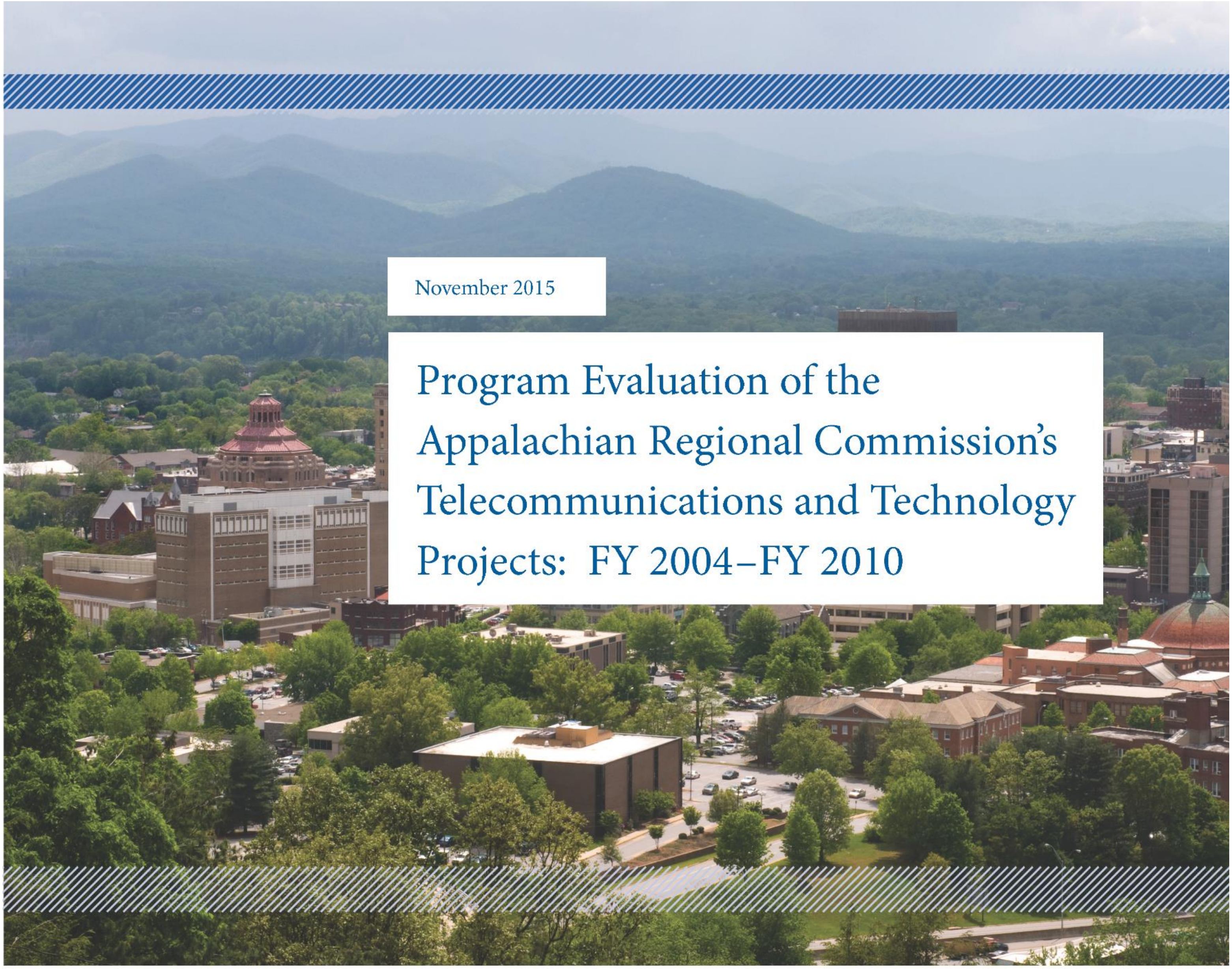

November 2015

Program Evaluation of the Appalachian Regional Commission's Telecommunications and Technology Projects: FY 2004–FY 2010

ARC
APPALACHIAN REGIONAL COMMISSION

Prepared for—

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RTI Project Number 0214556

RTI INTERNATIONAL

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1 Executive Summary

Broadband Internet and the telecommunications technologies that deliver it are integral to bolstering community economic development and alleviating the barriers to economic opportunity that persist in all too many Appalachian communities. Between fiscal year (FY) 2004 and FY 2010, the Appalachian Regional Commission (ARC) funded 322 projects as part of its telecommunications and technology program to increase broadband Internet availability, access, and adoption. These projects are highly diverse, encompassing different types of telecommunications and technology, geographies, scales, time spans, and costs. RTI International and a small team of consultants launched the evaluation to build and document a robust understanding of the impacts resulting from these projects. The RTI team also sought to identify important factors and glean best practices to guide future broadband Internet development efforts for the Appalachian Region.

The evaluation employed a five-pronged approach:

- a literature review on the importance of broadband Internet to rural community economic development
- a thorough description of the grant portfolio
- a survey to grantees, or closest available contacts, to share insights on the ARC grant impact not captured in closeout reports
- case studies of 18 select projects that highlight the tangible and intangible elements that helped foster the success of individual projects
- a review of the current policy environment and how those policies play a role in broadband Internet investments for the future

The timing and findings of this evaluation are significant as ARC finalizes and adopts a new strategic plan that recognizes the increased importance of broadband Internet for rural communities. The demands for broadband Internet in rural communities are numerous and intertwined with approaches for improving the social and economic conditions in the Appalachian Region. These demands are also growing rapidly as technology evolves and society becomes more dependent on the Internet for goods and services. At the same time, the policy environment for deploying broadband Internet is hyperdynamic, making it difficult for communities to ascertain the best path for improving broadband Internet deployment, adoption, and utilization for a future where all things are connected to the Internet.

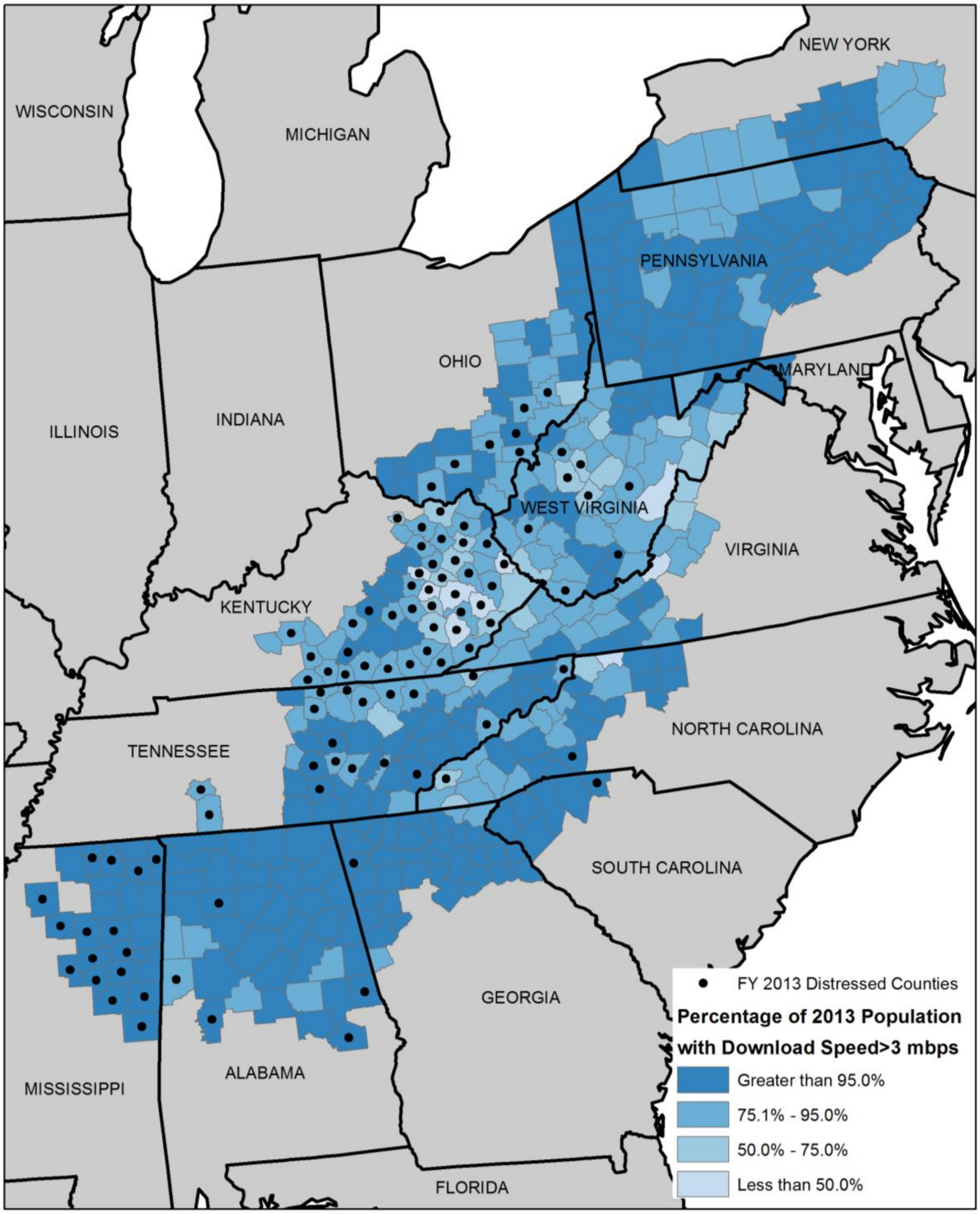
1.1 THE IMPORTANCE OF TELECOMMUNICATIONS PLATFORMS AND TECHNOLOGY FOR COMMUNITY ECONOMIC DEVELOPMENT

Broadband Internet telecommunications and technology is essential infrastructure for community and economic development today. Communities without access to broadband Internet face serious challenges such as lower access to quality health care, education, and training for workers and children and reduced access to markets for area businesses. Rural communities of Appalachia are no exception.

Research substantiates these assertions, showing that areas with higher levels of broadband Internet availability tend to perform better in economic development indicators such as income, unemployment, and job creation. Additionally, broadband Internet fosters positive benefits to education and health services, as well as lower costs for business transactions and government services. Applications including telemedicine, e-learning, and online business platforms have all shown important cost savings and benefits to users, particularly in rural areas.

The Appalachian Region, as defined by ARC, comprises 420 counties in 13 states from Mississippi to New York (see **Figure 1-1**). The Region is defined by a slow rate of population growth, below-average economic outcomes, and low rates of broadband Internet penetration. Within this Region, ARC designates distinct counties as economically "distressed." Using an index-based classification system for indicators including unemployment, income, and poverty, ARC identifies distressed

Figure 1-1. Access to Broadband Internet in the Appalachian Region: 2013



Data Source: National Telecommunications and Information Administration counties as those that fall in the lowest 10 percent of the nation's counties within these three indicators. As depicted in Figure 1-1, we found that distressed counties also tend to have the lowest availability of broadband Internet.

Some of these distressed areas face a trifecta of barriers—economic distress, declining population, and a lack of high-speed Internet availability—for community economic development (see **Table 1-1**). These trends are interrelated and cyclical in nature. Poor counties have less economic opportunity and thus can lose population as residents seek jobs elsewhere. Access, adoption, and utilization of broadband Internet by the Region's citizens and businesses is a catalytic factor for business growth and workforce development—two critical elements for increasing employment. The catalytic nature of broadband Internet is stymied, however, by the lack of access and adoption. This is exacerbated by broadband Internet service providers being less likely to provide services in sparsely populated areas because it initially has a lower return on investment and is less cost-effective.

Table 1-1. Broadband Internet Availability, Economic Distress, and Population Change in ARC Distressed Counties

	ARC County Designation FY 2014		
	Distressed (n=90)	**Not Distressed (n=330)**	**Difference**
Basic broadband Internet availability 2013[a]	83.6%	93.9%	10.2%[b]
Population change 2000–2010	+0.3%	+6.6%	5.3%[b]

[a] Basic broadband Internet defined as >3 Mbps download advertised speed

[b] Significant at the 99% confidence level

Source: ARC, U.S. Census Bureau, NTIA National Broadband Map

Availability alone is not a cure-all solution for issues related to telecommunications technology: projects must also address adoption issues that help residents of the Appalachian Region use broadband Internet. ARC, in its grantmaking efforts, targeted all aspects of telecommunications and technology, from increasing availability to improving adoption through devices, education, digital literacy, and Internet-based applications. Such a comprehensive strategy is essential to effecting the needed changes.

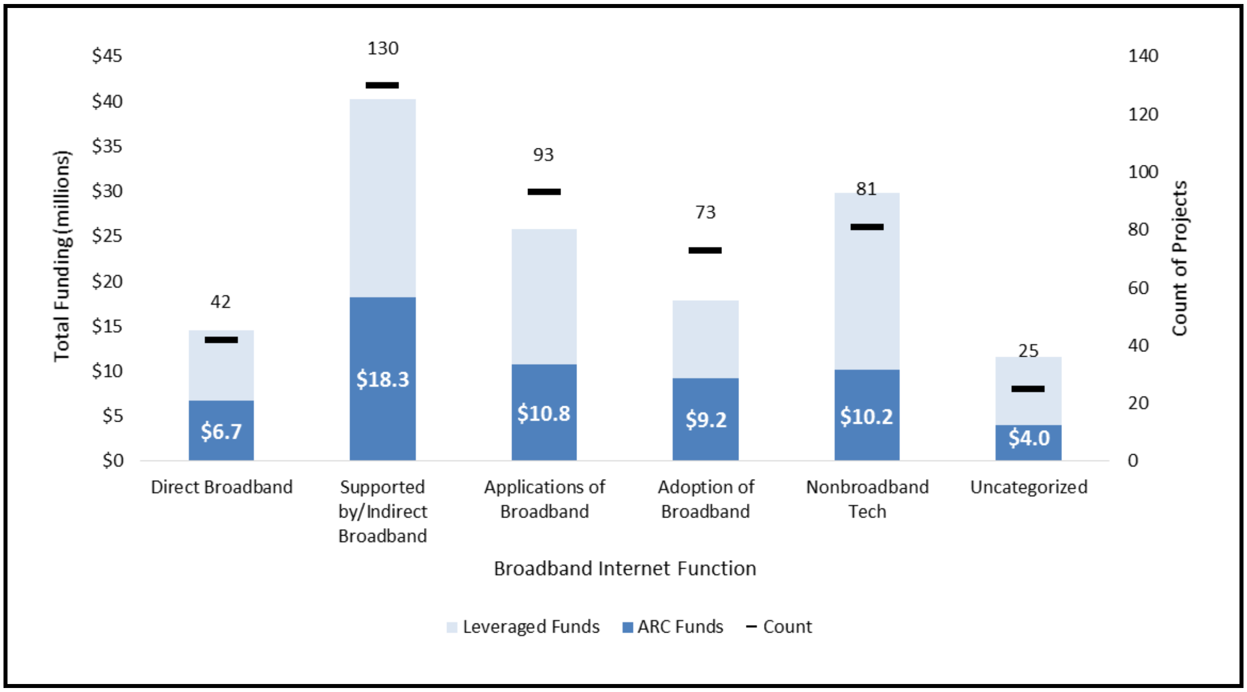
1.2 ARC TELECOMMUNICATIONS AND TECHNOLOGY GRANTS

During the period between FY 2004 and FY 2010, ARC granted nearly $41 million to telecommunications and technology programs, which leveraged another $59 million in local, state, and federal funding for a total of approximately $100 million over 322 projects. Over the 7-year grant period, ARC invested in a wide range of projects in terms of size, grantees, function, beneficiary, and geography. This range reflects the diverse needs and priorities of member states as they selected projects of most importance to their state.

We categorize ARC grants across the spectrum of broadband Internet functions beginning with the physical infrastructure of broadband Internet (direct broadband) and stretching across to the devices that connect to broadband Internet, to the applications to make use of the Internet, and adoption measures to improve knowledge and digital literacy. ARC invested across all of these stages of the spectrum in order to have the greatest impact on accessibility and adoption. **Figure 1-2** shows the number of grants and amount of funding allocated to the different functions that support broadband Internet. ARC frequently invested in equipment supported by broadband, such as computers and hardware to improve network connectivity within schools, hospitals, community centers, and government buildings. Additionally, RTI identified 101 projects that had multiple functions, addressing a variety of needs along the broadband Internet spectrum. Examples included projects that invested in equipment supported by broadband as well as a digital literacy curriculum to improve Internet adoption.

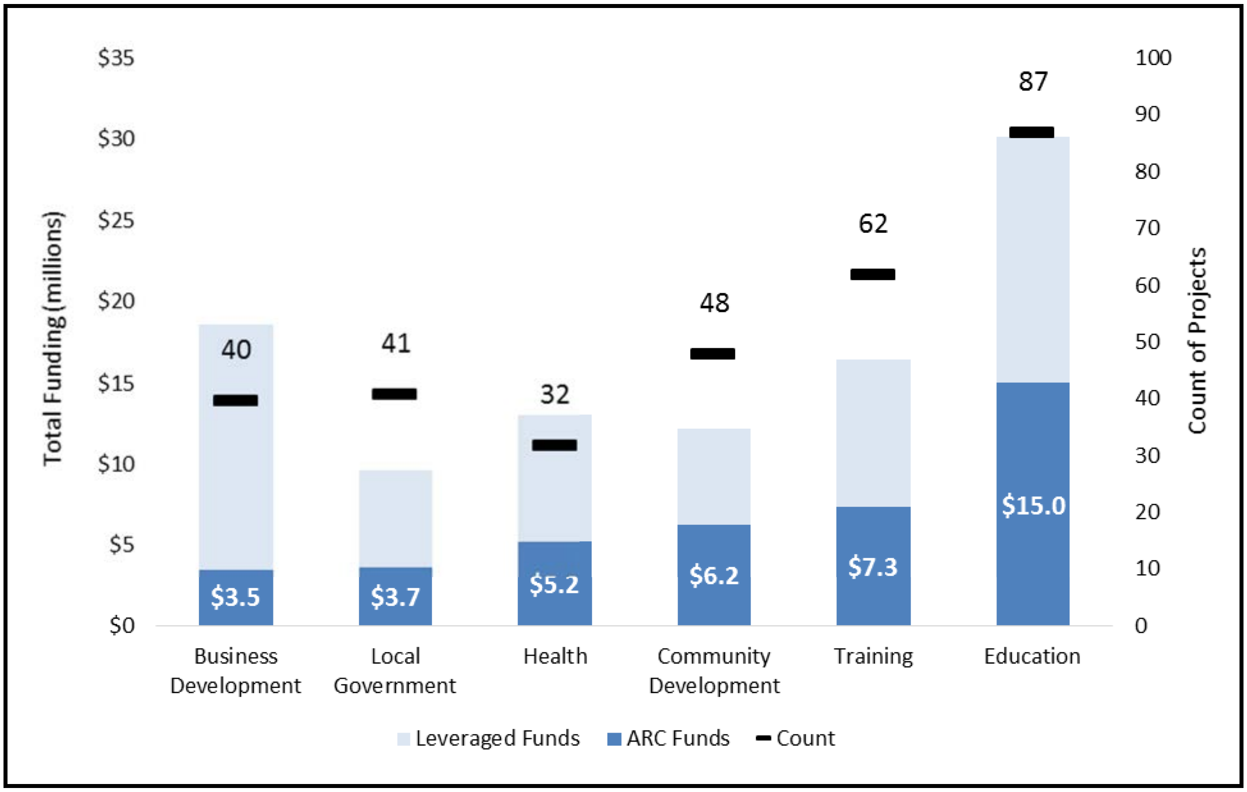
ARC’s grants also targeted different segments of the community. We describe these as primary beneficiaries of the grants. These beneficiaries are summarized in **Figure 1-3**. Project types varied by their primary beneficiary; education and job training projects accounted for over half of ARC’s funding during this period. Commonly, grants went to technology for classrooms, which often included equipment combined with digital literacy skills or an online learning curriculum. These initiatives, focused at K–12 education and job training, were meant to prepare individuals for both technology adoption at home and competitive skills in the job market.

Figure 1-2. ARC Funding and Count of Projects by Broadband Internet Functions



Source: ARC.net, RTI. Because of multifunctional projects, totals add to greater than portfolio totals.

Figure 1-3. ARC Funding and Count of Projects by Primary Beneficiary



Source: ARC.net, RTI

The outputs and outcomes from these investments, as documented at the close of ARC's involvement with each project, show how these grants affect the community in the short term. The numbers reveal a significant number of impacts on participants, patients, students, workers, businesses, and households that were served or improved as a result of the ARC grant. For example, ARC grantees improved 41,000 households; served over 5,000 businesses; created 2,800 jobs; leveraged over $10 million in private investment; and served 286,000 patients, 152,000 students, and 22,500 workers. All of the grant outputs and outcomes are illustrated in **Table 1-2**. These results also reflect the wide reach of telecommunications and technology grants in rural Appalachia, illustrating the importance of technology to health, education, business development, and local government capacity.

Table 1-2. Outputs and Outcomes at the Close of ARC Funded Projects: FY 2004–FY 2010

Performance Measure	Amount At-Close	n
Businesses created	101	11
Businesses served	5,176	36
Households improved	40,941	8
Jobs created	2,849	41
Jobs retained	759	6
Leveraged private investment	$10,319,458	15
Linear feet	756,494	10
Participants improved	212,625	34
Participants served	151,141	61
Patients improved	279,554	8
Patients served	285,994	9
Plans/reports	52	18
Programs implemented	108	34
Students improved	59,490	87
Students served	152,027	112
Telecommunications sites	676	108
Workers/trainees improved	10,058	57
Workers/trainees served	22,510	60

Note: n indicates the number of grants that used the corresponding performance measures for their projected goals or at-close performance measures. Includes totals for all grants (N=310).

Source: ARC Telecommunications and Technology Grants FY 2004–FY 2010, RTI

To get a sense of the performance of grants, we review how each grant performed at project close-out as compared with the stated goals at the grant's beginning. Fourteen percent of projects exceeded all of their goals—a notable achievement, particularly when projects have multiple goals. Fifty percent of projects met or exceeded their goals, while 55 percent of projects reached all of their goals by at least within 85 percent of their projected outputs or outcomes.

In terms of grant implementation, 55 percent of survey respondents indicated that they did not face challenges in carrying out their grant. For the 45 percent of respondents who self-reported facing challenges, the obstacles they most frequently confronted were issues with staffing including lack of expertise, not enough time to dedicate to the grant, and staff turnover. Difficulty in securing outside funding was the second most cited challenge by survey respondents.

Other issues in reaching performance goals related to the challenge of predicting project outputs and outcomes in the grant proposal, as well as the long-term nature of some of the outputs and outcomes. Leveraged private investment and businesses that were created, for example, can take several years to reach their target goals, which may not be captured adequately at the end of the grant period. More tangible measures such as plans completed or telecommunication sites or linear feet of fiber deployed tended to have better performance, while measures such as job creation or student improvement were more long term and harder to quantify in the short term. This finding underscores the importance of focusing on medium- to long-term impacts of the ARC grants. The RTI team's survey and case studies offer more insight into how projects evolved to have even greater impacts over time for the Appalachian Region.

1.3 LONG-TERM IMPACTS OF PROJECTS

Through its survey and case studies, RTI captured the long-term and qualitative impacts of projects that were not captured in the immediate closeout numbers. Survey results provided insights into the long-term impacts of projects after the close of the grant, which, in many cases, were greater than those that occurred during the grant period. For example, the number of businesses created (124) was greater than the original at-close performance measure of 101 businesses created. **Table 1-3** presents all of the stated after-close impacts from the survey, representing approximately one-sixth of the total ARC grant portfolio. Even though these figures represent a small portion of the overall portfolio, it is remarkable to note the kinds of impacts that the ARC grants have generated. For example, a telecommunications master planning initiative led to investments in quicker, more reliable, and significantly less expensive Internet service, serving over 10,000 students and 200 local businesses, all of which occurred as a result of the ARC-funded project.

