



BEYOND THE DIGITAL DIVIDE:

Broadband Internet Use and Rural Development in Pennsylvania

Final Report to the Center for Rural Pennsylvania

JUNE 2007

Amy K. Glasmeier, Chris Benner, and Chandrani Ohdedar

Department of Geography and

Earth and Environmental Systems Institute

The Pennsylvania State University

and

Lee Carpenter

Children, Youth, and Families Consortium

The Pennsylvania State University

**This report was made possible, in part, by a grant from the Center for Rural Pennsylvania,
a legislative agency of the Pennsylvania General Assembly**

Table of Contents

I. Introduction: Moving Beyond the Digital Divide	5
II. Background: Broadband and Access in Rural Pennsylvania	9
What is Broadband Anyway?	10
The State of Broadband Availability and Utilization in the U.S. and in Rural Pennsylvania ...	10
III. Methodology	19
Meta-Analysis and Review of Best Practices	19
Case Studies	21
IV. Broadband Use by Different Sectors: A Review of Best Practices	34
IT Use and Local Governments	34
IT Use and the Education Sector	36
IT and the Healthcare Industry	38
IT and the Small Business Sector	42
V. Case Studies of Business and Institutional Broadband Use	44
e-Government	44
Education Case Study	62
Healthcare Case Study	73
Small Business Case Study: Powdered Metal Broadband Utilization	82
Small Business Case Study: Route 6 Tourism Association and Broadband Use in Northern Pennsylvania	94
VI. Conclusion	114
VII. Policy Considerations	119

Table of Contents (cont'd.)

Bibliography 121

Appendix: Instruments 137

List of Tables

Table 1. Counties Selected for e-Government Analysis 24

Table 2. Evaluation of Hospital Websites 30

Table 3. Scoring System Used to Evaluate the Hospital Websites 32

Table 4. Municipalities Identified as Having Websites, by County 48

Table 5. Municipalities with Website, Selected Pennsylvania Counties..... 53

Table 6. Ratings of Government Websites in Selected Counties in Pennsylvania 56

Table 7. Ratings of Government Websites in Selected Municipalities in Pennsylvania... 60

Table 8. Forms of Telemedicine and Their Bandwidth Requirements..... 75

Table 9. Summary of Hospital Broadband Service Utilization to Complete
Health Service Activity 80

List of Figures

Figure 1. Index of e-Government, Selected PA Rural Counties 50

Figure 2. e-Government Score by Population 51

Figure 3. e-Government Score by Total Revenue 52

Figure 4. North American Iron Powder Shipments 83

BEYOND THE DIGITAL DIVIDE:

Broadband Internet Use and Rural Development in Pennsylvania

Final Report to the Center for Rural Pennsylvania

Amy K. Glasmeier, Chris Benner, Chandrani Ohdedar, and Lee Carpenter

The Pennsylvania State University

I. Introduction: Moving Beyond the Digital Divide

The concept of a digital divide gained prominence in the 1990s, with the development and dramatic expansion of the Internet. The basic notion reflected the widespread inequality in access to this new technology that was clearly evident. Historically disadvantaged sectors of our society, including people of color, women, those with less education and income, and those living in rural areas, were slower to gain access to the Internet and used it at lower rates than the overall population. As social and economic opportunity in our society is increasingly linked with Internet access, this digital divide is being viewed as a major barrier—another factor reinforcing widespread inequality and poverty. What happens to those without access to the Internet, for instance, when a company only accepts applications online, or a government office shuts down and is replaced by a public website?

Initially, confronting the digital divide was seen simply as a question of having or not having access to the Internet. If the digitally disenfranchised could simply gain access—through public libraries and schools, if not their own homes or through work—the substantial benefits of the Internet would be open to them. Increasingly, however, many analysts have realized that the Internet’s potential in promoting social and economic development requires more than access to the technology. Instead, at least two other dimensions of this digital divide are critical. The first dimension is obviously the issue of having the skills required to

actually use the technology—call it technology literacy—including the ability to use information technologies for a range of purposes and the knowledge of how and why information technologies can be used as a key resource. Second, and perhaps more important than access and skills, is the need for appropriate content—content that meets the needs of disenfranchised groups and that is created by those groups (see Servon, 2002).

Understanding the issues of technological literacy and appropriate content, however, is only the first step in moving beyond a simple understanding of a digital divide. The ability to rapidly access information, and to have the right information available, is only one of the aspects of the Internet. The development and widespread diffusion of the Internet has far more profound implications than simply getting better access to information. The Internet, and particularly the development of a broadband Internet, makes possible a whole range of processes and possibilities that could not have been envisioned before.

