive jobs for young people.

Telecommunications is but one piece in the more complex puzzle of rural development. Because the issue is wrapped up in human capital, it is far more than a relatively simple infrastructure supply issue. It is, to return to Drabenstott's five challenges, part of a complicated process that goes beyond rural and urban. The relationships that affect rural places are global, and digital technology is only a small part of what affects all places as times and technologies change.

Endnotes

[1] I wish to express appreciation to Mark Drabenstott prompting me to return to rural issues, and to Deborah Tootle and the late Ryan Poehling for their collaboration in interviews and discussions. This research was supported in part by National Science Foundation grant BCS-9911222. At the time of the conference, the author was Professor of Geography at the University of Florida.

[2] The data were those in MapInfo's POPInfo database, dated May 2000. It includes 1,711 POPs in the 48 states and the District of Columbia.

[3] The data on packet gateway switches are taken from the Local Exchange Routing Guide (LERG), compiled monthly by Telcordia Technologies (and formerly by Bellcore). The LERG is a massive data set of switching entities with location and capabilities. The data here are current as of April 1, 2000.

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