Table 1-3. Stated Impacts of Projects after the Close of the ARC Grant Period

Impact Type	Sum of Impacts	Count of Respondents
Businesses created	124	5
Businesses served	2,116	12
Households improved	287	8
Jobs created	2,883	8
Jobs retained	415	6
Funding leveraged	$72,754,002	5
Linear feet of broadband Internet established	113,040	2
Participants improved	4,659	7
Participants served	4,719	9
Patients improved	1	1
Patients served	212,345	4
Plans or reports created	17	6
Programs implemented	105	14
Students improved	19,070	12
Students served	49,646	25
Telecommunications sites established	2	2
Workers/trainees improved	1,412	9
Workers/trainees served	3,067	12

Note: Paired output/outcome measures are shaded in gray.
Source: RTI Survey Q13

Moreover, over three-quarters of projects surveyed continued after the end of the ARC funding period, and over half of projects surveyed received follow-up funding from a variety of sources, indicating the longevity of ARC's investments. We identified three types of additional long-term impacts of projects that fell outside of ARC's traditional performance numbers:

- *Increased capacity*
  ARC's investment increases the capacity of local institutions to deliver better services, meeting a broad array of ongoing, local needs. This improvement was found across educational institutions, public entities, health care facilities, nonprofit organizations, and private businesses.
- *Bolstered economic viability*
  The support received through ARC also bolstered the economic viability of the area by targeting fundamental roadblocks to workforce development and business recruitment, among other important growth opportunities.
- *Catalyst for longer-term transformation*
  ARC's funding is considered by many respondents as a catalyst for longer-term transformation. Targeted projects are often described as the first steps that underpin larger, enduring efforts that have shifted the way communities have progressed. Inclusive engagement and collaboration effected by the projects create a platform for future efforts.

In addition to its survey, the RTI team conducted a series of case studies to provide additional insights into the nature of how projects were able to succeed in achieving their goals and promoting long-term development. Common themes among the 18 case studies included the following:

- attention to the evolving nature of technology with a focus on open system and adaptable solutions,
- proactive planning with embedded adaptability, and
- organic partnerships unified by a shared sense of need and vision.

These traits were common threads in both project design and implementation that helped the grants realize greater potential as they were designed and implemented.

1.4 THEMES AND RECOMMENDATIONS FOR THE FUTURE

The forces shaping the telecommunications ecosystem today are very different from those that defined it through much of the FY 2004 to FY 2010 evaluation period. The shift to cloud computing, the explosive adoption of mobile devices, the emergence of the Internet of Things, and the massive move of services in key sectors to web-based platforms are fundamentally changing the paradigm of how individuals and organizations access and use digital information. Understanding the policy environment is important because there are many cross-cutting and significant implications for businesses, workers, households, and community-based institutions like libraries and schools as they seek to flourish and maintain relevance in the future.

To help inform these kinds of decisions, we reviewed 22 policy issues that underpin key dynamics important for the future of broadband Internet in Appalachian communities. They are summarized in **Table 1-4**. Even a brief summary of cross-cutting issues facing broadband Internet access, provision, and deployment underscores the hyperdynamic policy environment for the organizations, agencies, and individuals involved. The stakes are high, with significant potential for winners and losers to emerge. Certain policy directions could make it much easier or much more difficult for rural communities to access and use broadband Internet. Some of the cross-cutting issues, such as "dig and wire once" policies and public–private partnerships, will be driven at the local and state levels, while other issues, such as net neutrality, will be dealt with at the federal level. ARC and its member states can stay abreast of these issues at all levels and monitor how the Region will be affected by rules and regulations as they unfold. As ARC forges into a new period of telecommunications and technology grantmaking, it can navigate this volatile policy climate and adjust its course accordingly so that ARC and its member communities can best carve out a role for its investments to have the greatest long-term impacts.

Table 1-4. Key Policy Issues in Broadband Internet

Function	Key Policy Issues
Direct broadband	• Copper-to-fiber transition/"IP Transition" • Mobile vs. fiber • Gigabit cities • Last-mile connectivity • Electric co-ops, municipal electric utilities, and other entrants into the marketplace • Public–private partnerships
Indirect broadband/ supported by broadband	• Mobile device penetration • Connected devices to the Internet or the "Internet of Things" • Cloud computing • Medical insurance for telehealth projects
Applications of broadband	• Legal barriers to telemedicine • e911 needs coordination with FirstNet • Schools are shifting to digital curricula and e-textbooks • Certification issues surrounding distance learning for teachers
Availability of broadband	• E-rate program • Federal and state government funding for broadband Internet
Across all functions	• Net neutrality • "Dig and wire once"/coinvestment • Local choice • Cybersecurity/privacy of data • Tax policy • Broadband Opportunities Council

Source: RTI and Consultant Team.

Building on the understanding of the overactive and unstable policy climate, combined with the findings from the evaluation's literature review, grant portfolio summary, survey, and case studies, the RTI team developed a series of recommendations for action going forward. They fall into a three categories: understanding broader themes in broadband Internet, addressing pressing needs for the Appalachian Region, and effectively managing information and grants moving forward. Each of these recommendations comes with several action items that can help inform state program managers looking to develop strategies for telecommunications and technology-based development in their respective regions.

- *Understanding broader themes in broadband Internet*: In rural America, broadband Internet is an essential tool for connectivity that faces serious obstacles to deployment and accessibility. Some of the obstacles include a lack of incentives for the private sector, inadequate information, expensive last mile connectivity, and legacy technologies that become obsolete relatively quickly. ARC can continue to act proactively in this changing landscape by engaging in public–private partnerships, sharing knowledge among shareholders, investing in last mile projects, and prioritizing projects with technology that will be viable in the long term, such as high-capacity fiber.
- *Addressing pressing needs for the Appalachian Region*: The Region has a series of particular needs for Internet access that are similar to the rest of the rural United States. Affordability and digital literacy are among the principal barriers to adoption among individual users. Pressing needs in health, education, and job creation can be addressed by improving broadband Internet availability and creating legal structures that encourage innovative, technology-based solutions such as telemedicine and e-learning that can benefit rural populations.
- *Defining the role of ARC moving forward*: Between FY 2004 and FY 2010, ARC was flexible in its investments and, as a result, reached out to a wide range of beneficiaries through diverse grants across the entire telecommunications and technology spectrum. With its experience, ARC is uniquely positioned to be an expert on best practices and a nexus for information. Additionally, by improving its data collection, evaluation, and grant management techniques, it can continue to gain rich information and insights on the impacts of grants in the medium to long term. With its state program directors, ARC can contribute to greater future success by sharing information among states and grantees and conducting follow-on surveys at regular intervals after the close of each ARC-funded project.

Through ARC-supported efforts, distressed communities throughout Appalachia acquired telecommunications infrastructure, technology, training, and investment that resulted in improved access to education, health care, government and community services; business development; job training; and improved employability. These projects enabled public and nonprofit organizations to dramatically change the way they interact with clients and increase the number and quality of services delivered. ARC grants expanded the capacities of technology-assisted teachers in the Appalachian Region and reached learners of all ages through innovative educational strategies.

Beyond the ARC grant period, most projects sustained local support to continue or expand their operations. High levels of community support attest to the fact that local stakeholders valued ARC's effort. Additionally, high reported impacts after closeout offer evidence of sustained, long-term development that was not originally captured in the at-close numbers. The findings from RTI's evaluation, in conjunction with expert assessment of changes in the broadband regulatory, technical, and market arenas, form the basis of recommendations that can provide guidance to ARC as it looks forward. By helping other communities shape and build a more competitive, broadband-enabled future, ARC will remain on the forefront of rural telecommunications and technology development.

2 Introduction

The purpose of this evaluation is to obtain a robust understanding of the range of impacts that resulted from the ARC's telecommunications and technology portfolio of investments between FY 2004 and FY 2010. As ARC finalizes and adopts a new strategic plan that recognizes the increased importance of broadband Internet for rural communities, with these findings, ARC and other stakeholders can be more informed on ways to continue to improve broadband Internet access and affordability.

In this section, we explain the purpose and program design of this ARC initiative, summarize the socioeconomic conditions and state of broadband Internet availability and affordability in the Appalachian Region, and briefly describe the ARC telecommunications and technology grant portfolio.

2.1 PURPOSE

Broadband Internet and the telecommunications platforms that deliver it are integral to strategies to alleviate the economic and social distress that defines all too many Appalachian communities. ARC funded 322 grants as part of its telecommunications and technology program between 2004 and 2010 for their potential to increase Internet access. It aimed to improve infrastructure and to increase the availability and adoption of online health care and educational services in the Region. These projects are highly diverse, encompassing different types of interventions, geographies, scales, time spans, and costs.

Given the importance of broadband Internet and the technologies that rely on it for future economic development of the Appalachian Region, it is important to understand the impacts that these investments have had on Appalachian communities and the people that live and work there.

Given the importance of broadband Internet and the technologies that rely on it for future economic development of the Appalachian Region, it is important to understand the impacts that these investments have had on Appalachian communities and the people that live and work there. Furthermore, given the highly diverse nature of the projects and the hyperdynamic broadband Internet policy environment that ARC is operating in, it is critical to evaluate these projects with a thoughtful multidimensional approach that can best demonstrate the scale and illuminate the nuances of the results of these projects.

RTI International partnered with a team of the nation's leading rural broadband Internet and telecommunications experts to conduct this evaluation from October 2014 through October 2015. RTI is an independent nonprofit research institute, headquartered in Research Triangle Park, North Carolina, that provides research, development, and technical services to government and commercial clients worldwide. The small team of consultants engaged on this evaluation collectively has over 120 years of experience in digital and broadband Internet technologies and deployment of large and small networks at the local, state, national, and international levels. The consultants were

- Jim Baller, Broadband Internet Legal Expert;
- Mark Johnson, Broadband Internet Technical Expert;
- John Horrigan, Broadband Policy Expert;
- Jane Smith Patterson, Broadband Internet Development, Deployment, and Policy Expert;
- Ashley Stelfox, Broadband Internet Legal Expert; and
- Deborah Watts, Broadband Internet Evaluation and Implementation Expert.

Together RTI and the expert consultants bring experience in the telecommunications and media sectors, rural community economic development, and rigorous data collection and evaluation.

With this evaluation, the RTI team provides ARC with detailed data about the impacts of its telecommunications and technology projects from 2004 through 2010. Our survey and case studies help inform ARC and other rural broadband Internet stakeholders about what tends to work well with these kinds of investments and ways for investors to improve similar kinds of projects. Moreover, we understand the highly dynamic policy environment of broadband Internet, and the team has tailored the research to help rural broadband Internet stakeholders navigate decision making within this context for the future.

2.2 THE APPALACHIAN REGION

The Appalachian Region, as defined by ARC, contains 420 counties in 13 states from Mississippi to New York. The Region is defined by a slow rate of population growth, below-average economic outcomes, and low rates of broadband Internet penetration. Understanding these factors is important in framing the challenges the Region faces in telecommunications and technology adoption.

2.2.1 Demographics: 2000 through 2010

In 2010, the Appalachian Region was home to over 25 million people. The Region grew between the 2000 and 2010 census, but its rate of growth was lower than that of the United States as a whole. **Table 2-1** shows the change in population over the 10-year period.

Table 2-1. Population Change in the Appalachian Region: 2000–2010

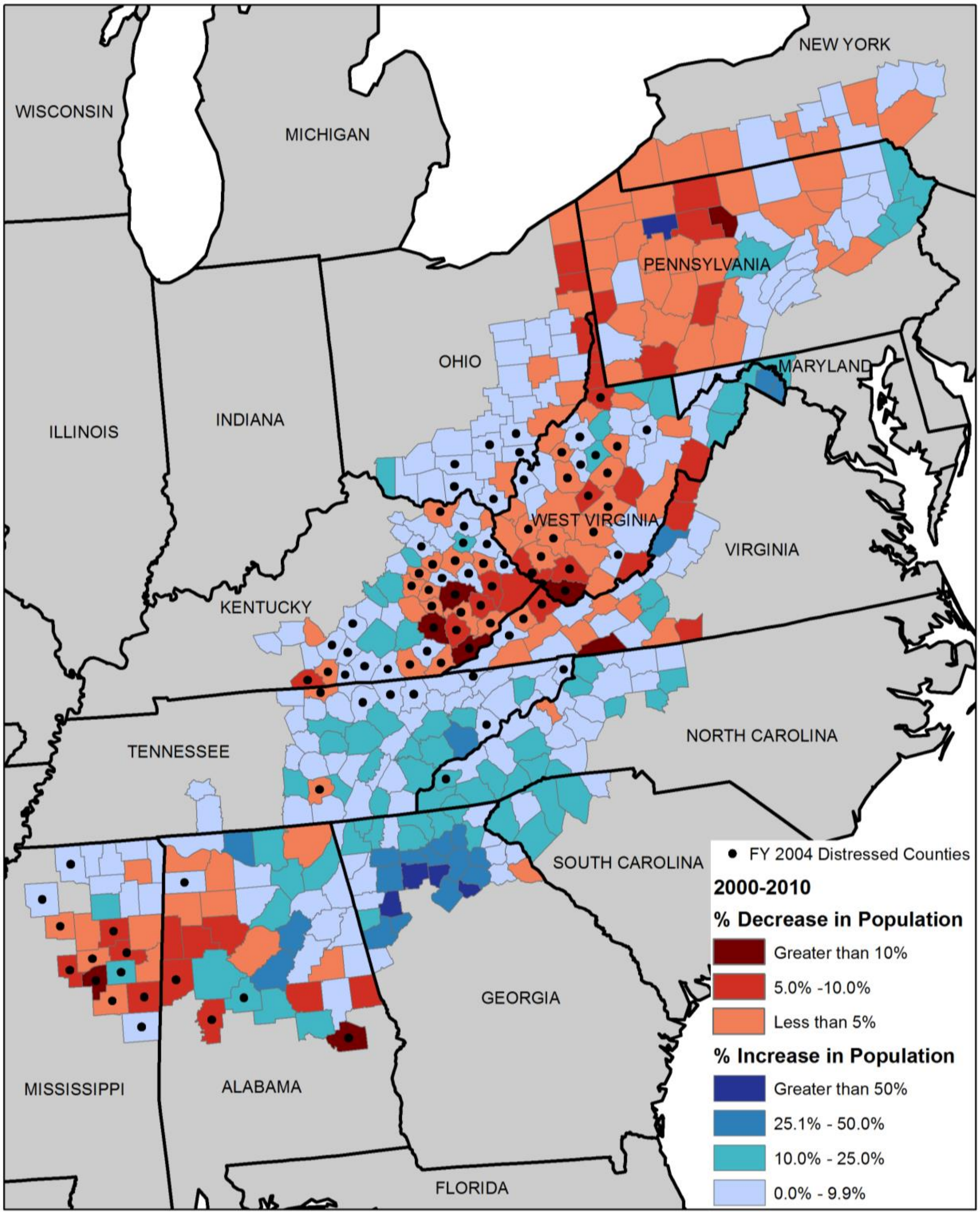
	Population		
	2000	**2010**	**Change, %**
United States (total)	281,421,906	308,745,538	+9.7
Appalachian Region	23,462,578	25,243,456	+6.8

Source: U.S. Census Bureau, ARC

Population growth and decline have not been evenly distributed across the Appalachian Region. **Figure 2-1** shows the change in population by county in the Region between 2000 and 2010. As the map indicates, the largest regional outflow of people during the decade was from Northern and Central Appalachia, particularly in Kentucky, West Virginia, and Pennsylvania. Additionally, economically distressed[1] regions of Alabama and Mississippi suffered significant population losses. Growth was concentrated in Georgia and Southern Appalachia.

[1] Economic distress is an indexed measure of income, poverty, and unemployment used by ARC to define the economic well-being of counties for program funding.

Figure 2-1. Percentage Change in Population by County in the Appalachian Region: 2000–2010



Data Source: U.S. Census Bureau

As a whole, the Region is growing more slowly than the rest of the United States and its population is increasingly aging. The Region is characterized by an outflow of younger, skilled workers. **Table 2-2** shows that from 2000 through 2010 the Appalachian Region had a higher percentage of the population over age 65 than the nation, and the proportion of residents over 65 has been growing more quickly as a share of the population in the Region.

Table 2-2. Portion of the Population over Age 65: 2000–2010

	Percent, %		
	Population Over Age 65		
	2000	2010	Change
United States (total)	12.4	13.0	+4.8
Appalachian Region	14.3	15.1	+5.6

Source: Center for Regional Economic Competitiveness and West Virginia University

According to the ARC-commissioned report *Appalachia: Then and Now: Examining Changes to the Appalachian Region Since 1965*, prepared by the Center for Regional Economic Competitiveness (CREC) and West Virginia University, the Region has poorer health outcomes and higher rates of mortality than the national average. In 2010, there were 1,018 deaths per 100,000 population (not age adjusted) in the Appalachian Region compared with an average of 800 for the country as a whole.[2] Health outcomes are indicative of the larger elderly population and limited access to critical health services in rural areas.

2.2.2 Economy: 2000–2010

The Appalachian Region has higher rates of poverty and lower per capita market income compared with the United States average.[3] The Appalachian Region has a higher percentage of

[2] Center for Regional Economic Competitiveness and West Virginia University. February 2015. *Appalachia Then and Now: Examining Changes to the Appalachian Region Since 1965*. Prepared for the Appalachian Regional Commission. Accessed at http://www.arc.gov/assets/research_reports/AppalachiaThenAndNowCompiledReports.pdf on August 12, 2015.

[3] Appalachian Regional Commission. No date. "Data Reports: Select Data Topics." Accessed at http://www.arc.gov/data on September 23, 2015.

people in poverty, and that percentage is continuing to increase (see **Table 2-3**).

Table 2-3. Poverty Rates: 2000–2010

	Percent, %		
	Poverty		
	2000	2010	Change
United States (total)	12.4	13.8	+11.2
Appalachian Region	13.6	15.6	+14.7

Source: ARC Data Reports[4]

Fewer job opportunities, a more prominent informal sector, and a portion of the population receiving government transfer payments all contributed to a low labor force participation rate.

In addition to high rates of poverty, the Region has a lower labor force participation rate than the country as a whole. The CREC and West Virginia University report also stated that the labor force participation rate in the Region was 59.5 percent compared with a 64.2 percent national average. It argued that fewer job opportunities, a more prominent informal sector, and a portion of the population receiving government transfer payments all contributed to a low labor force participation rate.[5]

The Appalachian Region's high rates of poverty and joblessness are related to the per capita market income, which is below the national average. The Appalachian Region's per capita market income was $24,425 in 2010 compared with $32,562 for the United States, a difference of $8,137 (see **Table 2-4**).

Table 2-4. Per Capita Income: FY 2004–FY 2010

	Per Capita Market[a] Income, $		
	2004	2010	Change, %
United States (total)	28,187	32,562	+15.5%
Appalachian Region	21,587	24,425	+13.1%

Source: ARC Data Reports

[a] Per capita market income defined as total personal income less transfer payments, divided by population

[4] Appalachian Regional Commission. Data Reports website. Accessed at http://www.arc.gov/data on August 30, 2015.

[5] Center for Regional Economic Competitiveness and West Virginia University. February 2015. *Appalachia Then and Now: Examining Changes to the Appalachian Region Since 1965*. Prepared for the Appalachian Regional Commission. Accessed at http://www.arc.gov/assets/research_reports/AppalachiaThenAndNowCompiledReports.pdf on August 12, 2015.

ARC uses an index to indicate levels of economic well-being: "distressed" is the most critical.

Within the Region, there are important differences in economic conditions, which ARC accounts for using its county economic status designation. ARC uses an index to indicate levels of economic well-being; "distressed" is the most critical. Three indicators are used to determine the categorization of county economies: 3-year average unemployment rate, per capita market income, and poverty rate.[6] ARC emphasizes investments in economically distressed areas. As research later in the report shows (see **Section 4.4**), income and costs of service are critical limiting factors in the success of telecommunications and technology adoption in the Region, particularly in economically distressed areas.

2.2.3 Broadband Internet Access: 2004–2013

The National Telecommunications & Information Administration (NTIA) defines basic broadband Internet service as having advertised speeds of greater than 3 Mbps download. NTIA considers that to be sufficient for sending email and using other basic Internet services.[7] NTIA calculates the approximate number of households by county that have access to basic broadband Internet services. Availability is the first step in adopting Internet-based applications, and it serves to indicate the level of broadband Internet infrastructure in a region.

In 2004, Oden and Strover outlined the state of broadband Internet deployment in the Appalachian Region, noting that in that year 88 percent of zip codes in the United States had access to a broadband Internet service provider. However, only 58 percent of the Appalachian Region had the same access. They argued that the modern digital divide between the Region and the rest of the United States would become a contributing factor in lower economic opportunity for those living in the Region.[8] Telecommunications and technology availability in the Appalachian Region have changed dramatically since the

[6] Appalachian Regional Commission. No date. "County Economic Status and Distressed Areas in Appalachia." Accessed at http://www.arc.gov/appalachian_region/CountyEconomicStatusandDistressedAreasinAppalachia.asp on September 23, 2015.

[7] NTIA, U.S. Department of Commerce. May 13, 2013. "NTIA Explores Broadband Availability in New Report Series." Accessed at http://www.ntia.doc.gov/blog/2013/ntia-explores-broadband-availability-new-report-series on September 23, 2015,

[8] Oden, Michael and Strover, Sharon. June 2004. "2004 Update: Links to the Future: The Role of Information and Telecommunications Technology in Appalachian Economic Development." University of Texas.

publication of the report. Broadband Internet penetration in the Region had improved significantly by 2013, reaching approximately 92 percent of households.

Broadband Internet penetration in the Region had improved significantly by 2013, reaching 92 percent of households, However, availability was lower than the national average and unevenly distributed across the Region.

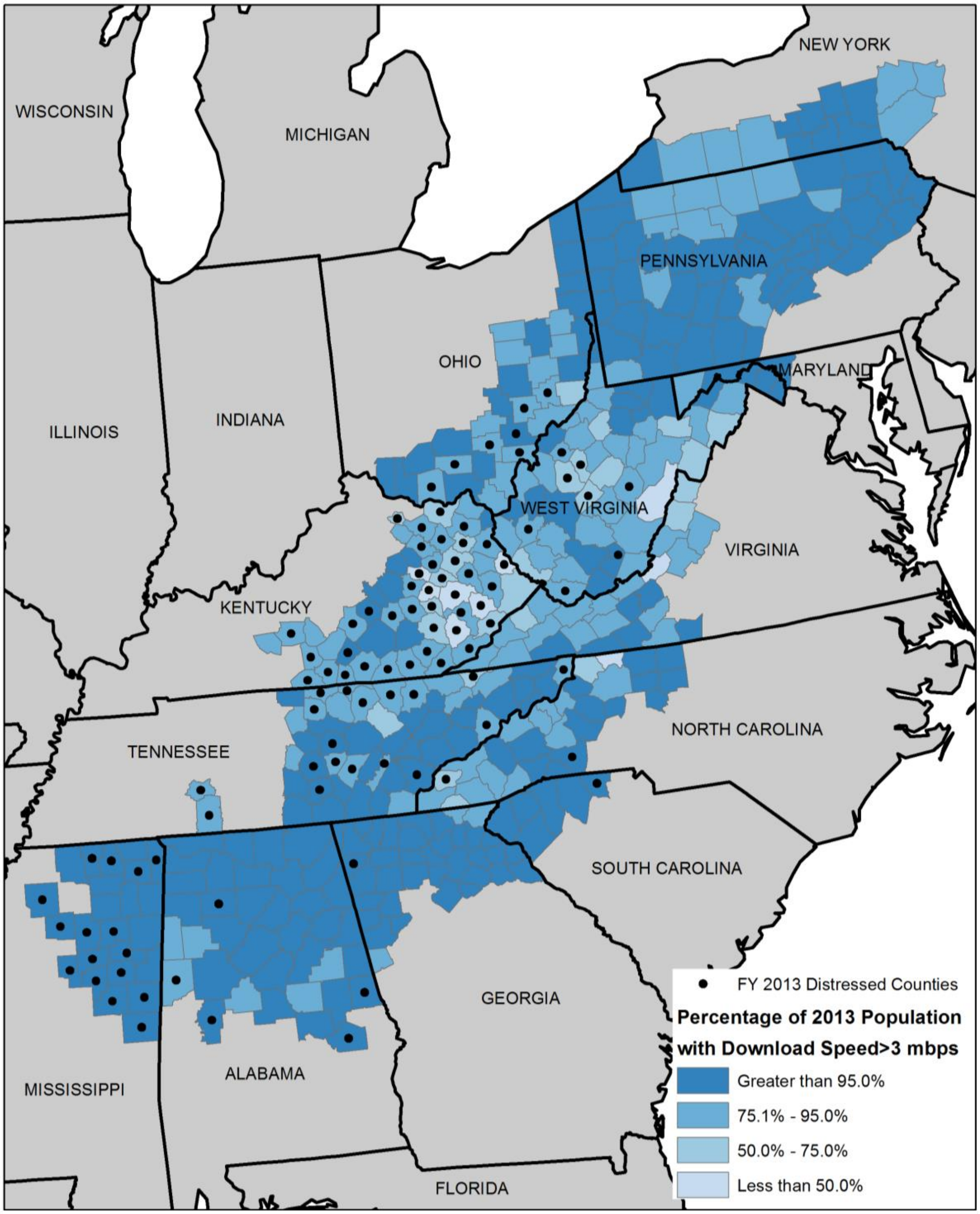
Despite the significant advances, availability was lower than the national average and unevenly distributed across the Region. **Figure 2-2** highlights basic broadband Internet availability in the Appalachian Region in 2013, representing the most up-to-date data available. It illustrates the low levels of broadband Internet availability in economically distressed areas, particularly in the central region of Tennessee, Kentucky, and West Virginia.