Harnessing the power of the Internet is an important issue for rural Pennsylvania. The limited availability of advanced telecommunications services has long been a concern of residents, businesses, and institutions in rural areas. Policymakers with rural constituencies have historically shared similar concerns. Over the past several years, trends indicate that telecommunications providers in rural areas are increasingly offering advanced telecommunication services—including broadband Internet services—to their rural customers. While access to technology is still far from universal in rural Pennsylvania, it has become widespread enough for academic researchers and policymakers to move beyond simply arguing that lack of access to the technology is obstructing social and economic development in rural areas. We must now begin asking a new set of questions aimed at understanding the broader implications of the Internet for rural Pennsylvania. How are

people in rural parts of the Commonwealth using broadband access to the Internet? How does this use differ in different sectors of society, and among different population groups? How is the use of broadband access shaping opportunities for social and economic development in rural Pennsylvania? In what ways might state policy and practice help to improve the use of broadband Internet use?

This report is an attempt to begin to answer these questions. At the core of the analysis is a distinction between *transactional use* and *transformational use* of the Internet. For example, when the *Encyclopedia Britannica* is made available on-line, its availability is more efficient, to a wider audience at a much lower price. This use of the Internet certainly makes the information in the *Encyclopedia Britannica* more accessible to a wider-range of people than before—a positive impact of the Internet. But this is a *transactional use* since it does not fundamentally change the processes involved in producing the encyclopedia. The editors and authors of the *Encyclopedia Britannica* are the experts and produce the information, while those who are interested purchase it. But consider, in contrast, what happened when the on-line free encyclopedia originally known as *nupedia* began to harness the power of collaborative software that allows any visitor to the website to add, remove, and otherwise edit and change available content; *wikipedia* was born, with the power to harness the collective knowledge of literally millions of on-line users. This is clearly a transformative use of the Internet—it has entirely transformed the process of how information is produced and who is considered an expert in producing that information.

In this report, the transactional and transformational use of broadband Internet access is examined in four different sectors important to rural Pennsylvania society: healthcare, education, government, and small business. In each sector, current types of practices are

examined, as well as activities that may be considered transactional or transformative uses of the technology. While the practices differ across the four sectors, in essence transformational uses are present when the Internet allows users to harness the power of *network* relations, rather than extant hierarchical structures, and when the producers of products and services are using the Internet to actively engage with the final consumers and to allow consumers to customize information production and consumption to meet their own particular needs.

In general, transformational use of broadband Internet access in rural Pennsylvania is hampered by a wide-range of factors. High costs of bandwidth, restrictive policies, lack of education and exposure to technological capabilities, hierarchical power relations with a few dominant actors in each sector and/or lack of coordination among critical actors within the sector, are all factors that limit the use of broadband to more traditional, transactional uses. Nonetheless, in each sector, exciting instances of transformational use point to significant future possibilities. Here, factors that helped enable the transformative use of broadband include human capital, the availability of complementary technologies, participation in vibrant, decentralized social and economic networks, and proximity to others areas with more advanced use of broadband. This suggests that state policy is best developed in a collaborative fashion that involves stakeholders throughout these vibrant networks, and focuses on the diffusion of transformative practice through these networks.

This report is structured in a straightforward fashion. In the next section, basic information on broadband Internet is reviewed, and a description of broadband access and current information about levels of access to broadband in the rural U.S. and in Pennsylvania is provided. Section III is devoted to explaining the methodology followed in gathering information on broadband Internet use, and includes an assessment of best practice around

the country and in the four specific sectors examined in some depth in Pennsylvania: healthcare, government, education, and small business. Section IV provides a review of global best practices in the use of broadband in these four sectors. In Section V, each of these sectors is examined in turn. The final section contains a summary of results across all sectors and provides comment on implications for policy that might help promote more transformational use of broadband Internet.

II. Background: Broadband and Access in Rural Pennsylvania

The concern about the availability of broadband has largely focused on the residential user. There has been substantially less assessment of the availability of broadband services for government, education, healthcare, and business users. In fact, at a recent workshop organized by The Pew Charitable Trusts' Internet and American Life Project (June 27 2006, Washington, D.C.), where the leading service providers, researchers, and market research firms were present, the only identifiable comprehensive study of broadband utilization by mentioned by a workshop member was done in 2000. All participants concluded that this was significantly out of date and lacked applicability to today's situation.

The lack of research on the demand for telecommunications is well known. Many researchers and policymakers comment that if the supply of broadband is evident, what are the rates of utilization of different sectors? Can we conclude that the availability of supply is a sufficient indicator of diffusion? In light of this gap in the literature and research, a study was undertaken of broadband utilization in the healthcare, education, local government, and small business sectors of tourism and manufacturing, to determine characteristics of and barriers to utilization, and to confirm the availability of broadband services in rural parts of the Commonwealth.