To better understand the relationship between broadband Internet availability, economic distress, and population change, we present data for each of these indicators in **Table 2-5**. The data show that economically distressed counties tended to have lower rates of broadband Internet availability (83.6 percent as compared with 93.9 percent for nondistressed counties) and flat population growth (0.3 percent population change in distressed counties compared with 6.6 percent in nondistressed counties). These data reinforce Oden and Strover's hypothesis that low levels of broadband Internet access are related to poor economic conditions. There was over a 10 percentage point difference in broadband Internet availability between economically distressed and nondistressed counties in 2013. Although this statistic does not prove a causal relationship, it shows a correlation between economic conditions and broadband Internet availability.

There was nearly a 13 percentage point difference in broadband Internet availability between economically distressed and nondistressed counties in 2013. Although this statistic does not prove a causal relationship, it shows a correlation between economic conditions and broadband Internet availability.

Taken together, the data show that distressed areas face a trifecta of barriers for community economic development: economic distress, declining population, and a lack of high-speed Internet availability. These trends are interrelated and cyclical in nature. Poor counties have less economic opportunity and thus can lose population as residents seek jobs elsewhere. Broadband Internet is an infrastructure critical for business growth and workforce development—two critical elements for increasing employment. A lack of access to broadband Internet can constrain counties trying to improve their community economic development because business owners, workers, students, parents, and health care providers are not able to access the digital economy and society. This situation is exacerbated by the fact that broadband Internet service.

Figure 2-2. Access to Broadband Internet in the Appalachian Region: 2013



Data Source: National Telecommunications and Information Administration

Table 2-5. Broadband Internet, Economic Distress, and Population Change in Appalachian Counties

Basic Broadband Internet Availability and Population Change	ARC County Designation FY 2014 Distressed (n=90)	Not Distressed (n=330)	Difference
Basic broadband Internet availability 2013[a]	83.6%	93.9%	10.2%[b]
Population change 2000–2010	+0.3%	+6.6%	5.3%[b]

[a] Basic broadband Internet defined as >3 Mbps download advertised speed
[b] Significant at the 99% confidence level
Source: ARC Data Reports, U.S. Census Bureau, NTIA National Broadband Map

providers are less likely to provide services in sparsely populated areas because it is not cost-effective

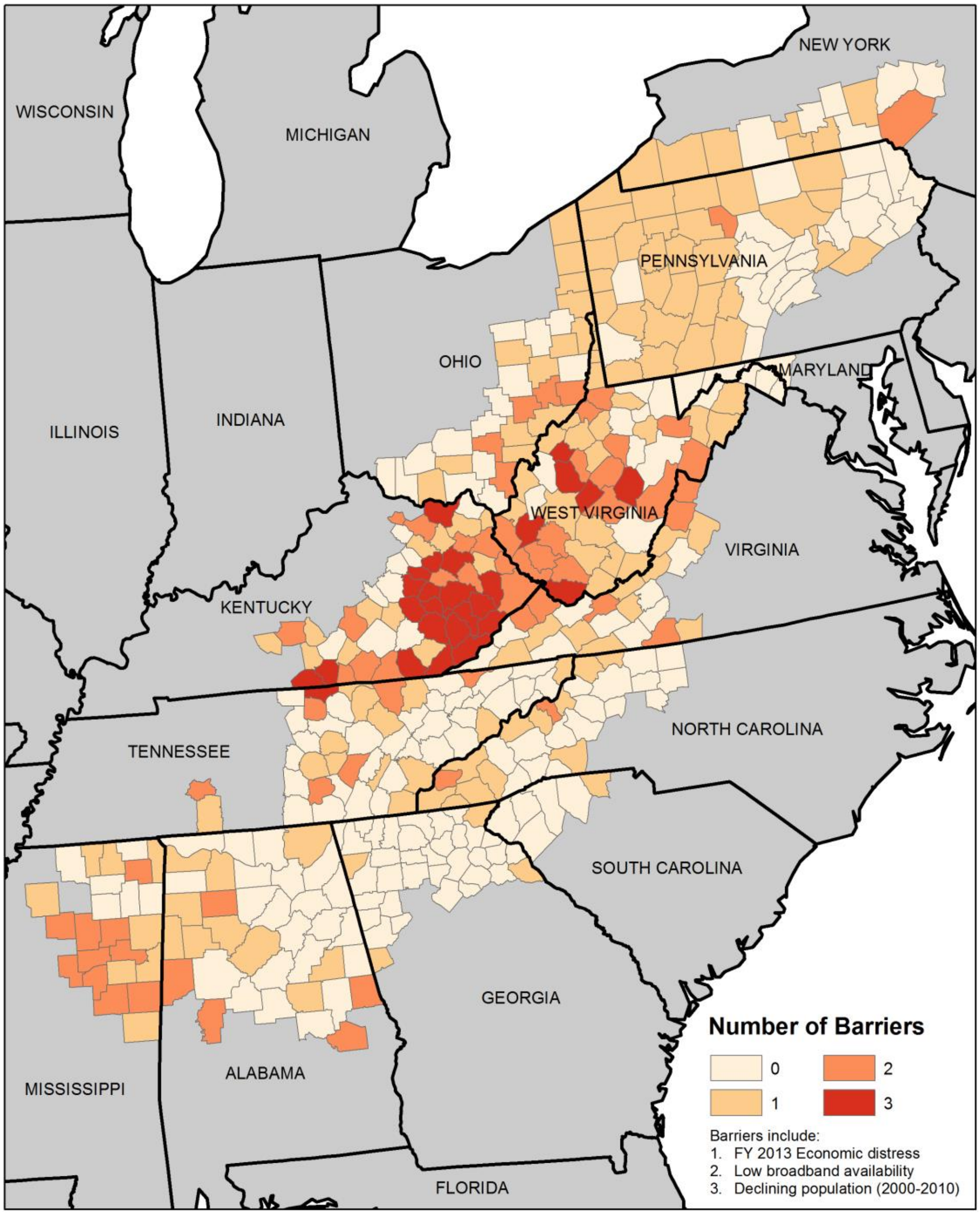
The dynamics of these three trends working in tandem in counties within the Appalachian Region underscore the importance of investments by organizations like ARC in improving telecommunications service and technology in economically distressed areas. **Figure 2-3** shows the Appalachian counties that face multiple barriers to community economic development. A barrier is defined as one or more of the following characteristics: economic distress, low levels of broadband Internet availability, declining population. Nearly every state has counties experiencing one or more barriers, while Kentucky and West Virginia have a concentration of multiple counties experiencing all three barriers.

As a whole, more people in the Region today have access to high-speed Internet services, and continuing expansion of wired and wireless technology will increase access. However, counties with economic distress and declining population are continuing to fall behind in the Region. Improving access will allow Appalachian residents better access to business, education, health, and other opportunities through the Internet.

There are new challenges regarding Internet adoption and improving technology.

- Private telecommunications providers will be less likely to invest in areas with declining population, viewing a lower return on investment from a shrinking potential customer base. This could have increasingly negative effects on areas experiencing two and three barriers to community economic development (see **Figure 2-3**).

Figure 2-3. Appalachian Counties Facing Multiple Barriers to Community Economic Development: 2013



Data Source: Applachian Regional Commission

- Broadband Internet availability is not sufficient; there are significant challenges in broadband Internet adoption. NTIA and the Federal Communications Commission (FCC) broadband Internet figures indicate the availability of service: they not indicate the percentage of Internet users. Barriers to adoption include cost of a device to connect, service costs, and digital literacy of the user.
- Increased demand for high-tech online services and advancing technology in digital and fiber communications is increasing Internet speeds across the country. Business, educational, and health applications such as cloud computing and teleconferencing require higher speed service beyond the NTIA definition for basic broadband Internet. In 2014, NTIA and FCC updated the threshold for high speed broadband Internet to >25MB/sec download, >3MB/sec upload.[9]

ARC, through its telecommunications and technology program, focused on improving the broadband Internet infrastructure, applying technology to educational, economic, and health outcomes, as well as helping to overcome the cost barriers to technology adoption.

2.2.4 Demographics, Economics, and Internet Usage

In 2015, the Pew Research Center reported that older, rural Americans were among the most likely not to use the Internet.

The aforementioned demographic and economic shifts have an impact on how telecommunications technology affects economic development. The shifts highlight the urgency of using telecommunications technology through the broadband Internet to improve health, education, and economic outcomes and provide more opportunities for well-paid jobs for young people in the Region. They also indicate that the Region still faces important obstacles that ARC is working to overcome.

In 2015, the Pew Research Center reported that older, rural Americans were among the most likely not to use the Internet. Thirty-nine percent of those age 65 or older, as well as 24 percent of rural Americans, reported not using the Internet in 2015.[10] Both groups were well above the national average of 15

[9] Federal Communications Commission. January 29, 2015. "FCC Finds US Broadband Deployment Not Keeping Pace." Accessed at https://apps.fcc.gov/edocs_public/attachmatch/DOC-331760A1.pdf on August 1, 2015.

[10] Anderson, Monica and Perrin, Andrew. July 2015. "15% of Americans Don't Use the Internet. Who Are They?" Pew Research Center. Accessed at http://www.pewresearch.org/fact-

percent of Internet nonusers. As ARC works to improve Internet access in the Region, it must also work to help older, rural communities adopt Internet-based technology that can provide important economic, health, and educational benefits to communities.

2.3 ARC'S TELECOMMUNICATIONS AND TECHNOLOGY PROGRAM

2.3.1 Background and Purpose

ARC's telecommunications and technology program was built from the ARC Telecommunications Strategic Initiative adopted in November 2001. Congress authorized this initiative by stipulating that funds allocated may be used for telecommunications investment, and authorized a special telecommunications authority to oversee investments. The authorization suggested that $33 million of a larger funding authorization could be used[11] for telecommunications and technology projects through FY 2006. States then selected how to designate funding allocations across all ARC programming, including economic development, health, and education.

When Congress authorized this funding, it did emphasize telecommunications: "While much of the Nation is experiencing the benefits of access to technology and communications, Appalachia has extremely limited access to these assets." [12] Unlike other kinds of infrastructure (e.g., highways, water, and sewer), telecommunications and technology infrastructure is provided by the private sector, "… but building advanced telecommunications infrastructure in low-density rural areas is difficult for private companies to achieve without subsidies to assist with construction costs."[13] Thus, ARC embraced the role to help the Region gain access to this modern information highway as a means to "help the region achieve economic parity with the Nation."[14]

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tank/2015/07/28/15-of-americans-dont-use-the-internet-who-are-they/ on August 1, 2015.

[11] Land, Guy. September 28, 2015. Chief of Staff, Appalachian Regional Commission. Personal email.

[12] Section 203 of the Appalachian Regional Development Act.

[13] Appalachian Regional Commission. "Telecommunications: Information Age Appalachia." Accessed at http://www.arc.gov/telecom on July 26, 2015.

[14] Ibid. Accessed on July 26, 2015.

Two of ARC's strategic plans (1997 and 2005) helped reinforce the grantmaking for this portfolio under evaluation (FY 2004 through FY 2010).

2.3.2 Program Design

ARC's program guidelines stress the importance of the grants in addressing the significant disparity in access to modern telecommunications and technology infrastructure with an emphasis on improving access in distressed counties. Funding was allocated "to increase affordable access to advanced telecommunications services, provide education and training, assist industry groups and businesses in preparing to use technology, and support entrepreneurial opportunities in these areas in the Region."[15] The initiative was designed to help citizen groups, educators, health care providers, and businesses with technological advancements. Grants help the Region achieve goals in four main areas:

1. Increase affordable access to advanced telecommunications, entrepreneurship, and management technologies or applications in the Region.
2. Provide education and training in the use of telecommunications and technology.
3. Develop programs to increase the readiness of industry groups and businesses in the Region to engage in electronic commerce.
4. Support entrepreneurial opportunities for businesses in the information technology sector.

Program guidelines strongly encouraged multiuse strategies and more importantly allowed states "maximum flexibility" in selecting approaches that best met their state's needs.[16] ARC requires that any projects it funds have matching grants of at least 50 percent of the total budget. ARC allows for a unique funding structure for projects with a substantial or primary impact on distressed counties. It grants up to 80 percent of a project's total budget instead of the usual 50 percent, recognizing the challenge of raising local funding in economically distressed areas.[17] Grantees use ARC funds to

[15] Appalachian Regional Commission. Revised 2011. ARC Project Guidelines. p. 25. Accessed at http://www.arc.gov/images/newsroom/publications/guidelines/ARCProjectGuidelines.pdf on July 28, 2015.
[16] Ibid. Accessed on July 28, 2015.
[17] Ibid. Accessed on August 3, 2015.

leverage potential and ongoing projects or to spark follow-on investment by other funders.

As a means to these ends, ARC grants are highly diverse, encompassing different types of interventions along the telecommunications and technology spectrum and focusing on different parts of the community such as businesses, K–12 schools, institutions of higher education, and local governments to name a few. A summary of ARC's grant portfolio is described in **Section 1.4**.

2.3.3 Grant Selection and Implementation

Grant applications for the telecommunications and technology initiative were largely driven and nominated by the state ARC program managers and offices. After a formula-based calculation determined the amount of funding allocated to each ARC state, states then determined the projects to submit to ARC for approval to ensure proposed projects met guidelines. Underscoring the importance of the role of the states in identifying and determining projects for ARC investment, like many of its program areas, ARC did not release Requests for Proposal for this initiative. However, ARC reviewed all proposed grants from state offices and had the authority to either turn down a grant or make recommendations for improving it to align more with ARC's mission and goals. In practice, ARC infrequently turned down applications and more commonly made recommendations in cases where grants would be outside of the scope of the program.

In addition to the projects from individual states, the Commission awards a limited number of grants through approval by the Co-chairs' Committee. Some examples of projects awarded by the Committee process include the Co-chairs' Committee Fund, regional initiatives identified by ARC partners, and use of special funds for a specific strategic objective.

As part of the grant agreement, ARC requested that grantees list their projected outputs and outcomes in accordance with ARC performance measures. When grants close, each grantee submitted their final outputs and outcomes at the end of the grant period. ARC largely tracked grantees' progress by monitoring these measures. ARC staff followed up with validation site visits for a few select grantees to deepen institutional knowledge about the performance of the grant portfolio.

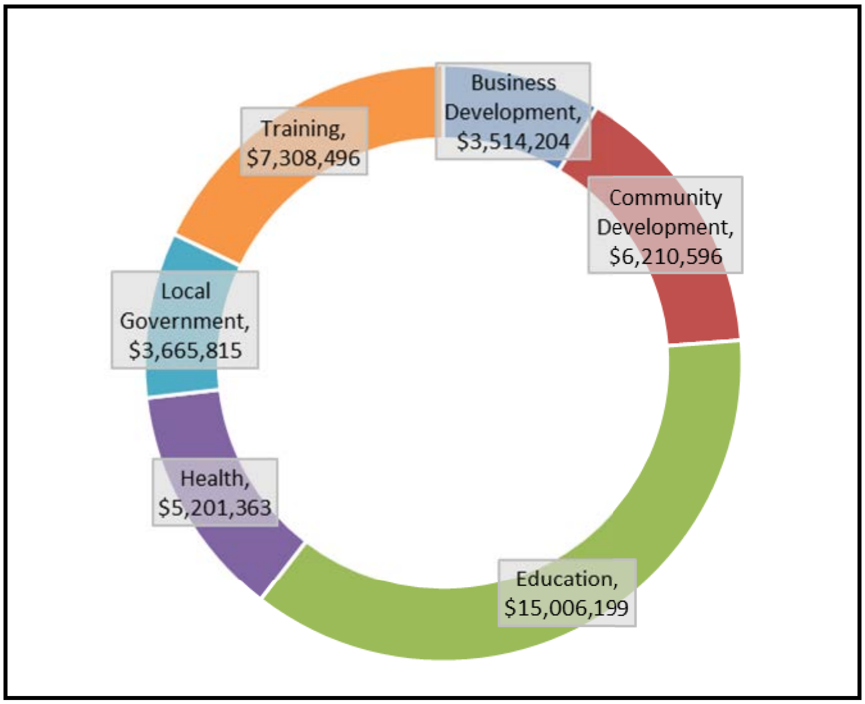
Between FY 2004 and FY 2010, ARC used both an internal online database (ARC.net) and paper files to retain the records for each grant.

2.4 SUMMARY OF THE ARC TELECOMMUNICATIONS AND TECHNOLOGY GRANT PORTFOLIO

ARC invested $41 million from 2004 through 2010 in a total of 322 telecommunications and technology grants.

ARC invested $41 million from 2004 through 2010 in a total of 322 telecommunications and technology grants. ARC funded projects ranging from local initiatives with a budget under $20,000 to large, multicounty projects with budgets over $2 million. As **Figure 2-4** shows, the majority of ARC funding ($15 million) was allocated to education-related grants. Training and community development grants were $7.3 and $6.2 million, respectively. ARC dispersed remaining investments to health, local government, and business development projects.

Figure 2-4. Allocation of ARC Funding to Telecommunications and Technology: FY 2004–FY 2010



On average, ARC grants comprised 41 percent of a project's total funding, meaning that grant recipients leveraged 59 percent of add-on funding from local and state governments or other federal funding sources. ARC investments averaged $132,000 per project and ranged from $2,192 to $2 million.[18] Of all of the grants made during the funding period, 129 had a substantial or primary impact on distressed counties (41.6 percent of the portfolio).

Over the 2004 through 2010 time frame, ARC grants, at the close of the project,

- served 5,176 businesses,
- deployed 756,494 linear feet of broadband Internet,
- served 151,141 participants,
- served 285,994 patients,
- created 52 plans or reports,
- served 152,027 students, and
- trained 22,510 workers.

Refer to **Section 5** of this report to review the detail of the ARC portfolio and its reported at-close impacts.[19]

2.5 STRUCTURE OF THE REPORT

Building on this introduction, the evaluation is structured as follows. In **Section 3** we provide an overview of the four main methods used to collect and analyze data for this evaluation. Next, we underpin this evaluation with a literature review (**Section 4**) that relays findings from research on the importance of broadband Internet for rural community economic development, how its role is growing, and the deployment of broadband Internet. In the next three sections we review the findings about ARC's grants in its telecommunications and technology portfolio. We start with detailed descriptive statistics on the grants from 2004 through 2010 (**Section 5**). We follow the project summary statistics with an analysis of the findings from the survey launched to all grantees (**Section 6**). We explore the nuances of ARC telecommunications and technology grants in-depth by reviewing 18 case studies the RTI team completed (**Section 7**).

[18] ARC made an in-kind contribution to one project "NC Medications Access and Review Program Expansion Pilot," which appears as a $0 cash investment in its records.

[19] At-close refers to the closure of the ARC grant funding period, not necessarily the end of the project. In many cases, the funding period was just the pilot or start-up period for the project.

In **Section 8**, we expand on all of the subsequent research to describe the hyperdynamic telecommunications policy environment and key policy issues and their potential impact on rural communities. We conclude the report with findings and recommendations in **Section 9**.

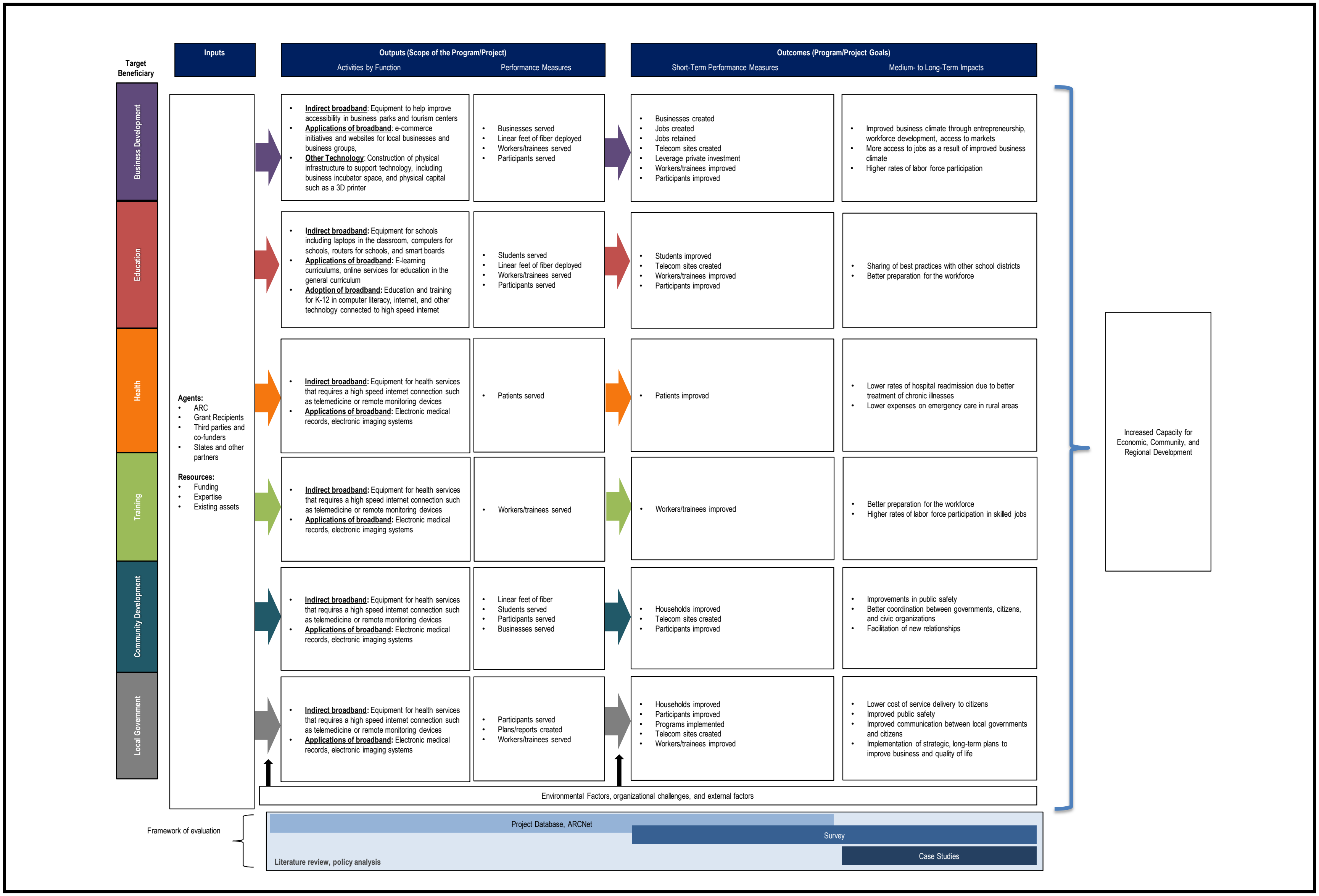
3 Methods

The RTI team employed four methods to conduct this evaluation—a literature review, project portfolio analysis, survey of grant recipients, and case studies. The four methods delivered rich results that complement one another. In this section we present an overarching methodological approach and summarize each method in turn. Precise methodological details are described within the corresponding sections (**Section 4**, Literature Review; **Section 5**, Project Portfolio; **Section 6**, Survey; **Section 7**, Case Studies; and **Section 8**, Policy Implications).