What is Broadband Anyway?

Broadband refers to a set of telecommunications capabilities that can support a wide range of frequencies, including video and audio. It can carry multiple signals by dividing the total capacity of the medium into multiple, independent bandwidth channels, where each channel operates only on a specific range of frequencies. It reflects a high-capacity, two-way link between an end user and access network suppliers capable of supporting full-motion, interactive video applications. Often erroneously referred to as a measure of speed of signal, it instead reflects multiple channels of data over a single communications medium. Characteristics of broadband include significantly higher bandwidth capacity than dial-up service, the reliance on some form of packet switching, and supporting “always on” functionality. Several national and international organizations describe bandwidth capacity as reflecting transmission speed of between of 1.5 to 2 Mbps. The National Research Council offers a two-part approach to defining broadband as transmission capacity in the local access link that is sufficient to enable unconstrained usage and not constrain a user’s ability to run advanced applications. Moreover, broadband should provide sufficient performance and wide penetration of services to encourage the development of new services and applications (NRC, 2002, as cited in Bauer et al., 2002).

The State of Broadband Availability and Utilization in the U.S. and in Rural Pennsylvania

In this section two recent studies are reviewed that offer up-to-date perspectives on broadband availability nationally across urban and rural areas of the country. A third research project focusing on Pennsylvania provides an intimate understanding of the broad outlines of broadband access and utilization in rural parts of the state. A review of these

studies serves as a backdrop for this project's subsequent assessment of broadband use in non-residential sectors of the state.

The two recent studies, both completed in the spring of 2006, were done by John Horrigan for the Pew Internet and American Life Project, and by the Government Accountability Office for the U.S. government. The two present different, though compatible, perspectives on the availability of broadband services in the U.S. Using different methodologies, both the Pew and the GAO studies conclude that broadband services are increasing in availability in the U.S. They both note differences in utilization rates by age, income, education, and locality. The two studies, though similar, reflect subtle differences in the distribution and utilization of broadband services. The GAO focuses on what Federal Communications Commission data reveal in terms of service coverage. The Pew study emphasizes public uptake of broadband technology and changes in the type of serviced utilized. A quick summary of both is in order as contextual background for this study.

The Pew Foundation Study

The May 2006 Pew Foundation survey study conducted by Princeton Survey Research Associates, a survey research consulting firm, used survey methodology to investigate growth of broadband adoption in the home between 2005 and 2006. This is a reoccurring study started in the early 2000s.

The Pew report was based on the results of two daily tracking surveys on Americans' use of the Internet. Both random digit dial phone surveys were completed by Princeton Survey Research Associates International between November 29 and December 31, 2005, among a sample of 3,011 adults aged 18 and older. The first study examined attitudes toward the Internet. The second survey occurred between February 15 and April 6, 2006, among a

sample of 4,001 adults aged 18 and older. The second survey collected material on broadband adoption. Part of the second survey captured information on demographic groups. A total of 2,822 adults were surveyed with a margin of sampling error of plus or minus 2.0 percentage points. The response rate for the Internet user survey for the February to April panel was 29.8%.

The study highlights the following results:

Evidence of Broadband Coverage and Demographics of Service Users

- Between 2005 and 2006, there was a 40% increase in the number of people with high-speed connections at home. During that period, 84 million adults had high speed Internet connections in the home.
- The rate of increase in adoption doubled from 2004.
- Adoption is reaching down into middle-income households, people of color, persons without a high school education, and seniors. All showed a brisk increase, though from a small base.
- Rural areas also saw a significant increase in the growth of adoption, but the rate of increase lagged behind the national average. Moreover, rural areas have the highest incidence of single provider service, with 35% of rural respondents versus 24% of urban respondents indicating that they had only one available local high-speed provider.

Of particular importance, the percentage of households with broadband service differs significantly between urban and rural areas. Broadband penetration in urban areas is almost

twice that of rural areas. Suburban areas show even higher rates of penetration compared with urban and rural areas.

Service Type

Departing from past experience, growth in broadband adoption has seen a shift in product penetration between DSL and cable modem. According to the Pew survey, 50% of respondents log on at home using DSL, compared with 41% who use cable modems (Horrigan, 2006). Wireless connections also are growing, but from a very small base. Little penetration of satellite service is evident.

Cost

According to the Pew study, the cost of service has converged between DSL and cable modem. DSL is now less expensive than cable service, contributing to growth in service utilization. The cost of service has declined by 8% since 2004 (Horrigan, 2006). Cost of service is lower in locations where more than one service supplier is available. Price competition between cable and DSL is evident in places where there are multiple providers and is leading to a decrease in overall service cost in these locations. In contrast, the lack of competition is most evident in rural areas, where according to the Pew study 35% of rural households surveyed indicated that only a single service was available to them. In terms of utilization, growth in DSL service use is occurring in the middle- and lower middle-income range of the market.