The evaluation was guided by an overarching logic model. This logic model (**Figure 3-1**) shows how the ARC grants served as "inputs" that helped lead to desired outputs, outcomes, and long-term goals of increased capacity for community economic and regional development.

On the left side of **Figure 3-1**, we show the beneficiary types of the ARC grants: local government, community development, training, health, education, and business development. These groups represent the students, community members, workers, and business owners that ARC grants are intended to support. The top of the diagram follows a typical logic model. Here we trace the inputs from the ARC telecommunications and technology grants and how this program was designed to lead to funded activities with associated performance measures resulting from these activities. These are described as outputs, or direct results from the inputs invested into the program. Following the figure to the right, we show the short-term outcomes and desired long-term impacts with associated performance measures. All of these activities and measures culminate to lead to the ultimate goal of these efforts, which is displayed on the far right. We also account for environmental factors that influence the process around which these

Figure 3-1. Evaluation Logic Mode



grants were made. They are summarized below the logic model. At the very bottom of the diagram, we list the key research modes for assessing the ARC telecommunications and technology program. As the reader reviews each element of the evaluation, this logic model shows how these varied grants are working in unison toward one goal. It also provides a structure to the details that the analysis reveals within each method.

3.1 LITERATURE REVIEW

The literature review section is intended to look back at the last 10 to 15 years of research related to broadband Internet deployment and its impact on communities. RTI began its research with a literature review to inform the rest of its findings, specifically to answer:

- What is the role of broadband Internet in community economic development?
- What were the needs for broadband Internet in the early 2000s as ARC designed and began funding this initiative?
- How is the role of broadband Internet growing?
- How is broadband Internet deployed today?

The RTI team was able to leverage the significant expertise of our consultants who are thought leaders in this field to deepen the understanding of the current state of knowledge that social scientists have about the connection between telecommunications infrastructure, technology adoption, and growth.

3.2 PROJECT PORTFOLIO SUMMARY

In October 2014, RTI immediately began reviewing ARC's project database that included descriptive data on 322 projects. After review, we either removed 12 grants from the database or consolidated them with other closely related projects, leaving a total of 310 projects from which we summarized descriptive statistics (refer to **Appendix A** for specific details). Building on the ARC database extracted from ARC.net, RTI and ARC filled data gaps by reviewing project reports and paper files to improve data quality.

To help better illustrate the breadth of ARC grants and the different beneficiaries in Appalachian communities that the grants affected, RTI designed a framework to analyze the project portfolio data. First, we summarized projects and their performance by function, that is, how the grant related to the direct installation of broadband Internet and other Internet infrastructure, implementation of networking and ancillary equipment, applications taking advantage of Internet connectivity, and efforts to accelerate the adoption of broadband Internet. Recognizing that telecommunications and technology investments are highly dependent on a broad functional infrastructure, we lay out five functions to analyze ARC investments, some of which cut across multiple functions. Second, we describe the target beneficiaries of ARC grants. These range from students, local government officials, and patients to workers and community members. Our designations for these frameworks with their definitions and rationales are detailed in **Section 5.1**.

3.3 SURVEY

After calling all 310 grant contacts to verify the most appropriate contact and contact email or phone number, RTI launched a web survey April 13, 2015, to all 310 grantees in the consolidated portfolio. We called all contacts in the verification process that preferred that the survey be administered verbally. We closed the survey on June 30, 2015. We sent regular email reminders to grantees and, a month prior to survey close, reviewed preliminary response rates to identify underrepresented project types by observable characteristics such as geography, function, beneficiary, year of award, and size. We reached out with targeted follow-up phone calls to grantees with underrepresented observable characteristics. Out of the 310 grantees, we received 102 complete responses (32.9 percent response rate) and 118 complete and partially complete responses (38.0 percent response rate). Greater detail on survey methods is in **Section 6.1**.

3.4 CASE STUDIES

As part of the project portfolio summary and survey contact outreach, the RTI research team familiarized itself with the characteristics and common themes across projects. It initially screened approximately 40 projects for case studies using the following criteria:

- Geographic distribution of grants: The case studies had to include at least one project from each state.
- Functional framework and target beneficiary: The case studies had to include an approximately representative mix of functions and target beneficiaries.
- Funding levels: The case studies had to contain a mix of small, medium, and large projects.
- Impact on distressed areas: RTI paid close attention to projects with impact on economically distressed counties.
- Gradations of success: RTI looked for projects with positive project performance data that met or exceeded expectations to understand factors for success. Additionally, RTI flagged some projects with low performance measures to understand less successful projects.

From that list of 40, the RTI research team and consultants narrowed the list to 18 projects for case studies and created a case study protocol based on the observations from the database. The team contacted the stakeholders of the 18 projects and performed site visits in May, June, and July of 2015, and synthesized the findings in **Section 7**. **Section 7.1** explains the case study methodology in greater detail.

3.5 POLICY ISSUES

While the literature review served as a retrospective look at past trends in telecommunications research, the policy implications section offers a forward-looking perspective on the present and future of broadband Internet and associated technology. RTI and its team sought to answer the following questions:

- What are ongoing and future trends in the policy environment for broadband Internet deployment in rural America?
- What trends in private-sector technology development will influence the future of telecommunications and technology in rural areas?

RTI leveraged its literature review with the help of its team of consultants to identify the most important policy developments and technology changes as they relate to each functional area of broadband Internet investment and how it is relevant for ARC moving forward.

4 Literature Review

In the twenty-first century, access to broadband Internet telecommunications and technology is an essential component of community and economic development. Today more than ever, the rapidly changing landscape of telecommunications and the growing consequences of the digital divide in access and adoption of broadband Internet create serious challenges for communities that fall outside of the traditional markets for high-speed telecommunications service providers. Rural regions of Appalachia are no exception. This section provides a current overview of the literature on broadband Internet and its connections with economic development and technology adoption. We describe the rapidly evolving role of broadband Internet as experienced by different kinds of beneficiaries and how broadband Internet is currently deployed in rural communities. We conclude this section with an overview of the leading organizations involved in broadband Internet deployment for the rural United States. We also provide a full list of the literature cited in this section and others in **Appendix B**.

4.1 THE IMPORTANCE OF BROADBAND INTERNET FOR COMMUNITY AND ECONOMIC DEVELOPMENT

The use of broadband Internet as a tool for economic and community development is grounded in economic theory on the role of access to markets in helping economies grow. Market access has been traditionally thought to be improved by geographic proximity, railroads, ports, or roads that made it easier to trade goods and services. Today, access to markets is also marked by high-speed communication networks and the ability to embrace global value chains that provide faster movement of goods and services and increased knowledge transfer virtually.[20] Areas that lack access to broadband Internet are at a disadvantage because they are isolated from virtual markets and lack the other benefits of information sharing, including improved learning and training, health care, and public safety, that result from advanced telecommunications technology.

A recent report underscores this linkage between broadband Internet and opportunity. In 2015, the White House Council of Economic Advisors released a report about the relationship between household income and levels of Internet use, repeating what researchers had said over the last two decades: higher income is related to higher levels of Internet adoption.[21]

On local and regional levels, there is evidence of a connection between broadband Internet access and economic outcomes. In 2005, Lehr et al. showed a correlation between broadband Internet availability and economic outcomes at the zip code level. The report found a positive relationship between Internet availability and economic outcomes and also explained that other factors make it impossible to establish a causal relationship between one and the other.[22] Various other studies, including Crandall et al.,[23] Baller and Lide,[24] and

[20] Baller, Jim and Lide, Casey. 2008. "Bigger Vision, Bolder Action, Brighter Future: Capturing the Promise of Broadband in North Carolina and America." Accessed at https://ncbroadband.gov/system/resources/BAhbBlsHOgZmSSI7MjAxMS8wMy8xOC8xMF81NV80NV81NDhfYnJvYWRiYW5kX3JlcG9ydF9jb21wb3NpdGUucGRmBjoGRVQ/broadband_report_composite.pdf on August 15, 2015.

[21] Dzieza, Josh and Bi, Frank. July 15, 2015. "Poverty, More than Geography, Determines who Gets Online in America" *the Verge*, Accessed at http://www.theverge.com/2015/7/15/8965409/us-internet-access-map-white-house-report-broadband-inequality on August 13, 2015.

[22] Lehr, William et al. 2006. "Measuring Broadband's Economic Impact." Working Paper.

[23] Crandall, Robert W., Lehr, William, and Litan, Robert E. July 2007. "The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis of U.S. Data." *The Brookings Institution: Issues in Economic Policy*, Number 6.

[24] Baller, Jim and Lide, Casey. 2008. "Bigger Vision, Bolder Action, Brighter Future: Capturing the Promise of Broadband in North Carolina and America." Accessed at https://ncbroadband.gov/system/resources/BAhbBlsHOgZmSSI7MjAxMS8wMy8xOC8xMF81NV80NV81NDhfYnJvYWRiYW5kX3JlcG9ydF9jb21wb3NpdGUucGRmBjoGRVQ/broadband_report_composite.pdf on August 15, 2015.

Kolko[25] came to the same conclusion: broadband Internet penetration is correlated with positive economic outcomes, including income and employment, but it is challenging to prove a statistically significant causal relationship between broadband Internet availability and economic outcomes because of data limitations and inadequate research methods.

Internationally, current research further strengthens the direct connection of broadband Internet to improved economic development. The International Telecommunications Union (ITU) and Katz in 2012 released a report on the impact of broadband Internet on economic outcomes on a global scale, showing how it was related to economic growth, productivity, employment, consumer surplus, and efficiency. Katz's work outlined relevant country-level policies on a global scale and found that in nearly every case broadband Internet deployment was correlated with improved economic outcomes. Their findings are reinforced in Ericsson, an industry-funded study that showed broadband Internet speed, availability, and adoption are closely linked to economic outcomes including GDP and productivity.[26] These studies and the research they cite show a range of incremental increases in GDP: a 10 percent increase in broadband Internet penetration is associated with GDP growth between 0.25 percent and 3.6 percent, depending on the study year and the region.[27]

Through different methods of evaluation, the research shows that expanded broadband Internet speed, availability, and adoption lead to improved economic outcomes.

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[25] Kolko, Jed. January 2012. "Broadband and Local Growth." *Journal of Urban Economics* 71(1). Accessed at http://www.sciencedirect.com/science/article/pii/S0094119011000490 on August 13, 2015.

[26] Ericsson, Arthur D. Little, and Chalmers University of Technology. September 2013. "Socioeconomic Effects of Broadband Speed." Accessed at http://www.ericsson.com/res/thecompany/docs/corporate-responsibility/2013/ericsson-broadband-final-071013.pdf on August 18, 2015.

[27] Katz, Raul. April 2012. "Impact of Broadband on the Economy." ITU Broadband Series. Accessed at https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf on August 19, 2015.

4.2 THE NEED FOR INVESTMENT IN BROADBAND INTERNET IN APPALACHIA

For this evaluation, it is useful to review the literature that informed ARC's grantmaking for the 2004–2010 technology and telecommunications portfolio. In 2002 (and revised in 2004), Oden and Strover, in *Links to the Future*, explained the barriers to broadband Internet investment and adoption in Appalachia. They cited a lack of general infrastructure, low penetration rates of computers, high costs of installation, low competition, and low rates of digital literacy as just a few of the many challenges that Appalachia and other rural regions of the United States face in improving telecommunications and technology. They framed the challenges in the context of the 1996 deregulation of the telecommunications industry, noting that private carriers alone were not providing an adequate level of service to keep the Region competitive.[28] **Section 8** presents a discussion of present-day policy issues.

Broadband Internet infrastructure (access) is distinct from the ability and desire of people and communities to take advantage of it (adoption). Access without adoption is much less impactful.

It is difficult to get an accurate picture of broadband Internet access and adoption rates in the United States because of the diverse data sources and data collection techniques.[29] The best data for broadband Internet availability are collected by the FCC, which provides rough estimates of the levels of regional broadband Internet penetration secured from coverage and speed data reported on Form 477 by providers of high-speed wired and wireless telecommunications services. The form requires that providers report the advertised maximum bandwidth provided to customers.[30] These self-reported numbers make up the basis of the National Broadband Map, a searchable tool that allows users to access information about broadband Internet availability across the country at the neighborhood level.[31] According to the December 2013 data from Form 477, approximately 94 percent of U.S. residents had

[28] Oden, Michael and Strover, Sharon. June 2004. "2004 Update: Links to the Future: The Role of Information and Telecommunications Technology in Appalachian Economic Development." ARC, University of Texas.

[29] The American Community Survey and Current Population Survey offer insight into a sample of U.S. residents' Internet use patterns. The Pew Research Center also collects information about Internet use of U.S. adults over time.

[30] Federal Communications Commission. 2015. "Frequently Asked Questions: FCC Form 477." Accessed at https://transition.fcc.gov/form477/477faqs.pdf on August 14, 2015.

[31] National Broadband Map. Accessed at http://www.broadbandmap.gov/about on August 25, 2015.

access to a high-speed Internet connection (defined then as 3 Mbps download and 768 kbps upload speeds). The situation in Appalachia is more closely allied with the Form 477 data on rural regions that show only 80 percent of rural Americans have broadband Internet access at those speeds. These data, however, are self-reported and could be overstated because maximum advertised speeds tend to be much higher than actual download speeds. Additionally, the data do not account for adoption levels. Providing broadband Internet infrastructure (access) is distinct from the ability and desire of people and communities to take advantage of it (adoption). Access without adoption is much less impactful. As the Pew Research Center reported in 2015, only 78 percent of American adults in rural areas use the Internet, compared with 85 percent of suburban and urban residents.[32] This statistic suggests that the challenges for adoption are more difficult in rural areas.

Two additional phenomena to consider for rural communities in uptake of broadband Internet technology are described in the 2010 FCC report "Broadband Adoption and Use in America." According to its survey in 2009, only 50 percent of rural residents had broadband Internet in their homes, partially due to a higher percentage of low-income and elderly residents. However, those who did have broadband Internet engaged in online shopping, media, and education at the same rate as suburban and urban residents, leading researchers to believe that given the same access, rural residents are just as likely to take advantage of Internet-based tools. The report also found that one in ten rural nonusers said that they have no access to broadband Internet service, indicating issues of access still persist.[33]

[32] Pew Research Center. June 26, 2015. "Americans' Internet Access: 2000-2015." Accessed at http://www.pewinternet.org/2015/06/26/americans-internet-access-2000-2015/ on August 17, 2015.

[33] Horrigan, John. 2010. "Broadband Adoption and Use in America." FCC Omnibus Broadband Initiative Working Paper Series Part I. Accessed at https://apps.fcc.gov/edocs_public/attachmatch/DOC-296442A1.pdf on August 17, 2015.

A simple increase in availability is insufficient to foster rural economic growth, and adoption measures are necessary to realize the potential of telecommunications-based economic development.

Gallardo, Strover, and Whitacre and the National Agricultural & Rural Development Policy Center analyzed how broadband Internet access contributed to economic health in rural areas. They analyzed Current Population Survey data alongside the FCC data available at the county level. Controlling for variables including education and job availability, they found that broadband Internet access was strongly correlated with economic outcomes. Rural counties with low levels of broadband Internet adoption had less favorable economic outcomes, even if they had similar levels of availability. The researchers argue that a simple increase in availability is insufficient to foster rural economic growth and measures to increase adoption are necessary to realize the potential of telecommunications-based economic development.[34]

More recently in 2015, the CREC and West Virginia University did a comprehensive study commissioned by ARC on the long-term demographic and economic shifts in the Appalachian Region. They identified an increasing convergence between broadband Internet and ARC's other focus areas, including workforce development and health. In interviews with local stakeholders, the researchers found that stakeholders cited broadband Internet as a priority moving forward. They expressed a need to improve access, speeds, and affordability for local businesses, institutions, and households.[35]

[34] Whitacre, Brian, Gallardo, Roberto, and Strover, Sharon. 2013. "Rural Broadband Availability and Adoption: Evidence, Policy Challenges, and Options." National Agricultural and Rural Development Policy Center. Accessed at http://www.nardep.info/uploads/BroadbandWhitePaper.pdf on August 24, 2015.

[35] Center for Regional Economic Competitiveness and West Virginia University. February 2015. *Appalachia Then and Now: Examining Changes to the Appalachian Region Since 1965*. Prepared for the Appalachian Regional Commission. Accessed at http://www.arc.gov/assets/research_reports/AppalachiaThenAndNowCompiledReports.pdf on August 12, 2015.

4.3 THE NEW DIGITAL WORLD: THE EVOLVING ROLE OF BROADBAND INTERNET FOR THE APPALACHIAN REGION

There is no doubt that broadband Internet's role as a platform *for economic and community development has been growing since the advent of the Internet and the widespread diffusion of computers*

Despite the challenges associated with statistically measuring the impact of broadband Internet access on economic indicators, there is no doubt that broadband Internet's role as a *platform* for economic and community development has been growing since the advent of the Internet and the widespread diffusion of computers. The Internet is no longer just a curiosity for the technically inclined. It pervades every aspect of our lives and is changing every field of work.

The following subsections highlight recent evidence (both quantitative data points and qualitative anecdotes) of the growing importance of broadband Internet as a platform for

- households,
- businesses, and
- community anchor institutions (including schools, health care providers, and local governments)

We include literature when available that explains the benefits and impacts relevant to each group. In **Table 4-1**, we summarize how the three kinds of entities (households, businesses, and community anchor institutions) use broadband Internet to illustrate the ways in which broadband Internet pervades our lives and work.

We expand on Table 4-1 to detail the growing presence and benefits of telecommunications and technology among each of the three beneficiary groups. The literature offers insight into the economic, educational, health, and social benefits that are associated with improvements in broadband Internet and telecommunications technology.

4.3.1 Trends and Demonstrated Benefits for Households

The Internet is at its root a communications platform, and it has proven to be of great social importance. The Internet is a platform for a wide range of applications such as using email and video chatting, searching for information, managing bills, purchasing goods and services, learning new skills, accessing entertainment, engaging with local communities and global social networks, interacting with governments, and engaging in

Table 4-1. Uses of Broadband Internet

Beneficiary	Uses of Broadband Internet
Households	• Emails, messaging, video chatting • Search engines • Personal finance – Online banking and bill pay • Connected homes (e.g., HVAC systems, appliances, lighting) • E-learning for adults • Homework for school age children • Shopping • Entertainment • Job applications • Social networking • The sharing economy • Freelancing and entrepreneurship • Interacting with businesses, schools, health care providers, and governments
Businesses	• Emails, messaging, video conferencing • Teleworking • Marketing • Business-to-consumer sales • Business-to-business sales • Recruiting/hiring • Process management • Data management • Real-time monitoring of key performance indicators • Connected devices and machines (Internet of Things/Industrial Internet of Things)[36] • Supply chain management • Cloud computing • Innovation • Training

(continued)

[36] For a primer on the Internet of Things, see Jankowski et al. 2014. "IoT Primer, The Internet of Things: Making sense of the next mega-trend." Goldman Sachs. Accessed at http://www.goldmansachs.com/our-thinking/outlook/internet-of-things/iot-report.pdf on September 17, 2015.

Table 4-1. Uses of Broadband Internet (continued)

Beneficiary	Uses of Broadband Internet
Community Anchor Institutions	
Education (K–12, community colleges, Universities, training)	• Curriculum development • Digital textbooks • E-courses • Distance learning – District-level supplemental programs – Statewide virtual schools • Personalized digital learning • Teacher training • Teacher–parent and school–parent communication platforms
Health care providers	• Telehealth services – Real-time patient consultation, diagnosis, and treatment – Remote patient monitoring – "Store-and-Forward"—technologies that store clinical information and forward to another site for clinical evaluation[37] • Electronic health records/electronic medical records (EMRs) • Precision medicine
Local governments	• Geospatial data management for public services such as water systems • E-services such as tax filing and permitting • Library services – Free computer-based Internet access – Free bring-your-own-device public Wi-Fi – E-books • Video conferencing in judicial systems • Public safety telecommunications systems

Source: RTI

In the last 10 years, the use of social networking sites such as Facebook, Twitter, WhatsApp, and Instagram has sky-rocketed. In 2014, 74 percent of online adults use a social networking site compared with just 8 percent in 2005.

countless other applications. Households are using the Internet to enrich their lives socially, culturally, and economically.

Email was one of the earliest applications of the Internet, and it is still a staple for most adults, although new forms of communication enabled by the Internet are growing, such as video chatting and social networking. In the last 10 years, the use of social networking sites such as Facebook, Twitter, WhatsApp, and Instagram has skyrocketed. In 2014, 74

[37] U.S. Department of Veterans Affairs. "VA Telehealth Services." Accessed at http://www.telehealth.va.gov/sft/ on August 23, 2015.

percent of online adults use a social networking site compared with just 8 percent in 2005.[38]

The Internet is also frequently used for entertainment. Many households use video-streaming sites such as YouTube, Netflix, Hulu, and Amazon Video to watch TV shows, movies, news, and video clips. Many people stream music over the Internet using services such as Pandora and Spotify. Online gaming is another form of entertainment that integrates both entertainment and social aspects. Some people have even used online games as an economic tool for buying and selling digital items.

As the importance of lifelong learning continues to grow in order to compete in the global economy, e-learning will play a vital role, and its use is on the rise. The growth of free and low-cost courses offered on the web by universities and private companies over platforms operated by edX and Coursera has opened up a world of opportunities for people around the globe. Massive open online courses are a potentially disruptive online learning model that challenges the status quo in higher education. Also, families benefit from sharing online educational experiences with their children, as seen in the research by Belo et al.[39]

The study points to several drivers of income that are linked to broadband Internet such as increased productivity, more flexible work arrangements, possibilities for home-based businesses, and more opportunities for social and cultural enrichment.

In addition to its countless social and cultural applications, the Internet has proven to be an invaluable economic resource for many households. Ericsson analyzed data from 22,000 respondents in developed and developing countries. Both broadband Internet access and speed upgrades were associated with income increases. The study points to several drivers of income that are linked to broadband Internet such as increased productivity, more flexible work arrangements, possibilities for

[38] Pew Research Center. *Three Technology Revolutions*. Accessed at http://www.pewinternet.org/three-technology-revolutions/ on August 20, 2015.

[39] Belo, Rodrigo, Ferreira, Pedro and Telang, Rahul. March 29, 2013. "Spillovers Effects of Wiring Schools with Broadband: The Critical Role of Children." Accessed at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032097 on August 24, 2015.

home-based businesses, and more opportunities for social and cultural enrichment.[40]

People use the Internet to access professional networks, search for job openings, and submit job applications. Broadband Internet has also facilitated the growth of home-based businesses and freelancing, which can provide a first or second source of income and more flexibility. Home-based businesses and freelancing are a growing source of income for many U.S. households, especially during economic downturns. The so-called "sharing economy" allows people to rent out their idle assets such as cars, spare bedrooms, and even lawnmowers over the Internet.[41] The sharing economy is built on person-to-person Internet exchanges that drive business. For example, websites like AirBnB and Uber use the Internet as a platform to rent out local residences and pay drivers for local transportation. They have rapidly gained popularity in use. Price Waterhouse Cooper's Digital Services group surveyed the general population in 2014 and found that 56 percent of the U.S. adult population was familiar with sharing economy products, and estimates show that the sharing economy has been growing rapidly.[42,43] Individuals are also using the Internet to more effectively manage their households by using online banking services, paying bills, managing investment portfolios, tracking energy usage, doing online shopping, finding information about their community, and filing tax returns. As an illustrative example, 51 percent of U.S. adults banked online as of 2013, up from 46 percent of adults in 2010. One can easily recall a time 20 years ago when no one even

[40] Ericsson, Arthur D. Little, and Chalmers University of Technology. September 2013. "Socioeconomic Effects of Broadband Speed." Accessed at http://www.ericsson.com/res/thecompany/docs/corporate-responsibility/2013/ericsson-broadband-final-071013.pdf on August 24, 2015.

[41] Economist. March 9, 2013. "The Rise of the Sharing Economy." Accessed at http://www.economist.com/news/leaders/21573104-internet-everything-hire-rise-sharing-economy# on August 24, 2015.

42 Price Waterhouse Coopers. April 2015. "The Sharing Economy." Accessed at http://www.pwc.com/en_US/us/technology/publications/assets/pwc-consumer-intelligence-series-the-sharing-economy.pdf on August 24, 2015.

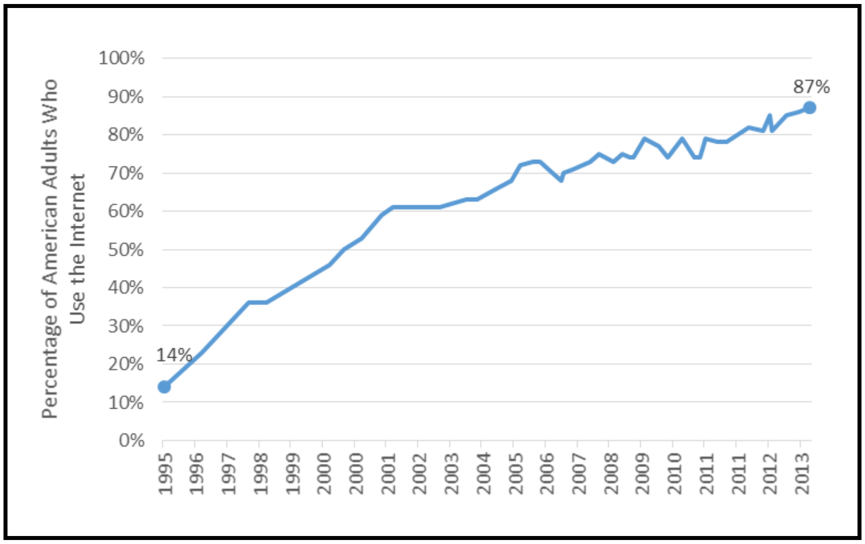
[43] Forbes. February 11, 2013. "Airbnb and the Unstoppable Rise of the Share Economy." Accessed at http://www.forbes.com/sites/tomiogeron/2013/01/23/airbnb-and-the-unstoppable-rise-of-the-share-economy/ on August 24, 2015.

had the option of accessing banking services online. Online banking is one barometer for how well consumers trust online transactions. Of adults who are Internet users, online banking has penetrated the market by a factor of three between 2000 and 2013.

Given the range of social, cultural, and economic applications on the Internet and the value that households derive from these applications, it is not surprising that Internet use has grown tremendously over the last two decades. According to the Pew Research Center, 87 percent of American adults used the Internet in 2014, up from 14 percent in 1995

Given the range of social, cultural, and economic applications on the Internet and the value that households derive from these applications, it is not surprising that Internet use has grown tremendously over the last two decades. According to the Pew Research Center, 87 percent of American adults used the Internet in 2014, up from 14 percent in 1995 (see **Figure 4-1**).[44] In the last decade, the trend has decelerated as the Internet begins to reach saturation for some groups; however, Internet use is still increasing.

Figure 4-1. Internet Use over Time: Percentage of American Adults Who Use the Internet



Source: Pew Research Center.

4.3.2 Trends and Demonstrated Benefits for Businesses

Economic development is often cited as a leading rationale for the development and deployment of local fiber optic and wireless high-speed networks, noting that this infrastructure is essential to attract businesses, strengthen local entrepreneurs, and create jobs. Baller et al. provided insight into the discussion of the use of broadband Internet technology as a catalyst for economic development. The authors cite studies

[44] Pew Research Center. No date. Internet Use over Time. Accessed at http://www.pewinternet.org/data-trend/internet-use/internet-use-over-time/ on August 24, 2015.

that illustrate how broadband Internet leads to achievement of business goals; improvement of competitiveness and efficiency; and eventually more jobs, higher local production, and increased tax revenues for local governments. They note that it is difficult to quantify the impact of broadband Internet on local economic development and propose qualitative approaches to help understand the impacts of broadband Internet. The authors cite case studies and examples of business recruitment deals that failed because of a lack of high-speed telecommunications infrastructure in a region.[45]

Businesses routinely use Internet-based technologies to conduct day-to-day business operations like recruiting new workers, managing data streams, managing and optimizing processes, monitoring key performance indicators in real time, and communicating across the supply chain

Broadband Internet's role as the preferred platform for businesses to communicate with customers and deliver services is growing. As more customers look to the Internet as a primary source of information, more and more businesses are developing websites and online advertisements to communicate with customers. Television and print have long been the dominant mediums for advertising products and services to customers; however, a recent forecast from Forrester Research indicates that digital ad spending could soon overtake TV advertisement spending in the United States.[46] This demonstrates the growing role of broadband Internet as a platform for business and consumers alike. In addition to communicating with customers, businesses routinely use Internet-based technologies to conduct day-to-day business operations like recruiting new workers, managing data streams, managing and optimizing processes, monitoring key performance indicators in real time, and communicating across the supply chain. Businesses are also undergoing a major migration to cloud computing. This means that traditional enterprise hardware and software solutions are being supplanted by cloud-based solutions. Cloud computing reduces the upfront investment in dedicated servers by moving to more of a fee-for-service or subscription business model. Growth in cloud computing means that reliable, high-speed Internet

[45] Baller, Jim, Hovis, Joanne and Stelfox, Ashley. 2014. "The Killer App for Local Fiber Networks." Accessed at http://www.bbpmag.com/MuniPortal/EditorsChoice/1114editorschoice.php on January 6, 2015.

[46] Peterson, Tim. "Digital to Overtake TV Ad Spending in Two Years, Says Forrester." *Advertising Age*. Accessed at http://adage.com/article/media/digital-overtake-tv-ad-spending-years-forrester/295694/ on August 25, 2015.

access will become even more important for basic business functions.

Growth in cloud computing means that reliable, high-speed Internet access will become even more important for basic business functions.

Beyond being a platform for conducting business, information and communication technology (ICT) is a driver of job growth in the United States. According to Shapiro and Mathur (2011), ICT contributed to 7.1 percent of the U.S. GDP in 2009, and jobs in the industry paid a salary 80.6 percent higher than the national average. The industry saw the fastest gains in employment and was responsible for the largest share of productivity gains in the United States.[47] They also point out that these jobs require unique skill sets and emphasize the need to train workers for new jobs in ICT.

In 2010, nearly one-third of North Carolina households were engaged in some type of home-based business.

As alluded to in the household section, in addition to ICT jobs, home-based businesses are an increasing component of the U.S. economy. The Strategic Networks Group (SNG) found that, in 2010, nearly one-third of North Carolina households were engaged in some type of home-based business. SNG has documented similar findings in other states. The most frequent types of home-based businesses included professional and technical services, arts, entertainment, recreation, and retail trade. Home-based businesses using broadband Internet emerged during the Great Recession as an alternative for professionals who had lost their jobs, and many of those surveyed expressed interest in starting a home-based business in the future.[48]

4.3.3 Trends and Demonstrated Benefits for Community Anchor Institutions

The FCC defines community anchor institutions as "schools, libraries, hospitals and other medical providers, public safety entities, institutions of higher education, and community support organizations that facilitate greater use of broadband Internet by vulnerable populations, including low-income, the

[47] Shapiro, Robert and Mathur, Aparna. September 2011. "The Contributions of Information and Communication Technologies on American Growth, Productivity, Jobs, and Prosperity." Accessed at http://www.sonecon.com/docs/studies/Report_on_ICT_and_Innovation-Shapiro-Mathur-September8-2011-1.pdf on August 19, 2015.

[48] Strategic Networks Group. 2011. "e-NC and SNG Study Reveals Types of Home-Based Businesses." Accessed at http://www.sngroup.com/wp-content/uploads/2011/07/SNG-Quick-byte-Home-based-businesses-findings-Jul2011.pdf on August 25, 2015.

unemployed, and the aged."[49] The FCC has a statutory charge to ensure that community anchor institutions have access to advanced telecommunications.

We review three kinds of community anchor institutions:

- schools
- health care providers
- local governments (e.g., local government agencies, libraries, local judicial systems, public safety entities)

Schools

Online learning in K–12 and higher education institutions continues to grow. Teachers use a mix of traditional classroom instruction supplemented by digital tools such as online curricula, online videos, online assessments, and digital textbooks. Distance learning programs are also on the rise, ranging from district-level supplemental programs to statewide supplemental programs to fully fledged, statewide virtual schools and online degree programs.

Harris Interactive and the FCC surveyed schools and libraries participating in the E-rate program (E-rate is discussed in **Section 4.4.1**), which cited deficiencies in the broadband Internet connections available to them: 80 percent of institutions surveyed said their needs are not met. The majority intended to expand their use of digital textbooks, wireless connections, and new devices for educational purposes. Schools participating in the program were concerned that their existing telecommunications and technology infrastructure was insufficient to meet anticipated demand.[50]

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[49] Federal Communications Commission. June 1, 2012. "WCB Cost Model Virtual Workshop 2012 Community Anchor Institutions." Accessed at https://www.fcc.gov/blog/wcb-cost-model-virtual-workshop-2012-community-anchor-institutions on August 24, 2015.

[50] Federal Communications Commission. 2010. "2010 E-Rate Program and Broadband Usage Survey: Report." FCC Wireline Competition Bureau. Accessed at http://transition.fcc.gov/010511_Eratereport.pdf on August 24, 2015.

Schools participating in the program were concerned that their existing telecommunications and technology infrastructure was insufficient to meet anticipated demand

The growth of broadband Internet use in schools supports a range of benefits. Research indicates that online learning tools, in combination with traditional classroom settings, can help students master material more quickly. Lovett et al. found that students in a statistics course at Carnegie Mellon University that used traditional in-class instruction in combination with web-based instruction learned a full semester's worth of material in half the time as those not exposed to online materials.[51]

Online learning tools also improve students' educational experience and increase the likelihood of digital adoption at home. Belo et al. analyzed the spillover effects of advanced classroom technology on families in Portugal. They found that families with children in schools with broadband Internet technology were 20 percent more likely to use Internet applications at home. They argued that this improved telecommunications and technology in the classroom causes more knowledge transfer between children and parents, as well as a greater demand among parents with school-aged children for broadband Internet telecommunications at home. They showed ripple effects in both the educational outcomes of the students and in the Internet adoption of the families.[52]

Knowledge-based jobs and businesses that depend on the Internet are growing, and research shows that students and their families benefit from improvements in access and adoption in the classroom. As mentioned in Shapiro and Mathur, improved broadband Internet telecommunications education and access contribute to a strong workforce in ICT. Their research showed that jobs in ICT had higher wages and higher expectations for future growth.[53] Broadband Internet

[51] Lovett, Marsha, Meyer, Oded, and Thille, Candace. 2008. "The Open Learning Initiative: Measuring the Effectiveness of the OLI Statistics Course in Accelerating Student Learning."

[52] Belo, Rodrigo, Ferreira, Pedro, and Telang, Rahul. March 29, 2013. "Spillovers Effects of Wiring Schools with Broadband: The Critical Role of Children." Accessed at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032097 on August 24, 2015.

[53] Shapiro, Robert and Mathur, Aparna. September 2011. "The Contributions of Information and Communication Technologies on American Growth, Productivity, Jobs, and Prosperity." Accessed at http://www.sonecon.com/docs/studies/Report_on_ICT_and_Innovation-Shapiro-Mathur-September8-2011-1.pdf on August 19, 2015.

and telecommunications technology in schools will contribute to a more educated and competitive workforce in the future.

Health Care Providers

Hospitals are increasingly using broadband Internet networks to deliver innovative telehealth services such as real-time patient care (including consultation, diagnosis, and treatment), remote patient monitoring (specifically for chronic diseases), and "store-and-forward" technologies that store clinical information and forward it to another site for clinical evaluation.

Health care has been moving from a paper-based environment to digital technology in all aspects of its operations. Patient records are electronic, most business functions including insurance are electronic, and medical imaging is typically stored digitally. This opens up a new world of possibilities for rural health care. Hospitals are increasingly using broadband Internet networks to deliver innovative telehealth services such as real-time patient care (including consultation, diagnosis, and treatment), remote patient monitoring (specifically for chronic diseases), and "store-and-forward" technologies that store clinical information and forward it to another site for clinical evaluation. For example, medical images (i.e., X-rays, CT scans, and MRIs) can be sent to remote experts for diagnosis. Recent improvements in sensors together with their declining costs is enabling real-time, digital collection of patient data over long distances. All of these applications require an emphasis on privacy and security and reliable high-speed broadband Internet networks.

A growing body of research demonstrates that telehealth services enabled by broadband Internet can improve the quality and decrease the cost of patient care.

A pilot program by the Veteran's Health Administration saw a 51 percent reduction in hospital readmission for heart failure using telemedicine services.

Research case studies show that broadband Internet can improve operational efficiency for health care providers and health systems. Additionally, a growing body of research demonstrates that telehealth services enabled by broadband Internet can improve the quality and decrease the cost of patient care. For example, Castro et al. argued that telehealth services have the potential to provide health care to people with chronic illnesses at a lower cost and with a lower readmission rate.[54] A pilot program by the Veteran's Health Administration saw a 51 percent reduction in hospital readmissions for heart failure using telemedicine services.[55] Another example is the North Carolina Telepsychiatry network, which was established in 2013. Nearly half of the state's hospitals were participating as of January 2015; the remainder are expected to join in the near future. The use of telepsychiatry resulted in less waiting time for patients in

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[54] Castro, Daniel, Miller, Ben, and Nager, Adams. 2014. "Unlocking the Potential of Physician-to-Patient Telehealth Services." Accessed at http://www2.itif.org/2014-unlocking-potential-physician-patient-telehealth.pdf on August 19, 2015.

[55] Ibid.

hospital emergency departments and a lower likelihood of returning for treatment. Involuntary commitments to state psychiatric hospitals have also decreased.[56]

As cloud computing grows, local governments are starting to move data storage from local servers to third-party servers at reduced costs.

Local Governments

Local governments have been digitizing operations and using broadband Internet to streamline operations, improve services, and increase reach. As cloud computing grows, local governments are starting to move data storage from local servers to third-party servers at reduced costs. Other examples of e-services include the collection of taxes, geospatial mapping of municipal waste and water assets, and the provision of library services.

Eighteen percent of library outlets offered wireless Internet connectivity in 2004. By 2006, that figure was up to 54 percent and by 2011 it stood at 86 percent. However, many libraries believe that their Internet connection speeds are insufficient, and there has been a strain on band-width as more people flocked to libraries for their Internet needs during the economic downturn.

Libraries, a critical community anchor institution, have experienced rapid growth in connectivity. Today, nearly all public libraries provide public access to computers and the Internet, often for individuals who do 'not have access to broadband Internet at home. They are also increasingly equipped to provide wireless access for those who prefer to bring their own device. According to the American Library Association, 18 percent of library outlets offered wireless Internet connectivity in 2004. By 2006, that figure was up to 54 percent and by 2011 it stood at 86 percent.[57] However, many libraries believe that their Internet connection speeds are insufficient, and there has been a strain on bandwidth as more people flocked to libraries for their Internet needs during the economic downturn.

People are not only coming to the library to access the Internet, but patrons are accessing more of their books digitally as well. As of 2012, 76 percent of libraries offered access to ebooks.[58]

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[56] American Hospital Association. January 2015. Trendwatch. The Promise of Telehealth for Hospitals, Health Systems and Their Communities.

[57] American Library Association and the College of Information, Florida State University. 2007. *Libraries Connect Communities: Public Library Funding & Technology Access Study 2006-2007*. Accessed at http://www.ala.org/research/sites/ala.org.research/files/content/initiatives/plftas/previousstudies/0607/finalreport.pdf. http://www.ala.org/research/sites/ala.org.research/files/content/initiatives/plftas/2010_2011/plftas11-execsummary.pdf on August 24, 2015.

[58] American Library Association. *The State of America's Libraries: A Report from the American Library Association 2013*. Accessed at http://www.ala.org/news/sites/ala.org.news/files/content/2013-State-of-Americas-Libraries-Report.pdf on August 24, 2015.

As of 2012, 76 percent of libraries offered access to ebooks.

Local judicial systems and public safety agencies also benefit from access to broadband Internet through enhanced telecommunications capabilities and efficiency gains as several projects in ARC's grant portfolio demonstrated. Police, fire fighters, and emergency management teams are beginning to replace voice radios with advanced mobile devices capable of sending and receiving video and other complex digital data. Communities will likely collaborate on efforts to expand their digital infrastructure to support public safety.

Despite the uptake of local governments using broadband Internet to enhance service provision, many municipalities do not have consistent proven approaches for expanding broadband Internet.

Despite the uptake of local governments using broadband Internet to enhance service provision, many municipalities do not have consistent proven approaches for expanding broadband Internet. Feser, Horrigan, and Lehr point out that there is "little known on appropriate public interventions (how and when to intervene); regulatory reform, subsidization, public–private partnership models of deployment and service delivery, technical assistance to would-be providers, information provision, and demand aggregation, etc."[59] We delve more into these important issues for local, state, and federal governments in **Section 8**.

4.3.4 Summary

Given the increasing role of broadband Internet as a platform for consuming information, managing information, conducting business, developing innovative services, and improving the delivery of government services, adequate access to broadband Internet is essential for participating in modern society. In fact, broadband Internet connectivity is increasingly becoming a public good similar to electricity lines, roads, and water and sewer systems.

The digital divide between urban and rural areas (such as the Appalachian Region) will not be defined solely in terms of access to the Internet, but rather in terms of having access to adequate Internet speeds that enable more sophisticated types of applications

As applications that use broadband Internet become ever more ubiquitous and sophisticated, the digital divide between urban and rural areas (such as the Appalachian Region) will not be defined solely in terms of access to the Internet, but rather in terms of having access to adequate Internet speeds that enable more sophisticated types of applications. Adoption through education and local anchor institutions plays a critical role to

[59] Feser, Ed, Horrigan, John, and Lehr, William. December 2012. "Symposium Report: Findings from the Research Roundtable on the Economic and Community Impact of Broadband." Accessed at http://works.bepress.com/edwardfeser/34/ on August 24, 2015.

increasing the benefits of broadband Internet for students, families, and households.

This discussion on the trends affecting the use of broadband Internet is coupled with text describing key policies affecting access and absorption of broadband Internet in **Section 8**.

4.4 DEPLOYMENT OF BROADBAND INTERNET IN RURAL AMERICA

In rural areas, ... high costs of infrastructure deployment due to challenging terrain, lower population density, and lower median income among residents make it more costly and risky to invest in telecommunications infrastructure.

Broadband Internet deployment and adoption in rural America is a uniquely dynamic environment. Traditional telecommunications providers have a clear profit incentive and seek to reach the highest number of people in dense urban areas. In rural areas, however, high costs of infrastructure deployment due to challenging terrain, lower population density, and lower median income among residents make it more costly and risky to invest in telecommunications infrastructure. An array of government programs and nonprofits work in the area of rural telecommunications development to complement private telecommunications companies because of the important spillover benefits that broadband Internet has on education, health, and economic development.

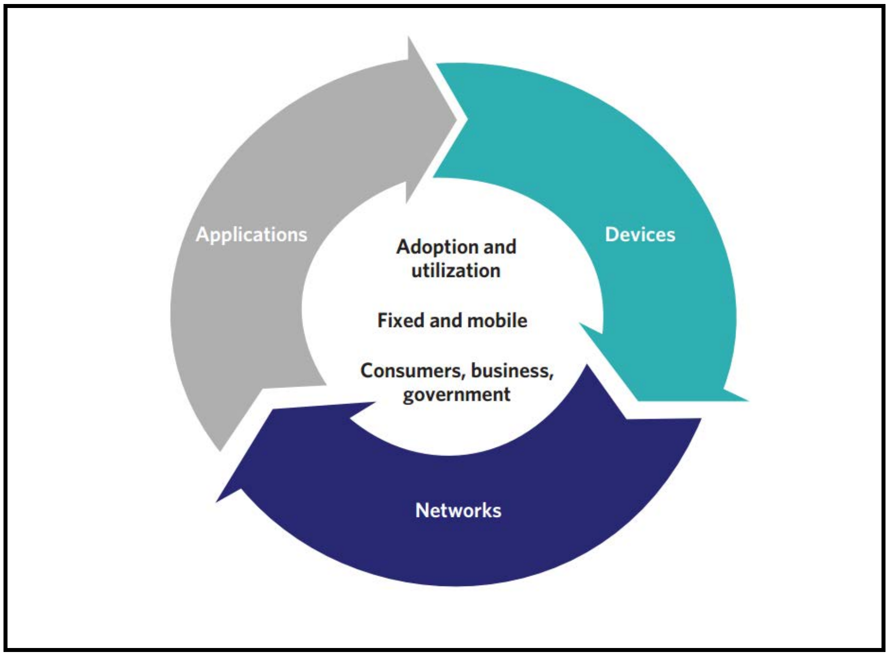
Understanding the importance of rural broadband Internet access, the federal government has a variety of programs to fund investments in underserved communities, particularly in rural areas. These programs include E-rate and the Connect America Fund (CAF) from the Universal Service Administrative Company (USAC), programs from the U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Commerce, and the U.S. Department of Agriculture (USDA). The American Reinvestment and Recovery Act invested heavily in telecommunications pilot projects through the Broadband Technology Opportunities Program (BTOP), the NTIA's State Broadband Initiatives (SBI), and the USDA Rural Utilities Service Broadband Investment Program and Telecommunications Loan and Grant Program. These federal programs interact with private service providers, state governments, and other organizations to create the current rural broadband Internet ecosystem in the United States.

The section below briefly describes the forces shaping the broadband Internet ecosystem and the programs and initiatives with a rural focus to provide a stronger understanding of the broader policy environment because ARC is one of many organizations working to expand broadband Internet to underserved and rural communities.

4.4.1 The Rural Broadband Internet Ecosystem

Modern telecommunications adoption requires networks, devices, and applications, all of which work together to create a positive feedback loop, as seen in the FCC's 2010 National Broadband Plan. The Broadband Plan "sets out a roadmap for initiatives to stimulate economic growth, spur job creation and boost America's capabilities in education, healthcare, homeland security and more." [60] Within its plan, the FCC outlined the existing broadband Internet ecosystem, breaking down the main forces shaping the sector at the time. **Figure 4-2** depicts the FCC's model of forces driving the broadband Internet ecosystem.

Figure 4-2. Forces Shaping the Broadband Ecosystem in the United States



Source: FCC

- Within this model, the FCC briefly explains how the rural ecosystem is distinct in availability of networks, levels of adoption and utilization, and access to devices to connect to networks.

[60] Federal Communications Commission. 2010. "National Broadband Plan." Accessed at https://www.fcc.gov/national-broadband-plan on August 12, 2015.