Reasons for Upgrading to Broadband Services

The majority of respondents indicated that gravitation to broadband services was tied to the benefit of greater bandwidth and therefore more effective information retrieval

capacity as measured by rate of retrieval. The Pew survey also noted that upgrades were linked to the cost of service.

An interesting development is the evolution in the type of use of broadband. There is growing evidence that users are posting information on the Internet rather than simply using it for data and information retrieval or consumer purchases.

GAO and Broadband Service Availability

In 2005, the Government Accountability Office completed a study of household broadband service utilization and the availability of cable services to those households, in a multi-stage analysis. First, the GAO analyzed the resulting data from a household survey of 3,127 randomly sampled households, about the purchasing behavior of Internet services by households and the availability of cable services to those households. Using data from 1,500 households who responded to the Knowledge Networks/SRI's *The Home Technology Monitor: Spring 2005 Ownership and Trend Report*, the GAO estimated factors affecting broadband deployment and factors affecting households' adoption of broadband services. These data were combined with FCC Form 477 data, which tracks broadband service deployment at the zip code level (note the definition of the FCC zip code reflects a modified post office-designated code; see the GAO report for details). The two information sources were combined to develop information about the broadband service options available to a particular household. Using this approach, the GAO estimated that 99% of the country's population lives in 95% of the zip codes that register at least one broadband provider in the area.

Using the survey data, the GAO concluded that approximately 30 million customers or 28% of U.S. households subscribed to broadband service. However, according to the

GAO, this estimation procedure is insufficient to determine whether there are gaps in the availability of broadband in local markets. With this proviso and the noted limitations of this estimate, GAO concluded that broadband utilization, while growing, is still a fraction of the total user population. A significant proportion of the user public still uses dial-up—30% of surveyed households utilized dial-up services, while another 41% did not access the Internet from their home. Similar to the Pew study, the GAO also concluded that Internet users employing broadband were divided almost equally among type of service purchased, DSL, and cable modem services.

Using the FCC data, the GAO concluded that gaps remain in the availability of cost-competitive broadband services in parts of the country. In 83% of the zip codes utilized in conjunction with the FCC 477 data, subscribers indicated service availability by more than one broadband provider; in 40% of the zip codes, subscribers were served by more than five providers of broadband services. Of considerable importance, the GAO noted that FCC data do not represent data about where subscribers are served and where providers have deployed broadband infrastructure. Instead, the FCC data indicated solely that within specific spatial units—FCC modified zip codes, there appears to be at least one service provider. The missing link is the last mile considerations and the fact that zip codes are of varying sizes and population densities, thus diluting the ability to conclude that the presence of one service provider indicates everyone in the zip code has access to service. According to the GAO report, the FCC data does not necessarily provide a highly accurate depiction of broadband deployment in some areas including rural areas.

Local Development District Survey of Broadband Availability in Pennsylvania

The most detailed source of information on broadband availability in the Commonwealth of Pennsylvania is present in a June 2006 draft study for the Local Development Districts (LDDs) of the Appalachian Regional Commission, which together with the Pennsylvania Department of Community and Economic Development sought to determine the existing availability of broadband services in the state and to create scenarios to expand access to broadband (Baker, 2006). Five LDDs (Southwestern Pennsylvania Commission; Southern Alleghenies Planning and Development Commission; SEDA-Council of Governments; Northeastern Pennsylvania Alliance Region; Northern Tier Regional Planning Development Commission) generated comparable survey data of service availability. Two other LDDs, while participating in the study, had an insufficient response rate to be included in the study results. The study areas covered 94% of the geographic areas of the state and 64% of the population.

The study combined a range of information from service providers, users, and other knowledgeable persons to determine the distribution and availability of broadband in rural parts of Pennsylvania. The LDD study emphasized the availability of broadband for economic development purposes. The results provide an important window onto the availability of broadband in rural parts of the state.

The research project had as an objective the identification of broadband services in rural and more underserved parts of the state. A total of 10,000 surveys were distributed; 9,000 residential and 1,000 business properties were surveyed. A 12% response rate was achieved; 5,396 residential and 564 businesses responded to the survey. While this response rate is low by social science standards, taken together the results of the household/residential

component of the survey yield important and reliable information. The much lower response rate of the business respondents indicates the results can be used to build educated guesses about issues relevant to businesses in rural parts of the state, but the results cannot be used in statistical generalization.