- Networks: 99 percent of physician-run health care organizations in 2010 had access to high-speed telecommunications, only 71 percent of rural health clinics had access to the same level of service. Furthermore, rural areas in general are less likely to have access to more than one wireline broadband Internet provider than other areas, indicating that competition in rural areas could be limited.
- Devices: In 2010, computers were the majority of connected devices, but the FCC recognized that mobile devices would likely outpace computer sales. Rural areas must have infrastructure to handle mobile rural devices.
- Adoption and Utilization: People who are least likely to use the Internet tend to be less educated, have less income, and live in a rural area. Additionally, those over 65 years old are less likely than any other age group to use the Internet.

With these considerations in mind, the FCC designed its Broadband Plan to incorporate these distinctions to help ensure that broadband Internet infrastructure is deployed effectively nationally so that every American, regardless of geographic location, has access to broadband Internet capability.

4.4.2 Actors in the Rural Broadband Internet Ecosystem

Multiple government and nongovernment actors work in the field of rural broadband Internet. The current landscape in rural telecommunications in the United States includes the FCC, federal programs under the Universal Service Administrative Company (USAC), other federal agencies, and a series of nongovernmental organizations (NGOs), nonprofits, and other organizations that advocate on behalf of rural broadband Internet deployment. **Table 4-2** lists key members of the ecosystem and the role they play in rural telecommunications as of 2015. Understanding the array of organizations working to accelerate broadband Internet deployment will help ARC recognize its role within the ecosystem and how to be most impactful in its grantmaking through enhanced coordination with the ecosystem.

We expand on some of these key actors and relevant programs below.

Table 4-2. Actors in the Rural Broadband Internet Ecosystem

Organization	Purpose
FCC	Regulates interstate and international communication via radio, television, wire, satellite, and cable in the United States
Federal Organizations under the USAC	
USAC Schools and Libraries: E-rate	Lowers costs of high-speed telecommunications service to schools and libraries
USAC Rural Health Care	Lowers costs of high-speed telecommunications service to rural health care clinics
USAC Lifeline	Provides discounts for basic, local telephone service for low-income households
USAC High Cost/CAF	Helps telecommunications companies reach customers in hard-to-serve rural areas
Other Federal Organizations	
U.S. Department of Commerce	Works closely with NTIA to design and implement telecommunications grant programs for business development purposes
NTIA	An executive branch agency that advises the President on telecommunications and information policy issues. Responsible for the BTOP and other grant programs, as well as the National Broadband Map
HUD	As of 2015, HUD’s ConnectHome program is a pilot to expand high-speed broadband Internet in low-income houses in urban and tribal areas across the United States
USDA	The Rural Utilities Service of USDA administers the Rural Broadband Access Loan and Loan Guarantee Program and the Broadband Investment Program, which target low-income rural areas for broadband Internet infrastructure investment
U.S. Department of Transportation	Involved in physical deployment of fiber and broadband Internet infrastructure along roads and highways
Broadband Opportunity Council	Works in the office of the President with the NTIA to better coordinate broadband Internet efforts in the United States
NGOs, Nonprofits, and Other Organizations	
Rural Telecom Conference	A national nonprofit that connects people, businesses, governments, and organizations to improve rural broadband Internet service
Coalition for Local Internet Choice (CLIC)	A nonprofit that advocates on behalf of empowering local government through “local choice”: a legal structure that allows for municipal broadband Internet networks
Rural Assembly	A network of rural organizations and individuals that advocate on behalf of rural issues including broadband Internet
Institute of Medicine	A part of the National Academy of Sciences and an advocate for telemedicine in rural areas
Private Companies	
Various	In collaboration with government, nonprofits, and other organizations, private companies are working to overcome barriers to broadband Internet deployment in rural areas and are offering discounts to low-income residents in some markets

Universal Service Administrative Company

The largest share of public funding for broadband Internet comes from programs through the USAC, an independent not-for-profit corporation designated by the FCC as administrator of universal service. USAC works to bridge the digital divide in rural areas through a series of government programs and subsidies. It is funded through fees on telecommunications service providers and is intended to provide a universal base level for Internet access. It runs a series of programs through the funds it raises, principally through the Universal Service Fund (USF) financed by a tax on telecommunications service bills; these programs include the CAF, the E-rate Program, the Rural Healthcare Support Program, and Lifeline, each of which is explained below in more detail.

USAC CAF: Phase II

The CAF was born out of the USF's High Cost Program to bring both voice and broadband Internet service to underserved rural areas. It is the largest program that provides subsidies to telecommunications providers in rural areas.

USAC Schools and Libraries Program: E-rate

The Schools and Libraries Program, better known as E-rate, began in 1997 to lower Internet access costs for schools and libraries and better improve their connectivity to the digital world. It is funded by the USF, a mix of subsidies and fees from the FCC. The E-rate program allows schools to receive subsidies between 20 and 90 percent of the total cost of Internet service. The E-rate subsidy percentage increases with the percentage of students eligible for free and reduced-price lunch.[61]

The program has contributed to increased uptake of the Internet by schools and libraries. The share of classrooms with Internet access jumped from 14 percent in 1997 to 94 percent in 2005. In 2014, the FCC updated the E-rate program to modernize the policy and adapt to new technology. Some of the changes include

[61] Federal Communications Commission. July 11, 2014. "Summary of the E-Rate Modernization Order." Accessed at https://www.fcc.gov/page/summary-e-rate-modernization-order on August 17, 2015.

- deemphasizing wired connections to classrooms and legacy technologies and placing a greater emphasis on high-speed fiber connections to schools and seamless Wi-Fi inside the building and
- streamlining and simplifying the application process.

USAC Rural Health Care Support

The USAC provides support to rural health care providers and consortia through several programs, including the Healthcare Connect Fund. USAC Rural Health Care programs provide discounted equipment and service so that the costs of telecommunications for rural health providers is more in line with the costs of their urban counterparts.[62]

USAC Lifeline

The USAC provides financial support to help eligible telecommunications carriers offer modest discounts for telecommunications services to low-income consumers.

FCC Rural Broadband Internet Experiments

In 2014, the FCC began a pilot project for technology transitions in rural communities. The program allocated $100 million from the CAF to deploy next-generation telecommunications technology in high-cost rural areas, including fiber-to-the-premises investments that are often too costly for rural customers.[63] The program is intended as a pilot for potential future investments in high-capacity fiber Internet connections in traditionally underserved areas.

NTIA BTOP

The BTOP emerged as part of the American Reinvestment and Recovery Act, and between 2009 and 2014 it funded $4.7 billion in broadband Internet adoption projects, public computer centers, Internet infrastructure projects, and SBI projects.[64] In

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[62] Federal Communications Commission. September 2015. "Rural Health Care Program." Accessed at https://www.fcc.gov/encyclopedia/rural-health-care on August 17, 2015.

[63] Federal Communications Commission. July 11, 2014. "Rural Broadband Experiments Order." Accessed at https://www.fcc.gov/document/rural-broadband-experiments-order on August 17, 2015.

[64] National Telecommunications & Information Administration. "About BroadbandUSA." Accessed at http://www2.ntia.doc.gov/about on August 14, 2015.

2014, ASR Analytics delivered a comprehensive analysis of the BTOP program and found the following:

- BTOP communities had a 2 percent higher growth in broadband Internet availability compared with non-BTOP communities. The program observed the highest growth in rural areas, with an impact of nearly 5 percent.
- Per ASR's economic modeling, the additional infrastructure could contribute to as many as 22,000 jobs.
- Prices of service to community institutions declined by an average of 95 percent, and service increased sevenfold.[65]

As of 2015, BTOP is closed, but the experience of BTOP grantees serves as further evidence that federal investments in broadband Internet are closely related to economic growth and have an important return on investment in the long run, particularly in rural areas.

State Broadband Internet Initiatives

The NTIA launched the SBI in 2009 under the American Reinvestment and Recovery Act to incorporate state-level broadband Internet initiatives into federal planning and information sharing. It awarded a total of $293 million to 56 grantees, representing all 50 states, five territories, and the District of Columbia. The grants went to a variety of government and nonprofit institutions to engage in research and strategic planning for future broadband Internet investments in their respective states.[66]

Broadband Opportunity Council

Recently announced in March 2015, the Broadband Opportunity Council brings together 25 federal agencies to help the executive branch better understand community needs for broadband Internet. The Council, which is co-chaired by the USDA and Department of Commerce, will also work on

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[65] ASR Analytics. 2014. *National Telecommunications and Information Administration Broadband Technology Opportunities Program Evaluation Study. Final Report: Social and Economic Impacts of the Broadband Technology Opportunities Program*. Accessed at http://www2.ntia.doc.gov/files/asr_final_report.pdf on August 17, 2015.

[66] National Telecommunications & Information Administration. 2010. "State Broadband Initiative." Accessed at http://www2.ntia.doc.gov/SBDD?page=1 on August 13, 2015.

identifying regulatory barriers that constrain broadband Internet deployment. Public comments have been gathered to inform the work of the council.

Given the complexity of the rural broadband Internet ecosystem, ARC can play an important coordinating role in helping communities in the Appalachian Region navigate this environment and how to best leverage all of these assets.

This collection of organizations underscores the highly dynamic nature of entities working to supply broadband Internet at adequate speeds and prices so that adoption can increase.

4.5 FINDINGS AND CONCLUSIONS

This contemporary literature review reveals the degree to which activities, opportunities, and needs of broadband Internet are complex and evolving rapidly. ARC and others must stay attuned to this hyper-dynamic realm of activity to ensure they are directing resources to have maximum impact over the long term.

Broadband Internet plays an essential role in community and economic development in the twenty-first century. Modern business, government, education, and health care all require a reliable, affordable high-speed Internet connection to operate effectively. The role of broadband Internet in our society is evolving as it becomes integrated with our daily lives and its applications grow ever more sophisticated. Internet use is on the rise because there are social, cultural, and economic benefits that can result from increased adoption.

Unfortunately, rural communities have some of the lowest rates of broadband Internet penetration and usage because of a mix of factors such as cost of service, access to service, and concerns about digital literacy. However, rural communities stand to gain the most from broadband Internet because it levels the playing field between urban and rural areas.

A complex ecosystem of programs is in place at the state and federal levels to help overcome the barriers to rural broadband Internet deployment and provide rural communities access and ability to adopt broadband Internet and advanced telecommunications technology to improve economic outcomes, health, governance, education, and quality of life.

In **Section 5**, we review ARC's efforts to help the Appalachian Region access and adopt telecommunications and technology through its FY 2004 through FY 2010 grant portfolio. We return to some of these issues discussed in the literature review in **Section 8** where we identify key policy issues for broadband Internet in the future. We offer ARC and others a summary of issues to consider as various interested parties seek to extend access, affordability, and quality broadband Internet to rural America.

5 Grant Portfolio Analysis

The following summary of ARC's telecommunications and technology grant portfolio from FY 2004 through FY 2010 provides an excellent overview of the program by describing the grants by attributes such as FY, geography, function, beneficiary, scale of the project, and the proportion of grants going to distressed counties. We also describe the performance of the grants during the grantmaking period by comparing performance measures at the close of the grant with the projected performance measures[67] that were established as goals at the beginning of the grant.

As we discuss, ARC's portfolio of grants served hundreds of thousands of people in the Appalachian Region by serving businesses, patients, students, and workers among others. **Table 5-1** summarizes the extent to which ARC telecommunications and technology grants served the people of Appalachia.

Table 5-1. Outputs of ARC Telecommunications and Technology Grants at the End of Grant Period (N=310)

	Number	
Outputs	At Close	Grants with Output as a Performance Measure
Businesses served	5,176	36
Linear feet of fiber	756,494	10
Participants served	151,141	61
Patients served	285,994	9
Plans/reports	52	18
Students served	152,027	112
Workers/trainees served	22,510	60

Source: RTI

[67] We use the term "measures" or "goals" to refer broadly to both outputs and outcomes that ARC tracks in ARC.net.

Of the projects with complete data, 127 (50 percent[68]) met or exceeded the goals set forth at the beginning of the grant. Thirty-five of those projects exceeded their established goals. Many projects came close to meeting all of their stated goals within their grant. We found that 140 (55 percent) projects reached 85 percent of the goals the grantees established at the beginning of the grant period. At the same time, 115 (45 percent) grants did not come within the 85 percent threshold for meeting stated goals. A variety of factors may have led to the significant portion of grants that met or exceeded project goals and likewise a variety of factors that likely made it difficult for grantees to meet all of their stated outcomes. This research explores many of the reasons that helped grants have stronger or weaker performance than expected. The survey findings (**Section 6**) and case studies (**Section 7**) delve into the factors and circumstances that grantees thought helped or hindered their ability to perform.

In addition to understanding the circumstances that help or hinder grant performance, it is important to note three significant things when considering grant performance. First, ensuring data quality for grant reporting is difficult and cumbersome for grantees. Secondly, grant applications from the states were inventive and highly varied to the needs of each state and county served. Many of these kinds of grants had not been implemented before; thus, stating the expected goals at the grant outset likely held a degree of uncertainty. Lastly, telecommunications and technology, by their nature, tend to have much more long-lasting impacts. Capturing performance measures at the end of a 1- or 4-year period misses the long-term and ongoing impacts that these kinds of grants can have. We capture some of these impacts in **Section 6.2**.

The data for the analysis in this section reflect the outputs and outcomes at the close of the grant period for each individual project. These data we review largely in this report are limited to the grant period for each project. They do not indicate long-term success or failure of projects. In fact, one of the key findings from our survey (**Section 6**) is the degree to which a project's impacts can continue to accumulate even after the ARC grant ends. In this section, we focus more specifically on

[68] Of the portfolio of 265 projects with complete information.

descriptors of how grant funding was allocated and grant performance at project closeout. Grant performance at the conclusion of the grant should not be interpreted as a definitive metric of success or failure.

5.1 INTRODUCTION

This section summarizes the information collected on each ARC grant within the telecommunications and technology portfolio during the grant period up to the end of the grant or at the close of the project. The ARC grant database provides detailed information on the traits of each grant, its intended objectives, and the status of each grant at its conclusion. This section provides a rich overview of the ARC portfolio in telecommunications and technology that serves as a foundation from which other data analyses (e.g., survey and case studies) build on throughout the remainder of the report.

Section 5.2 explains the data methods used to analyze grant performance and the steps RTI took to ensure quality data. Section 5.3 outlines RTI's framework for analyzing the project data based on the (1) function of the grant along the broadband Internet spectrum and (2) primary target beneficiary of the grant. **Section 5.4** provides an overview of ARC's grants by time frame, state, function, beneficiary, levels of funding, and economically distressed areas. **Section 5.5** summarizes how at-close performance measures compare with corresponding projected goals across functions and geography. We also analyze multifunctional grants. At the end of this section, the reader will have a detailed understanding of the ARC portfolio, its performance, and how it has directly affected people in the Appalachian Region.

5.2 DATA METHODS

The ARC database of grants formed the starting point for our evaluation and is the basis for the descriptive summary that follows in **Section 5.3**. The ARC database was extracted from ARC.net by ARC staff and originally included 322 grants as part of the telecommunications and technology program between fiscal years 2004 and 2010. Of the original 322 grants, RTI removed 12 grants from the evaluation for the following reasons:

- Six grants were revisions of previous grants that began before the start of the study period (FY 2004) and therefore were deemed outside of the study period.
- Eight grants represented pairs of grants that were revisions to the original grants, so they were collapsed into four grants for this evaluation. RTI combined the data on funding and performance measures for these grants accordingly.
- Two grants were removed because they were outside the scope of this evaluation.[69]

The complete list of these 12 grants can be found in **Appendix A**. The database contains descriptive information such as

- grant codes and titles;
- information about grant location, grant recipients, and contact information;
- performance measures (projected, at close, and validated); and
- text descriptions of the grants, closeout reports, and validation visits.

Of the 310 grants used for the evaluation, RTI reviewed the grant performance data for accuracy and consistency. There were missing data and data quality issues in the database that RTI staff addressed. Thus, RTI staff carefully reviewed data for each grant to track whether grants had both projected and at-close measures and to verify consistency of the recorded performance measures with project descriptions from the database and other documentation from ARC.net such as closeout notes. RTI paid close attention to paired output and outcome measures to understand how project participants were positively affected by grants. However, as **Section 5.5.2** shows, RTI researchers found inconsistencies in how grant recipients reported paired outputs and outcomes.

Through this process, RTI made direct data edits for nine grants where there was an apparent discrepancy between closeout notes and the recorded performance measures. In most of

[69] Projects removed were Southern Growth Policies Board 2006 Annual Conference (CO-14135-C4) and Web-Based Resources for Grant Development/Performance Measurement & Assessment of Opportunities to Improve Business Process (CO-12882-I-J).

these cases, there was an at-close measure in the closeout notes that was not recorded in the data.

RTI also identified 79 grants that were missing at-close numbers or projected numbers.[70] ARC and RTI were able to review and update data for 25 grants by searching through paper files that were not captured in ARC.net, leaving 54 (17 percent of the grant portfolio) without at-close data. Of the 54 grants without at-close data, they fell into three categories:

- 23 had no performance data available at the close of the grant because the programs were just getting started or were in the early stages of implementation.
- 10 were managed by another agency, and ARC does not receive closeout numbers from them. Examples of other agencies are HUD and the Tennessee Valley Authority (TVA).
- ARC and RTI were unable to locate the paper files for 21 grants. These were primarily for grants between FY 2004 and FY 2007.

The complete list of these 54 grants and the reasons for their missing data can be found in **Appendix A**. At the end of the data-cleaning process 256 grants had complete performance measures. Any analysis of performance measures in this section thus refers to the 256 grants with complete data. Descriptive statistics about the portfolio, however, reflect the 310 total grants. We note throughout the report when we use the full database (N=310) or when we are summarizing only the grants with complete data files (n=256).

5.3 EVALUATION FRAMEWORK: FUNCTION AND TARGET BENEFICIARY

ARC's grantmaking efforts during the evaluation period were diverse. To provide a common analytical structure across the evaluation, RTI devised a framework to organize the portfolio. The framework comprises two dimensions:

- *Function* of the grant—that is, how the grant related to the direct installation of broadband Internet and other Internet infrastructure, implementation of networking and ancillary equipment, applications taking advantage

[70] RTI did not make any modifications to the validated data. Of the 310 projects, 65 had a validation visit from ARC. This report does not analyze validation data.

of Internet connectivity, and efforts to accelerate the adoption of broadband Internet.

- *Beneficiary*—the individuals, groups, or types of organizations the investments were intended to primarily benefit.

The first dimension of the framework is a significant change in how grants were organized in the database, while the second dimension refined what ARC was already tracking. Overall, this framework helps clarify how ARC is investing across the broadband Internet spectrum and the beneficiaries of these efforts.

5.3.1 Function

Telecommunications and technology adoption projects, particularly focused on broadband Internet use, do not occur in a vacuum. The function dimension of the evaluation framework is based on the spectrum of telecommunications investments and includes direct installation of broadband Internet infrastructure, equipment that allows people to access the broadband Internet, applications that allow people and organizations to take advantage of broadband Internet, and education to adopt broadband Internet technology. It is based on the logic that grants of different functions serve communities in different ways. **Table 5-2** describes RTI's functional framework and gives examples of the types of grants that fall into each category.

In the data analysis, RTI reviewed each grant and categorized them with all functions that were applicable to capture the nature of cross-functionality of grants in the portfolio. Therefore, in some cases, the totals for the grants by function will add up to be greater than 310 because many grants were multifunctional, such as computer equipment for broadband Internet access ("indirect broadband Internet") combined with computer skills training grants ("adoption of broadband Internet"). We focused on multifunctional grants, because of the emphasis within the ARC project guidelines on multiuse strategies (see **Section 2.3**). Also, RTI analysts were able to understand how multifunctional grant performance compared with that of grants with a single goal or function.

Table 5-2. Function Dimension of the Evaluation Framework

Function	Description	Examples
Direct broadband	"Outside the building" projects that expand broadband Internet access or improve Internet connectivity for local businesses, schools, or the community more broadly.	• Laying fiber optics • Wireless broadband Internet antennas • WiMAX • Community-wide Wi-Fi access
Indirect broadband/ supported by broadband	"Inside the building" projects that invest in networking equipment and other telecommunications tools that are supported by or depend on broadband Internet access.	• Networking equipment: fiber optic termination equipment, cabling, ATM switches, routers, servers, etc. • Wi-Fi routers • Video-conferencing equipment • Voice over Internet Protocol equipment • Connected classroom technology • Point-of-presence systems • Internet2 for educational institutions
Applications of broadband	Projects that convey information or provide services via broadband Internet.	• Distance learning • Health technology: picture archiving and communication systems, EMRs, tele-health programs • Websites • E-payment systems • Business incubators focused on e-commerce or online tech services • Geographic information systems (GIS) with web-based functionality • Wireless kiosks
Adoption of broadband	Projects focused on improving the planning for broadband Internet infrastructure and developing the digital literacy of participants through training, professional development, or education to spur adoption of broadband Internet and telecommunications technologies.	• Curriculum development • Training – Computer literacy – E-commerce initiatives/training – Software training – Seminars and conferences • Workforce development • Technical assistance • Strategic planning for broadband Internet • Telecommunications assessments

(continued)

Table 5-2. Function Dimension of the Evaluation Framework (continued)

Function	Description	Examples
Other nontele-communica-tions technologies	General purpose technologies that are not directly related to telecommunications.	• General medical technology unrelated to broadband Internet or Internet • Lab equipment for community colleges • Public safety projects – Fire training equipment – light-emitting diode (LED) traffic lights • Building technologies: general construction, HVAC systems, green building technologies, LED lighting, other building technologies • Other technologies such as energy, manufacturing, etc. • GIS systems for internal use: Without web functionality
Uncategorized	Outliers	• Experiential learning • Business incubators (with no direct link to broadband Internet) • Science, technology, engineering, math (STEM)-oriented education and training projects such as Oak Ridge National Laboratory (ORNL) Summer Institute

Source: RTI, ARC

Of the grants during the study period, RTI classified 119 as multifunctional with at least one telecommunications function, making up 38 percent of the portfolio. The grants represented a wide range of project types and geographies and were not concentrated in a single category. **Table 5-3** outlines the single-function and multifunctional grants and how they incorporated telecommunications functions.

Table 5-3. Function of ARC Telecommunications and Technology Grants (N=310)

Single Function or Multifunctional	Function	Count	Percentage of Total[a]
Single function	Direct broadband	30	10
Single function	Indirect broadband /supported by broadband	31	10
Single function	Applications of broadband	20	6
Single function	Adoption of broadband	29	9
Multifunctional	Multifunctional with at least one telecommunications function	119	38
Single function	Other nontelecommunications technologies	60	20
	All other	21	6

[a] Percentages do not add to 100 because of rounding.
Source: RTI

5.3.2 Beneficiary

In addition to organizing grants along the function dimension, RTI identified the kinds of people primarily affected by each grant. The primary beneficiary dimension of the evaluation framework was based on ARC's original categories but more specifically focused on the group that was most directly affected or expected to be affected by the grant. Furthermore, we refined some of ARC's original categories to best describe the suite of grants. **Table 5-4** lists the primary beneficiary and the most common examples of projects in each category.

Table 5-4. Primary Beneficiary of ARC Telecommunications and Technology Grants (N=310)

Primary Target Beneficiary	Count	Description
Business development	40	Business parks, entrepreneurial centers, business incubators, tourism projects, and business development centers in the context of workforce development
Community development	48	Community-wide initiatives and other projects that have a broad reach beyond a single category
Education	87	Projects that directly affect K–12 education, including projects that directly affect the classroom through teacher training and curriculum development
Training	62	Projects focused on community colleges, universities, job training, and workforce development
Health	32	All health-related projects such as EMRs, telemedicine, and digital imaging technology
Local government	41	Projects that directly benefit improved government services such as emergency services and electronic records keeping, which then have a secondary effect on the community

Source: RTI

In the designation of the primary beneficiary, RTI focused on the group that would be most directly affected by ARC funding. By the nature of these categories, many grants had secondary beneficiaries: local government projects would, in turn, benefit the community because of improved government services. To be consistent across grants, RTI solely categorized grants by one primary beneficiary.