Survey Highlights

Residential respondents. Residential survey respondents indicated 85% owned computers and the majority accessed the Internet from their home, work, or another location. Only 18% indicated that they did not use the Internet. The majority of residential respondents made from \$35,000–\$75,000 per year. A significant percentage of respondents had children at home aged 5–17.

A slight majority of the respondents felt access to the Internet was very important (59%) or important (28%) and use the service for a variety of purposes. Residential respondents indicated that they used the Internet to gather information about travel, healthcare, public services, and entertainment, while two-thirds used the Internet for purchases. Slightly less than half (43%) used the Internet to conduct financial transactions and many used it for communication.

Recognizing the small sample size, for those residential respondents dial-up remains the most common means of Internet access. Given computer ownership and Internet utilization, it is somewhat surprising that the majority of users (60%) still rely on dial-up for Internet access, with another 18% using DSL. The majority of users paid \$30 for service access. Half of the population using dial-up indicated that cost was the primary factor limiting their purchase of broadband services. Another 40% indicated that such service was

not available to them. Several respondents indicated that a lack of competition in service providers explained the high cost of available service.

Business respondents. Business respondents were predominantly small firms (58%) with 1–5 persons and annual sales of less than \$500,000. The sectoral composition of the respondents mirrored the overall economy, with the largest group of respondents working in the service sector, followed by retail. Business use of the Internet was high (90 % indicated Internet access was critically important or somewhat important), with communications the most frequently cited use. At least half of the businesses indicated using the Internet for financial transactions, while more than two-thirds used the Internet for information acquisition and research.

Internet access methods varied considerably, with one-third of business respondents using dial-up. DSL was the next most widely used access technology (21%) behind dial-up, followed by cable modem (16%). Almost half of businesses indicated their Internet bandwidth was inadequate. The cost of higher speed Internet access was cited by 50% of dial-up users as the reason for continued dial-up usage, while another 42% indicated higher speeds were not available to them.

In summary, according to the LDD-sponsored survey from 2006, businesses do not use high-speed access with the same frequency as do households. The majority of respondents indicated cost was the primary barrier to the purchase of broadband service. While the majority of firms using dial-up indicated that cost of service was the primary inhibitor, 42% indicated that higher speeds did not appear to be available. Thus, while similar to residential respondents who indicated cost was a factor limiting broadband

utilization, businesses seemed even more reluctant to use higher capability services due to cost and lack of competitive service providers.

Summary of the Findings from the Pew, GAO, and LDD Studies on Availability and Utilization of Broadband

- Broadband utilization is a function of demographic characteristics, including: age, income, education, employment history, and local sectoral base of employment.
- Use of broadband services continues to grow and diversify. More sophisticated uses of the Internet are evident in respondents' comments in all three surveys.
- Chief among factors limiting broadband access are cost and availability of service.
- These results echo the findings of Wood and Glasmeier (2003)—supply was not the problem per se. Rather, the area of concern was the narrowness of supply and the concomitant high price of the service. The lack of competition is cited as one explanation for the high cost. Other contributing factors include geographic remoteness and sparse settlement patterns.

The discussion of broadband utilization identified supply of service and price of different modes of service as continuing factors limiting the availability and use of high-speed Internet connection in rural Pennsylvania.

III. Methodology

In this section, the methodology utilized in reviewing best practices and in selecting the in-depth case studies in the four sectors is described.

Comparison of Studies Measuring Broadband Utilization and Review of Best Practices

Originally, the first phase of this research was intended to be a “study of studies” of the contemporary literature on broadband utilization in rural areas known as a meta-analysis.

Meta-analysis takes the existing body of research on a subject of interest and then combines and compares the results of these studies to explore a specific question like ours: what explains the adoption or lack thereof of broadband technology? It is a technique that allows researchers to examine a number of studies simultaneously to identify trends or patterns that can be generalized. These trends then form the basis of new studies that start from a benchmark or a state-of-the-field assessment. It is widely used in epidemiological studies and evidence-based medicine, and it is an increasingly popular method in policy analysis.

A meta-analysis takes a standard measure of effect or size—in this case, broadband utilization—and compares studies interested in the same question but which employ different explanatory variables such as personal characteristics of users, often measured on different scales, to determine effect. In these cases, the correlation itself is the indicator of the effect size.

A comparison of studies requires that the research approach from different investigations is similar in intent. In the case of this study, this minimum requirement was not achieved. There are many studies of broadband uptake, but research designs are overwhelmingly non-statistical in nature and case study in approach. In this case, the amount of variation associated with the cases overwhelms the ability to make generalizations.

This meta-analysis was designed to catalogue the literature on studies that examine the experiences and outcomes of broadband utilization in rural areas and to compare the documentary evidence in support of conclusions derived in these studies. The purpose was to review the similarities and differences in how researchers are studying the use of broadband in rural areas, the particular data they are collecting to conduct their analyses, and the conclusions they are drawing. This was designed to provide a comprehensive overview

of current broadband applications in each of the four user areas (government, education, healthcare, and small business), and to fully inventory the various capability and connectivity constraints that these users can encounter.

In this review of the literature, both academic and popular, it became clear that the study of broadband use is at a much earlier and formative stage than had been anticipated. There are many case studies of interesting projects in the four sectors focused on here. In most cases, however, the specific data gathered in these case studies are highly idiosyncratic, extremely diverse, and in many cases purely exploratory. With the partial exception of e-government, there are no widely accepted metrics for measuring broadband use, much less for determining the *best practices* in any of these sectors.

Thus, the review of broadband use in each of the four sectors (in section IV) should be viewed as a qualitative description of diverse types of broadband Internet use, rather than a scientific evaluation of best practice in the field, which is currently impossible given the early stage of study in this field.

Case Studies

After reviewing best practice around the globe, this project originally sought to select three different rural communities, and to examine broadband Internet use in those three communities in four different areas: education, healthcare, government, and small business. As the study developed, however, and the meta-analysis was conducted, several issues led to the revision of the case study selection process. First, there is no widely accepted framework for evaluating best practice in broadband *use*. Developing metrics to use in assessing broadband *access* is straightforward and a broad consensus has been developed about the most important factors to analyze when examining broadband access, but no such consensus

has developed about how to analyze broadband *use*. Without such a framework, it is unclear how best to choose particular rural areas for further study. Second, and more importantly, in this review of the literature, it was clear that effective broadband use differs significantly by type of activity and by sector of society. Thus, what would constitute best practice in the healthcare industry might differ dramatically from what would constitute best practice among small businesses or in government. Furthermore, while one region might have best practices in a single sector, it was unlikely that a single region would reflect best practices in all sectors.

Rather than examine broadband Internet use in four of these sectors in three different rural communities, it was decided to study each of the sectors separately, focusing on those rural communities in each sector that would be the most instructive for this analysis. The study criteria and process for selecting each sector, and the way each sectoral case study was selected, are described in the following sections. .

Government

Government is the sector in which detailed measures of best practice in broadband use have been the most developed. This is visible in measurements of the types of information and interactive activities that are possible to perform on the websites of local government. Though there is some variation in the specific measures, broadly, this meta-analysis supports assessing the effectiveness of e-government along four dimensions: a) information dissemination; b) interactive functions, such as permits, licenses, applications, and the like; c) eCommerce, with the ability to pay for government services, taxes, and fines on-line; and d) eDemocracy, with citizens able to use the Internet to provide feedback to elected officials as inputs into policy decisions.

To evaluate the effectiveness of local government websites along these four dimensions, a website evaluation tool was adapted that had been developed as part of a nationwide study of local government websites.¹ The details of the evaluation tool, which include more than 60 individual measures within these broad categories, are provided in the discussion of case study results. The goal was to select websites of 16 county governments that were representative of rural Pennsylvania counties, and 16 local government (boroughs, townships, and municipalities) within those counties that were representative of all municipalities in that county. To select the 16 counties, all rural counties² in the state were divided into one of four regions (NW, NE, SE, and SW). Then, within each region, the largest and smallest rural counties (by population) adjacent to urban counties, and the largest and smallest rural counties not adjacent to urban counties, were chosen. The counties selected for analysis are shown in Table 1. Then, within each county, all municipalities (townships, boroughs, and cities) that had a website as of the 2002 Census of Governments were identified. This list of municipalities was also compared with the list of municipalities with websites identified by the Governor's Center for Local Government Services and listed on its website.³ A random number generator was used to select one of the municipalities within each county for evaluation of their web presence. The specific municipalities, along with the analysis of their web presence, are presented in the case study discussion.

It should be noted that additional local governments within each of the counties have websites, beyond those identified through the 2002 Census of Governments and the Governor's Center for Local Government Services. To check the comprehensiveness of

¹ Kaylor, Charles, Randy Deshazo and David van Eck (2001), "Gauging e-government: A report on implementing services among American Cities," *Government Information Quarterly* 18, 293–307.

² As defined by the Center for Rural Pennsylvania.

³ <http://sites.state.pa.us/govlocal.html?papowerPNavCtr=|30207|#30214>

these sources as of 2006, Google searches were conducted for websites of other local governments within each of the selected counties and links were sought to additional sites from the county websites. This search produced no additional sites operated by local governments. This should not be considered a definitive sampling process, and there are possibly other local governments with websites in the counties selected for study here. Any additional ones, however, are likely to have been developed more recently than those local governments identified by the Census and the Governor's Center for Local Government Services. Thus, the local governments considered here are likely to have established experience with running and operating a website.