5.3.3 Summarizing Grants by Function and Beneficiary

When used together, the function of the grant and target beneficiary helps to more succinctly describe the breadth of the grant portfolio. More specifically, it highlights how ARC has invested in telecommunications and technology to positively affect the people of the Appalachian Region.

Table 5-5 provides a matrix that details the dual frameworks for analysis—function and beneficiary. Under each cross-section between the two dimensions, we summarize the types of grants and list the corresponding number of grants associated with each. Common themes emerge across the portfolio, revealing common areas of focus. The following are the most common intersections of function and primary beneficiary:

- ***Direct*** **broadband Internet** ***for community development:*** Municipal fiber, wireless, or other high-speed broadband Internet connection for a large area.
- ***Indirect*** **broadband Internet** ***for education:*** Equipment for K–12 schools and classrooms to connect to broadband Internet, including laptops, smart boards, networking, routers, and other hardware.
- ***Indirect*** **broadband Internet for** ***training***: Equipment, including computers for workforce training centers, community colleges, and universities.
- ***Indirect*** **broadband Internet for** ***health***: Equipment for health services that requires a high-speed broadband Internet connection such as telemedicine or remote monitoring devices.
- ***Applications*** **of broadband Internet for** ***education***: E-learning curriculums and online education programs.
- ***Applications*** **of broadband Internet for** ***health*****:** Systems for telemedicine and remote diagnosis, EMRs for hospitals, and electronic imaging systems.
- ***Other*** **technology investments for** ***training***: General-purpose technology-based training for a variety of job skills including manufacturing, horticulture, and experiential learning.

Table 5-5. Summary of the Framework—Function

Primary Beneficiary	Direct Broadband	Supported by Broadband/Indirect	Applications of Broadband	Adoption of Broadband	Other Technology Investments Unrelated to Broadband	Other
Business development	Fiber or wireless Internet connecting a business park to high-speed Internet service (6)[a]	Equipment to help improve accessibility in business parks and tourism centers (10)	Applications include e-commerce initiatives and websites for local businesses and business groups (15)	Support programs to help businesses access broadband Internet technology applications (7)	Construction of physical infrastructure to support technology, including business incubator space and physical capital such as a 3D printer (13)	Entrepreneurship programs and business incubators (6)
Community development	Municipal fiber, wireless or other high-speed Internet connection for a large area (24)	Equipment for municipal services including emergency services, civic centers, and public libraries (11)	Applications include asset mapping for local communities (7)	Technical assistance and master planning programs for community broadband Internet initiatives (10)	GIS systems without web functionality (4)	(0)
Education	Providing a direct high-speed connection to a school for Internet or Internet2 connectivity (6)	Equipment for schools including laptops in the classroom, computers for schools, routers for schools, and smart boards (51)	E-learning curriculums, online services for education in the general curriculum (26)	Education and training for K–12 in computer literacy, Internet, and other technology-connected to high speed Internet (20)	Other classroom technology that does not require broadband Internet, such as science labs, recording studios, and other technology education (15)	Afterschool programs, summer institutes, and general education (12)
Training	Training for workers to install broadband Internet technology including fiber optic line (2)	Equipment including computers for workforce training centers, community colleges, and universities (26)	Includes complementary applications for equipment in training centers (9)	Technology training for adults in computer literacy, e-commerce, web design, and Internet-related skills (19)	General technology-based training on emergency response, manufacturing workforce training (26)	General purpose technology-based training for a variety of job skills including manufacturing, horticulture, and experiential learning (6)
Health	(0)	Equipment for health services that requires a high speed Internet connection such as telemedicine or remote monitoring devices (20)	EMRs, electronic imaging systems (23)	Training for any health equipment that requires high-speed Internet including telemedicine and EMR systems (6)	Hospital equipment that does not necessarily require broadband Internet: radiography, monitoring equipment, diagnostic equipment (8)	(0)
Local government	High-speed connection for improved municipal services, including criminal justice (4)	Equipment for improved government services, including criminal justice, records keeping, communication, and e-payment systems (12)	E-government services including emergency services, e-payment systems, records backup, web hosting (13)	Government outreach programs for broadband Internet adoption, including conferences, technical assistance, and training (11)	Includes GIS, technical assistance for GIS, and physical infrastructure for government services (15)	(0)

[a] Numbers in parentheses represent the number of grants that are classified by the primary beneficiary and function. Totals do not add to 310 because some grants are multifunctional.
Source: RTI

5.4 DESCRIPTIVE ANALYSIS

Now that we have established the frameworks that underpin the analysis we describe all of ARC's grantmaking activity in telecommunications and technology between FY 2004 and FY 2010. Over the 7-year grant period, ARC invested in a wide range of projects in terms of size, grantees, function, beneficiary, geography, and other observable characteristics of grants.

5.4.1 Summary Statistics of the Portfolio

Summary statistics of the quantitative variables for the portfolio of grants are summarized in **Table 5-6**. ARC contributed roughly $132,000 in funding for each project, although that is skewed by the larger grants. The median, a more reliable measure of central tendency in this case, is $87,730. ARC contributed between $2,192 and up to $2 million for a single grant.[71] On average, ARC funds accounted for about 41 percent of total funding.

Table 5-6. Summary Statistics (N=310)

Variable	Mean	Median	Min	Max
ARC funds	131,957	86,730	2,192	2,000,000
Local funds	119,058	50,000	0	1,472,500
State funds	49,902	0	0	4,000,000
Other federal funds	21,902	0	0	1,925,000
Total funds	322,819	183,318	3,000	4,851,168
Grant duration (days)	681	590	107	2,514
Continuation	11%	0	0	1
Number of functions	1.4	1.0	1.0	4.0
Number of counties served[a]	5.4	1	1	55

[a] Summary statistics for the number of counties were only calculated for the 292 non-Commission-funded grants. Counties were unavailable for the Commission-funded projects.

ARC funding typically supports grants for close to 2 years. The shortest grant lasted for three and a half months, while the longest grant lasted for nearly 7 years. Eleven percent of grants

[71] One grant with $0 in ARC funding—"NC Medications Access and Review Program Expansion Pilot"—received in-kind services from ARC instead of cash funding.

awarded by ARC during the 7-year period were continuations of previous projects.

Approximately 60 percent of the grants only had a single function along the telecommunications and technology spectrum. The average was 1.4, meaning grants tended to have between one and two functions. Several grants were highly multifunctional with as many as four total functions.

The geographic reach of each grant varied significantly. Roughly half of the grants were targeted at a single county; however, grants like the Space Science Center Instructional Equipment and Furnishings in Kentucky and the WV State Museum Education served more than 50 counties each.

5.4.2 Scale of Projects

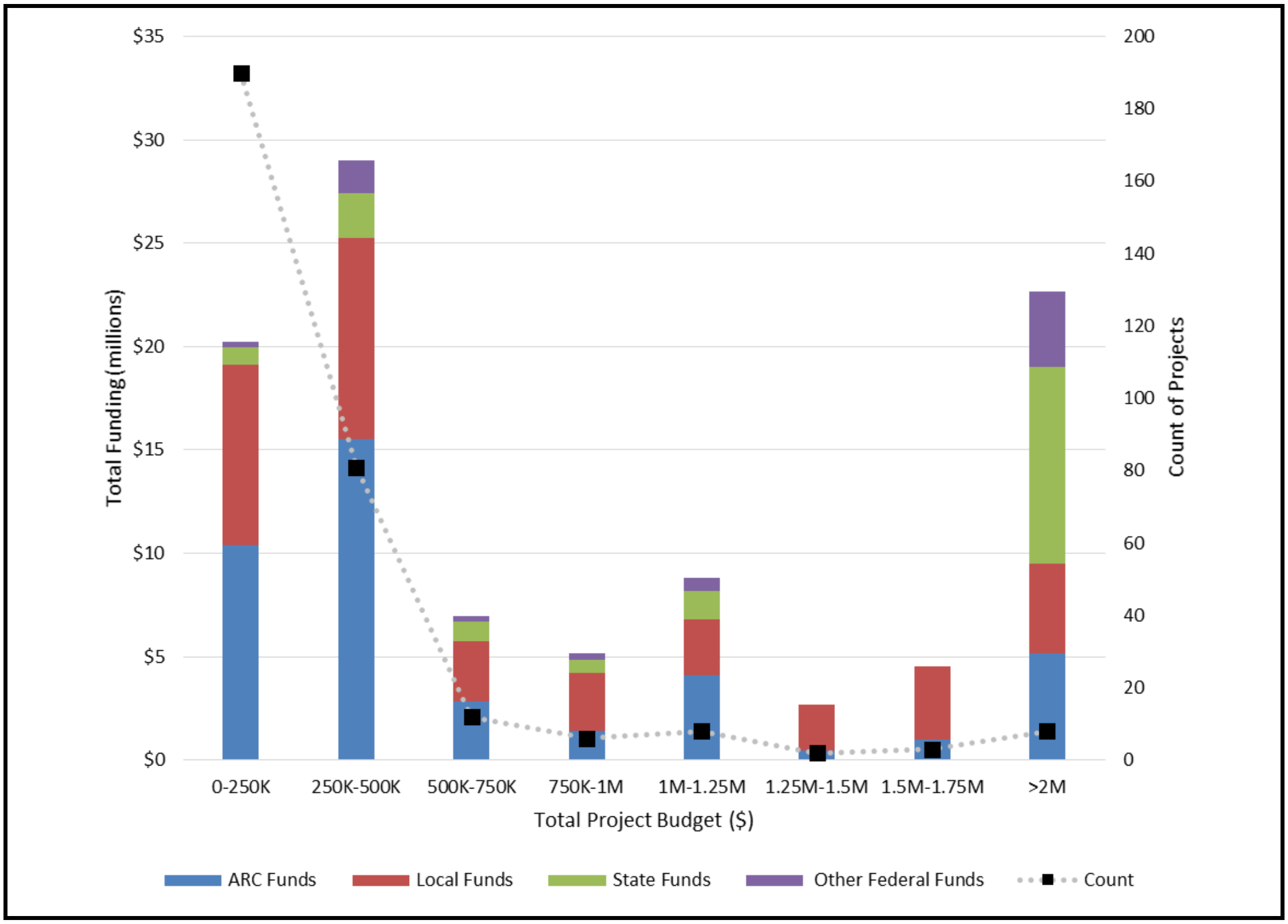
In its telecommunications and technology portfolio, ARC funded projects ranging from local initiatives with a budget in the thousands of dollars to large, multicounty projects with budgets as high as $2 million. ARC guidelines generally allow for grants up to 50 percent of a project’s total cost, but the scale of projects depends on the discretion of the state’s grant manager. **Figure 5-1** shows the funding and number of projects by total project budget funding (ARC and non-ARC sources) over the 7-year period.

The most common grants funded were for projects with a budget of $250,000 or less, of which ARC contributed approximately half of the total funding. Larger projects received less ARC funding as a portion of their total funding. The eight projects with a budget over $2 million received less than one-quarter of their funding from ARC and leveraged more state and other federal funding. These projects included large medical center expansions and business development projects, such as entrepreneurship centers and business development parks.

5.4.3 Funding Over Time

During the period between FY 2004 and FY 2010, ARC granted nearly $41 million to programs which leveraged another $59 million in local, state, and federal funding for a total of approximately $100 million. The following figures show the trends over the seven year grantmaking period. They show ARC funding, total funding, and number of grants over the 7-year period.

Figure 5-1. Total Funding and Number of ARC Telecommunications and Technology Grants by Project Size: FY 2004–FY 2010



Source: ARC.net, RTI

ARC funding oscillated between FY 2004 and FY 2008 and declined significantly between FY 2008 and 2010. Funding levels do not reflect budgets cuts or increases in the telecommunications and technology portfolio. Two factors play a major role in how and when ARC awards grants by program area. First, states determine the grants across all program areas that they submit to ARC for final approval. For example, a state may submit applications for entrepreneurship grants rather than telecommunications and technology grants during one year. Secondly, funding fluctuations reflect the grant applications submitted. For example, if a state does not submit any applications for telecommunications and technology grants, no funding is allocated. Thus, the budget for telecommunications and technology grants may decrease or increase year by year depending on states' priorities.

FY 2010 had the lowest level of ARC funding, with $3.9 million going toward 39 telecommunications and technology grants. Total funding toward telecommunications and technology declined every year from FY 2004 through FY 2010. **Figures 5-2** through **5-4** show the timeline of ARC's grantmaking during that time.

5.4.4 Grantees

The most common grant recipient was a nonprofit without 501(c)(3) status: These recipients included community organizations, hospitals, foundations, economic development corporations, and business associations. Additionally, public institutions of higher education, county governments, and local development districts received a large number of grants. **Figure 5-5** shows the most common recipients of ARC grants in telecommunications and technology.

Some grantees received more than one grant during the study period, while most grantees were one-time grant recipients. Some of the repeat grantees include the SEDA-Council of Governments (six grants), Allegheny College of MD (five grants), Mission WV, Inc. (four grants), Mississippi State University (four grants), Board of Education Allegheny County (four grants), and Oak Ridge Associated Universities (four grants).

Overall, 33 grants, or about 11 percent of the total portfolio, were continuations of previous grants.

Of the repeat grantees, some received ARC funding for continuations of previous projects, while some received ARC funding for altogether new projects. Overall, 33 grants, or about 11 percent of the total portfolio, were continuations of previous grants. For example, the ORNL Summer Institute was funded six times during the study period, every year from 2004 through 2010 with the exception of 2007 (see spotlight below for the 2004 project).

Figure 5-2. ARC Funding for Telecommunications and Technology Grants by Fiscal Year: FY 2004–FY 2010

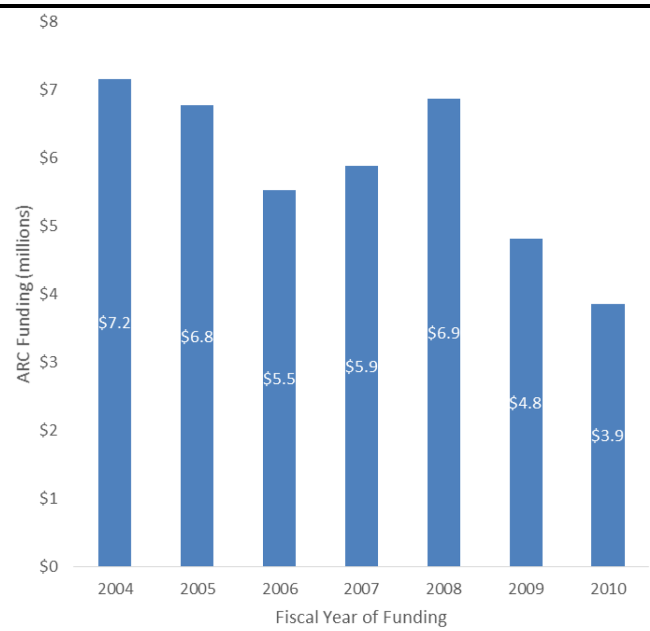


Figure 5-3. Total Funding and Funding Sources for ARC Telecommunications and Technology Projects by Fiscal Year: FY 2004–FY 2010

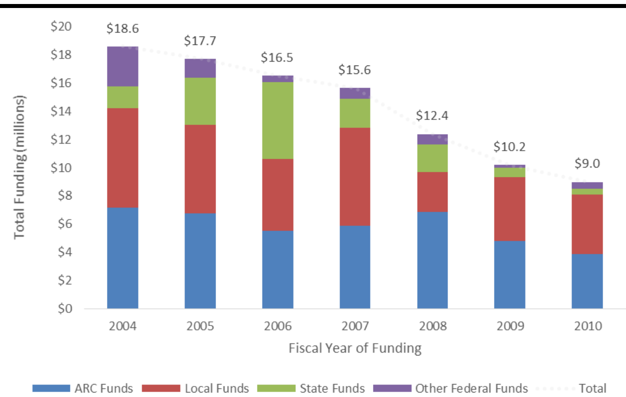


Figure 5-4. Number of ARC Telecommunications and Technology Grants by Fiscal Year: FY 2004–FY 2010

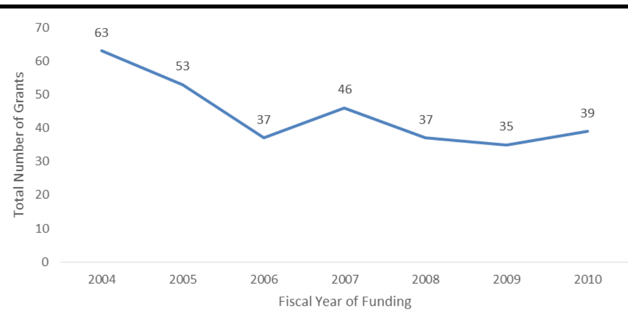
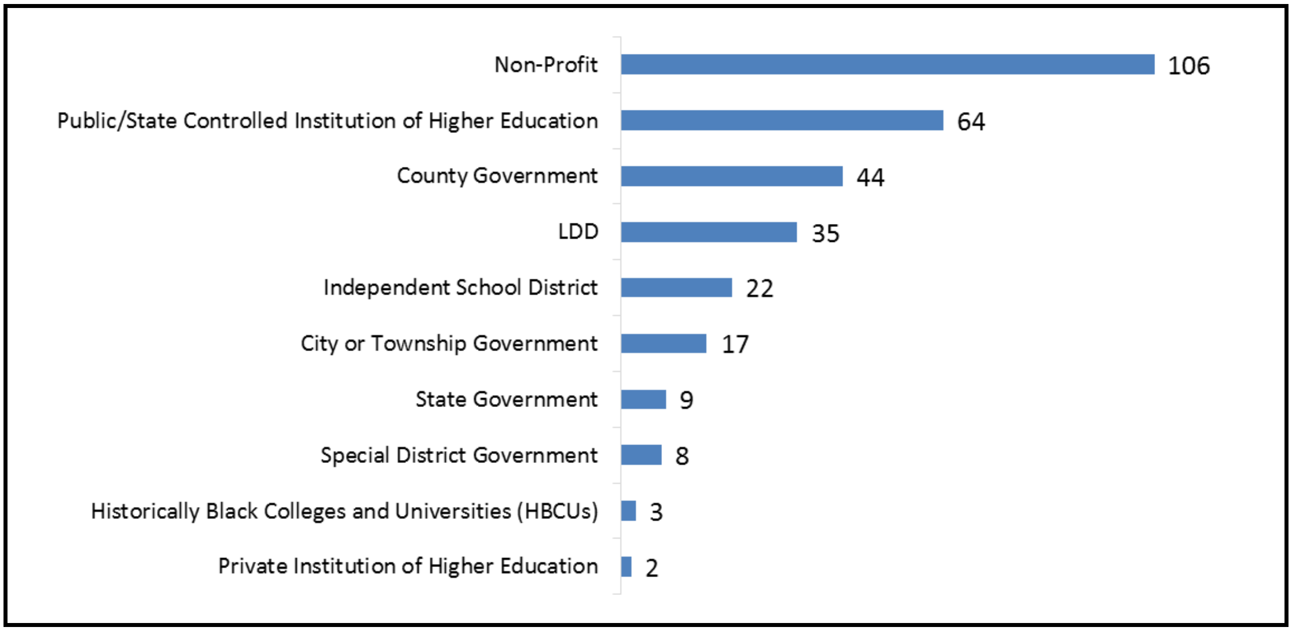


Figure 5-5. Number of ARC Telecommunications and Technology Grants by Grantee Type: FY 2004–FY 2010 (N=310)



Source: ARC.net, RTI

Grant Spotlight: Oak Ridge National Laboratory 2004 Summer Institute

The Oak Ridge Institute for Science and Education managed the ARC/ORNL Math-Science-Technology Institute in Oak Ridge, Tennessee, that was held for 2 weeks in July 2004. Twenty teachers and 33 students from high schools in the Appalachian Region participated in the institute. The participants engaged in research projects and in cultural and recreational activities to celebrate their Appalachian heritage. The institute not only encouraged the students to attend college and pursue careers in science, mathematics, engineering, and technology, but also strengthened the scientific content knowledge of participating teachers.

ARC invested a total of $1.4 million in the summer institute from FY 2004 through FY 2010.

Another example of a continuation is the Mission WV Striving for Technological Empowerment while Providing Unlimited Potential (STEPUP) project. This initiative focused on creating computer labs with access to broadband Internet for worker training in rural West Virginia. It was initially funded by ARC in 2003 and was funded an additional four times during the study period.

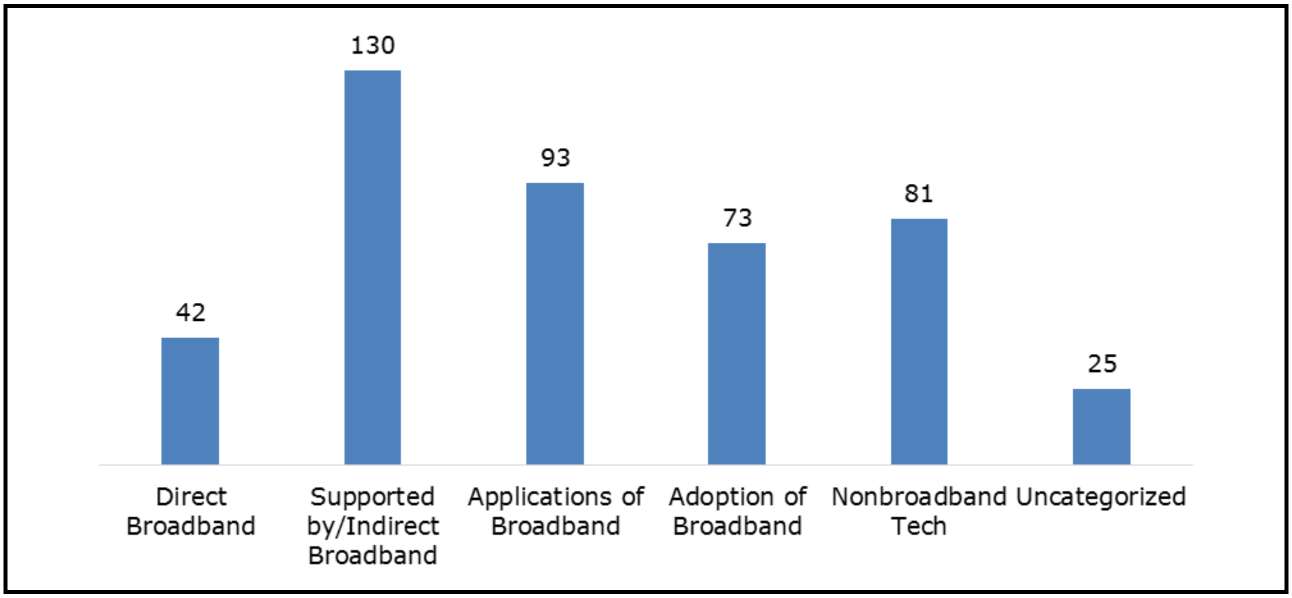
5.4.5 Function and Beneficiary

Function

During the study period, ARC invested heavily in all levels of the telecommunications and technology spectrum, and its investments went far beyond infrastructure in fiber or wireless broadband Internet. **Figure 5-6** shows the counts of projects by function.

The most frequent type of grant was for equipment supported by broadband Internet or "indirect broadband Internet." These grants most commonly involved purchasing hardware for an educational institution (computers, routers, smart boards) or health center (telemedicine equipment) or purchasing equipment for other civic or community needs, such as a community center or training center. These grants give people direct access to the Internet and rely on an existing Internet connection.

Figure 5-6. Number of Grants with Each Function as a Component of the Grant (N=310)



Source: ARC.net, RTI

Grant Spotlight: Broome Tioga BOCES Distance Learning Project

This ARC grant provided funds to purchase video conferencing equipment for two school districts to improve distance learning capabilities. In its first year, the project served 360 students through new course offerings and advanced learning experiences.