Education

The sample cases selected in this sector also used the same methodology discussed in the government section—dividing rural counties in the state into four geographical sections (NW, NE, SE, and S), and selecting four rural counties in each region (two adjacent and two nonadjacent to urban areas). For education, one school district was selected per county. In cases in which the first school district selected would not speak with the research team, a second school district was selected in the same county. In the event that an interview could not be conducted with any of the schools in a county, a different county in that region was selected. In total, of the initial 16 county interview targets, interviews were conducted with 12, including substitute counties in cases where no one was available for interviews in the original set of selected counties. The school districts that were interviewed wished to be kept anonymous in this report and hence the participating school districts have not been named.

Table 1. Counties Selected for e-Government Analysis

County Name	Website	2000 Population	Adjacent to Urban County?
Northeast			
Monroe County	http://www.co.monroe.pa.us/	138,687	Yes—Adjacent to Luzerne County
Bradford County	http://www.bradfordcountypa.org/	62,761	Non-adjacent
Montour County	http://www.montourco.org/	18,236	Non-adjacent
Sullivan County	http://www.sullivancounty-pa.us/	6,556	Yes—Adjacent to Luzerne County
Northwest			
Crawford County	http://www.co.crawford.pa.us/	90,366	Yes—Adjacent to Erie County
Venango County	http://www.co.venango.pa.us/	57,565	Non-adjacent
Warren County	http://www.warren-county.net/	43,863	Yes—Adjacent to Erie County
Forest County	http://www.co.forest.pa.us/	4,946	Non-adjacent
Southeast			
Schuylkill			
County	http://www.co.schuylkill.pa.us/	150,336	Yes—Adjacent to Berks County
Adams County	http://www.adamscounty.us/	91,292	Yes—Adjacent to York County
Mifflin County	http://www.co.mifflin.pa.us/	46,486	Non-adjacent
Snyder County	http://www.snydercounty.org/	37,546	Non-adjacent
Southwest			
Lawrence County	http://www.co.lawrence.pa.us/	94,643	Yes—Adjacent to Beaver County
Somerset County	http://www.co.somerset.pa.us/	80,023	Yes—Adjacent to Westmoreland County
Bedford County	http://bedford.pacounties.org/	49,984	Non-adjacent
Fulton County		14,261	Non-adjacent

A qualitative methodology was used for the education sector case study that involved collecting primary and secondary data. The objective in using primary data was to gather information about existing broadband infrastructure and teaching practices in schools in rural Pennsylvania. This information could then be used to compare current best-practices in the education sector in other parts of the world. Secondary data was collected to provide information about current best practices in the education sector that have transformed

teaching practices and shifted the focus from a teacher-centric approach, where only the teachers are responsible for framing the course material, to a more student-centric approach where the students participate in developing course content. The primary data consisted of information from interviews with the technology officers in selected rural school districts, while the secondary data included literature reviews and surveys of websites of schools in many countries and their broadband-based networks across the world that revealed current teaching practices involving broadband technology.

The initial plan for collecting primary data was to interview technology officers from 16 school districts in rural Pennsylvania. These school districts were selected in four regions of Pennsylvania using the same methodology as that used in the government sector study. In each region, two rural counties were identified that were adjacent to urban counties and two rural counties non-adjacent to urban counties. After the selection of counties, the school district in each county was identified. The school districts were identified on the basis of secondary data collected from the National Center for Education Statistics, U.S. Department of Education⁴.

The official website of the NCES provides a *Data Tool* that allows data on all school districts in the United States to be sorted under various categories. The data on all school districts in the selected counties in rural Pennsylvania were scanned. The school district that did not serve a MSA and had the highest number of students eligible for the Free-Lunch and Reduced-Price Lunch Program was selected for the study. The same methodology was used in selecting all 16 school districts for this study. In some of the school districts selected in the northeastern, northwestern, and southeastern regions, the technology officer could not be reached after repeated attempts over a one-month period. As a result, a replacement school

⁴ National Center for Education Statistics, <http://nces.ed.gov/index.asp>

district within the same region but in another county was identified and selected for an interview. This procedure, however, did alter the initial choice of counties located adjacent and non-adjacent to urban counties in each region but the selection of school districts based upon highest number of students eligible for Free Lunch and Reduced-Price Lunch was still maintained. A total of 12 interviews in the target 16 school districts were successfully conducted.

The point of contact for the interviews in all school districts was the technology officer with the exception of one school district in which the principal was interviewed because the school district did not have a technology officer. At first, the interview was conducted with the school principal, but answers to many questions regarding the availability of computers, the specifics of the broadband connection, and the type of training modules available to the staff were not known in great detail by that individual. After an initial discussion with principals interviewers were usually transferred to the school district's technology officer for answers to specific questions. After initial conversations with principals, all interviews were conducted thereafter with the technology officer in the school districts. The interview was conducted over the phone using a questionnaire with open-ended questions (see Appendix) that included a variety of topics related to broadband use in the local school district. The technology officer was asked about the extent of the availability of computers and broadband connections in all schools, the use of broadband by teachers and students in the curriculum, and the training provided to them for use of broadband. The answers to each question by all 12 respondents are summarized in this report under categories related to utilization, in order to give a consistent perspective of the current practices being used in school districts in rural Pennsylvania.

Healthcare

Like the education and e-government sectors, a multi-stage assessment of broadband utilization was used in this study. A website assessment using the e-government assessment protocol modified to reflect specific qualities of health care was conducted. In parallel, a sampling procedure was implemented to identify hospitals as possible interview candidates. Over a six-week period, hospitals were contacted and interviews were conducted when possible.

Based on the literature, a set of characteristics was selected that demarcated among hospital services as broadly discussed in the literature; these were then used in an ordinal scoring system to discriminate among websites. This served as a first cut at the analysis of broadband utilization in hospitals.

In the case study of healthcare, the same selection process was used as with the local government and education sectors: identifying four counties per region of the state, and then selecting one hospital facility per county. In some cases there was no hospital facility to speak to. In other cases a hospital facility could be identified but repeated attempts to identify the appropriate contact failed to locate a person in the hospital willing to speak with a member of the project team. Hospital interviews were conducted over a six-week period based on extensive calling and persistent soliciting of participation. The low response rate was attributed to the difficulty of identifying the key person in institutions who could answer questions. A three-step strategy was followed in contacting interviewees. First, phone calls were made to verify the institution and the person to speak with. Next, letters were sent and appointments were set up to conduct phone interviews. When steps 1 and 2 were

accomplished, an interview was conducted. In a number of cases, even with scheduled interviews, meetings could not be concluded with the intended respondent.

Over a six-week period of continuous contact, four interviews were secured with hospital administrators knowledgeable of facility technology practices. Of the 16 counties selected for the case study, 13 counties with hospital facilities were identified as possible interview subjects. An attempt was made to access websites for hospitals in all 13 counties. Three counties had hospitals that did not have individual websites. Of the remaining 10, oral interviews were secured with two hospital Information Technology Officials. Efforts were made to secure interviews with additional healthcare facilities in the remaining counties. Contact was made with two hospitals in two additional counties outside the original 16 selected. These were added to the interview pool. In the end, a total of four interviews were conducted. After selecting the sample, an analysis of healthcare facility broadband utilization was conducted in two stages. In the first stage we conducted assessments of the websites of the major health service providers in our final group of counties (see Table 2). In stage two, Technology Officers or other persons responsible for the implementation of broadband in the major medical facilities in the four counties were contacted. In completing these interviews the hospitals instructed interviewers not to reveal the name of the hospitals or their location. The report on broadband and healthcare thus reflects the desire for anonymity on the part by the hospitals. In the discussion of healthcare, counties referred to by name are those that were part of the website analysis. Since this information is publicly available, it did not present possible disclosure issues.

The evaluation of the hospital websites drew upon the e-Government assessment. The e-Government rating scheme was first examined to identify factors that applied to both

government and healthcare service provision. The websites of target groups were then examined and qualities were identified that were directly linked to broadband utilization. While there were overlaps between e-Government services and healthcare such as payments, maps, schedules, complaint forms, and rules and regulations, video conferencing between doctors and patients and other more interactive services were not evident. The literature on best practices in the health sector also revealed other broadband-enabled metrics currently available in hospitals in other states in the U.S., in urban areas of Pennsylvania, and in other countries. These additional metrics were then compiled into a single survey instrument under separate categories that was used to evaluate the hospitals' websites.

For the evaluation of the websites, a numerical scoring system from 0 to 4 was used, with 0 meaning service not present and 4 meaning that the transaction could be done completely on line (Table 3). According to this scoring system, 0 was assigned if, according to the hospital website, a particular service was not available at all. A score of 1 indicated that some information was present on the website related to a service—e.g., the name of the person to be contacted and/or the address where people could visit to collect more information. A score of 2 indicated that detailed text information was provided for a service and more contact information for relevant officers, such as email addresses or phone numbers, which could be used to get in touch with the hospital without having to travel to the hospital. A 3 was assigned if downloadable forms for various services such as appointments with doctors, job applications, donations, information release forms, etc., were available in addition to the contact information as mentioned for scores 1 and 2. The highest possible score was 4, which was assigned if an entire transaction could be completed online without having to visit the hospital at all. This meant that clients of the hospital could obtain contact