Applications of broadband Internet grants were varied but involved giving people added value through access to the Internet and Internet-connected devices. They included e-commerce and e-learning programs that improved outcomes for business and education. Adoption-oriented grants were designed to teach people how to take advantage of the Internet and associated telecommunications technology. Direct broadband Internet grants were less common, and they involved physically laying fiber or installing antennas to give people access to Internet service or improved speeds.

Nonbroadband Internet, general-purpose technology grants were wide ranging and covered a variety of categories:

- building construction
- vocational and skills training
- medical and dental equipment
- manufacturing equipment
- laboratory equipment for schools, colleges, and universities

These grants included technology elements but were not technologies that depended on high-speed Internet or broadband Internet.

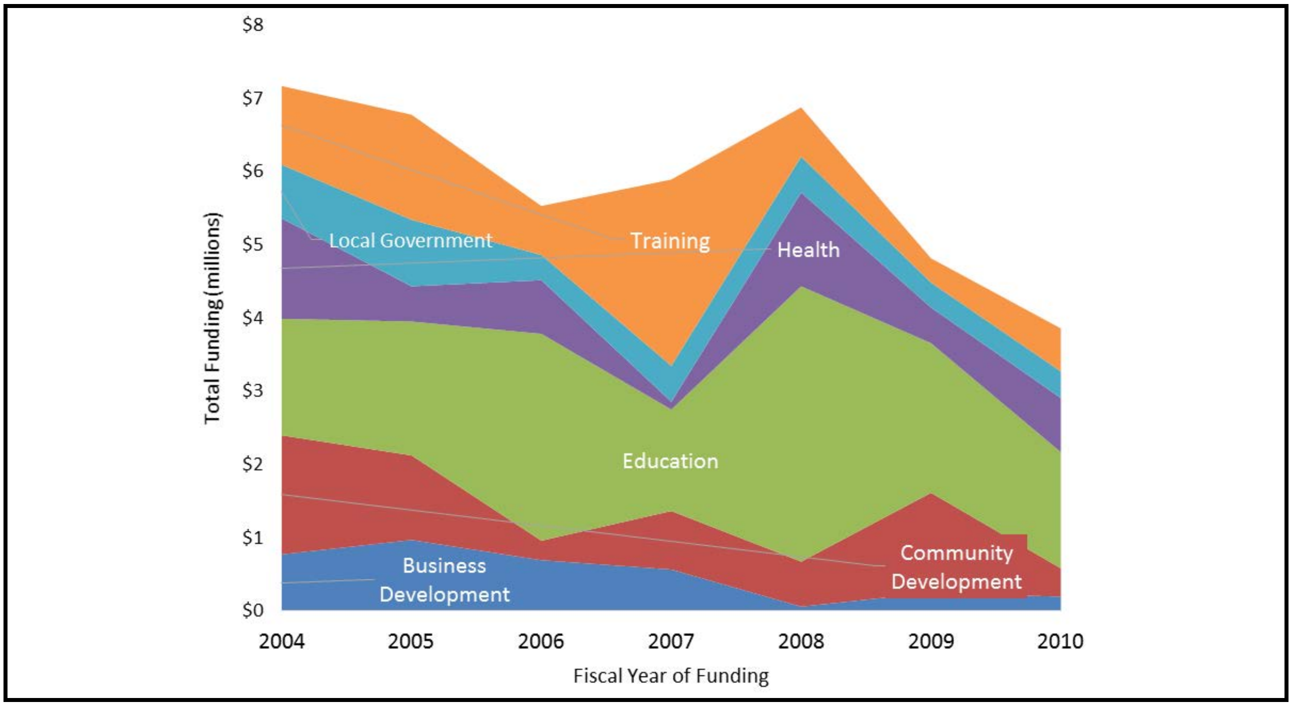
Target Beneficiary

Looking at funding by target beneficiary allows us to see how ARC's grantmaking priorities affected the people who live and work in Appalachia. The most common beneficiary categories were education (K–12) and training (community colleges, universities, job training, and workforce development), both in total number of grants and in ARC funding. **Figure 5-7** shows levels of ARC funding for projects by target beneficiary during the 7-year period.

Figure 5-8 shows ARC funding, leveraged funding, and counts of projects by primary target beneficiary. Although education and training beneficiaries were the largest recipients of ARC funding, business development projects were able to leverage a higher percentage of funding from other sources.

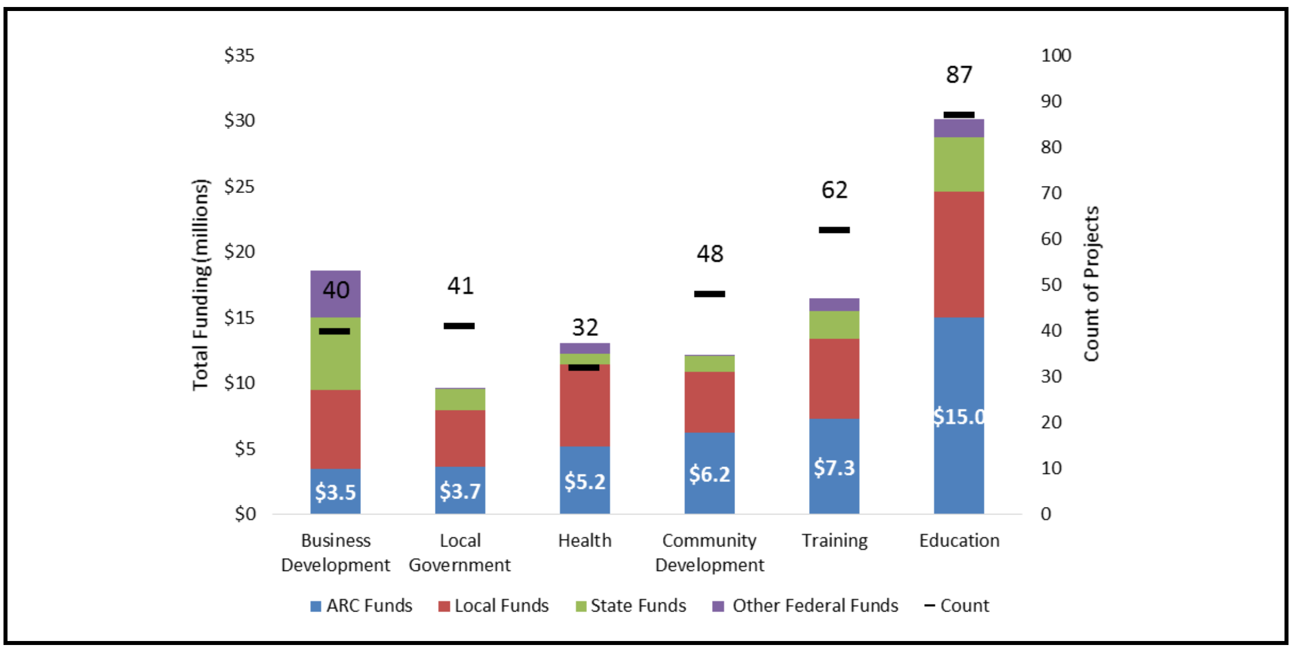
Excluding leveraged funding from other sources, we can see in **Figure 5-7** how ARC's investments changed over time. ARC funding for education increased slightly over the period but was quite volatile. Training declined over the period and had one

Figure 5-7. ARC Funding by Target Beneficiary of ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Source: ARC.net, RTI

Figure 5-8. ARC Funding, Leveraged Funding, and Count of Projects by Target Beneficiary of ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Source: ARC.net, RTI

large spike in 2007. Of the remaining four beneficiary categories, business development has the clearest trend because it appears to decline right around the time of the recession in 2008 through 2010.[72]

5.4.6 Geographic Distribution of Grants: Distressed Areas

ARC places a special emphasis on grants to economically distressed counties, which it defines by an index of three economic indicators: unemployment, income, and poverty rates.

As described in **Section 2**, ARC places a special emphasis on grants to economically distressed counties, which it defines by an index of three economic indicators: unemployment, income, and poverty rates. At the beginning of the grant period in FY 2004, ARC identified 91 counties as distressed: these counties were concentrated in Mississippi, Kentucky, and West Virginia.[73] In the application process, grantees indicated the degree to which the grant would have an impact on distressed areas; "primary" indicated the largest impact. "Substantial," "limited," and "none" indicated decreasing degrees of impact.

RTI observed a difference between states in the percentage of grants going to distressed areas, which was indicative of the percentage of distressed counties by state. **Figure 5-9** shows the percentage of projects by state that had a substantial or primary impact on distressed areas, as well as the portion of Appalachian counties within each state designated as economically distressed.

Virginia stands out as a state with a low level of economic distress but a high percentage of projects with an impact on distressed areas.

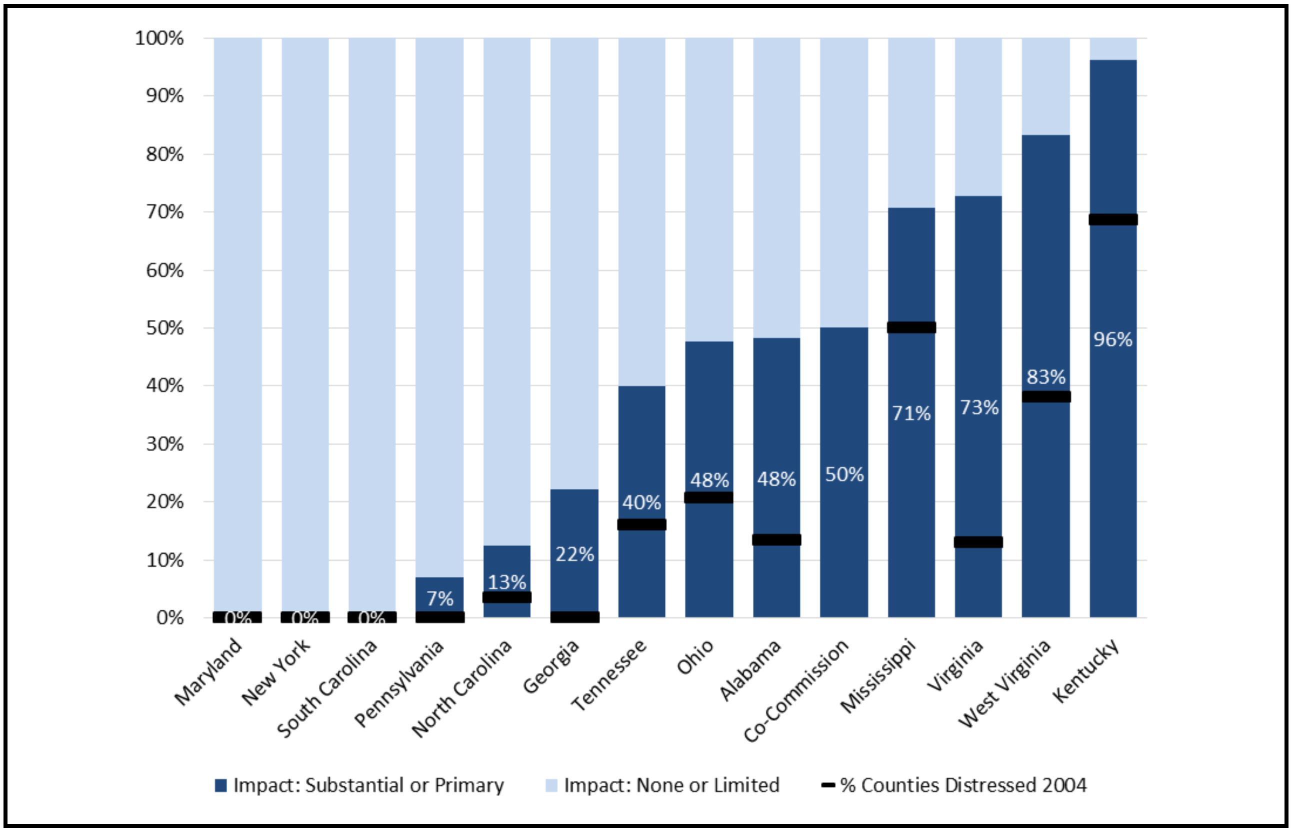
States with the highest concentration of grants to distressed counties were Kentucky, Virginia, West Virginia, and Mississippi. Three of these four states also have the highest levels of economic distress as defined by ARC. Virginia stands out as a state with a low level of economic distress but a high percentage of projects with an impact on distressed areas: 73 percent of grants in Virginia were categorized as having a substantial or primary impact on economically distressed areas.

ARC allows for a unique funding structure for projects with a substantial or primary impact on distressed counties. It grants up to 80 percent of a project's total budget instead of the usual 50 percent, recognizing the challenge of raising local funding in economically distressed areas. **Figure 5-10** shows how projects leveraged funding based on impact on distressed counties.

[72] If one looks at leveraged funding from other sources for business development, the same trend holds.

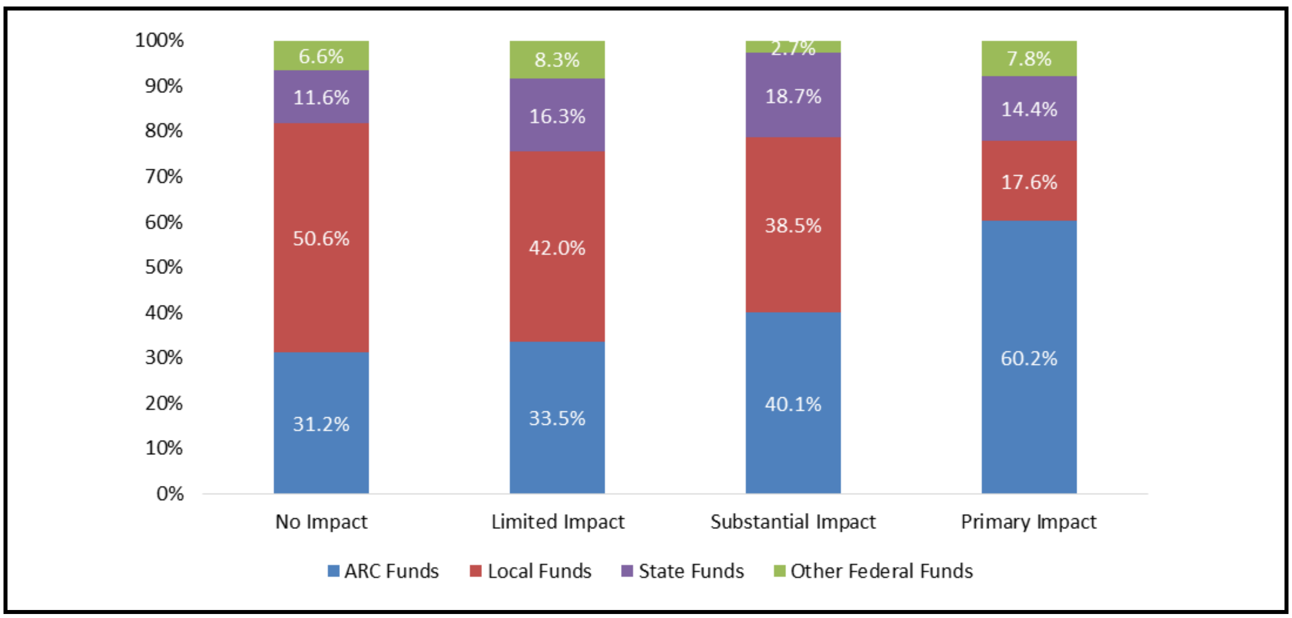
[73] Appalachian Regional Commission. "County Economic Status in Appalachia, FY 2004." Accessed at http://www.arc.gov/research/MapsofAppalachia.asp?MAP_ID=11 on August 1, 2015.

Figure 5-9. Percentage of Grants to Distressed Areas by State: ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Source: ARC.net, ARC Data Reports, RTI

Figure 5-10. Funding Structure for Projects by Impact on Distressed Counties: ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Source: ARC.net, RTI

Projects with a primary impact on distressed counties received, on average, over 60 percent of their funding from ARC. This occurred principally for two reasons:

1. ARC will fund up to 80 percent of the total project budget for projects that significantly affect distressed areas.
2. Because of less favorable economic conditions, organizations tended to leverage less local funding. Local funding accounted for less than 18 percent of the total when the impact was deemed "primary" by the grantee.

This report places particular attention on how projects affected distressed areas. As we show in **Section 5.5.3**, projects in distressed areas had performance outputs and outcomes that were similar to or better than the mean.

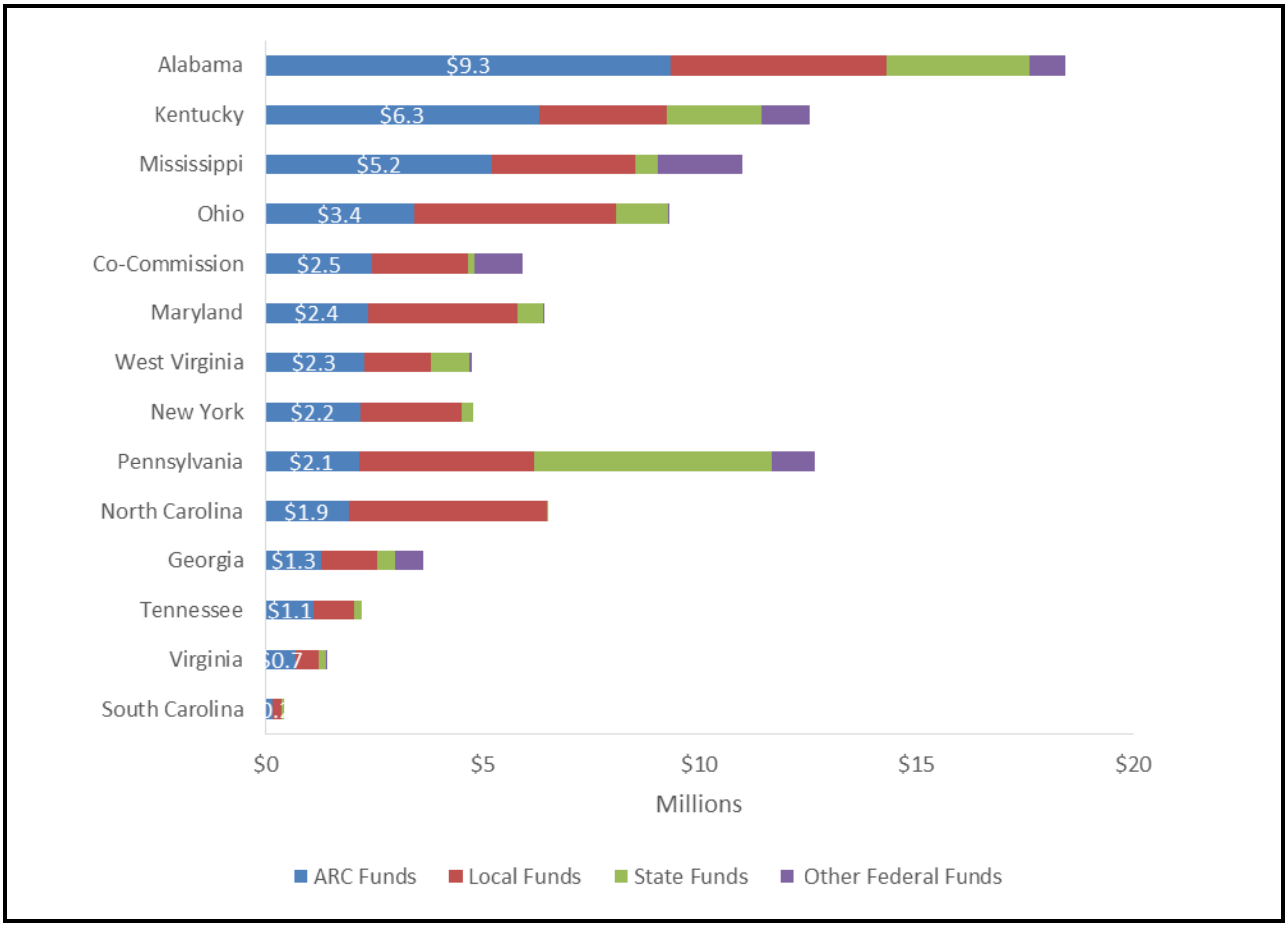
5.4.7 Geographic Distribution of Grants: States

ARC's grant programs are run through a state program officer, who distributes each state's allotment of ARC grant money according to local priorities and local grant requests. Telecommunications and technology is just one of many areas ARC invests in through grants. Each state has a unique portfolio of ARC telecommunications and technology grants.

Of all of the states in the Appalachian Region, Alabama allocated the most money to telecommunications and technology grants ($9.3 million), followed by Kentucky and Mississippi. ARC funds made up a large portion of the total budget for projects in these states because many of them had an impact on distressed counties.

Figure 5-11 shows the total funding to each state's telecommunications and technology grants from ARC and outside sources. Pennsylvania stands out as having leveraged the most state and local funding: although it only received $2.1 million in ARC funding, its projects had a total budget of over $12.5 million. This is partially due to two large business development projects with budgets over $3.5 million, which leveraged over 95 percent of their funding from other sources. The two projects are spotlighted below.

Figure 5-11. Total Funding by State and by Funding Source: ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Source: ARC.net, RTI

Grant Spotlight: East Stroudsburg Incubator Expansion

This project, run through the U.S. Economic Development Administration, invested $3.6 million, including $75K from ARC in an economic development outreach center for the community to expand an existing business incubator. The project additionally worked to connect East Stroudsburg State University with local start-ups and connect businesses with university-level research.

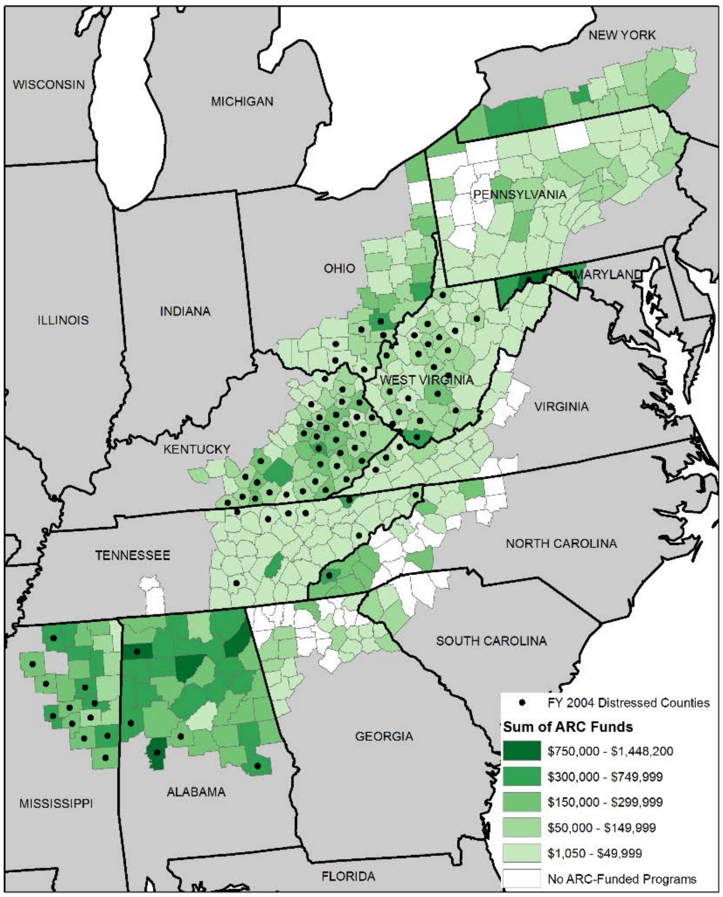
Grant Spotlight: Erie Technology Incubator at Gannon University

This project, run through HUD, invested nearly $5 million, including $200K from ARC to refurbish an old industrial site in Erie, PA, with the aim to attract high-tech businesses to downtown Erie.

Other states, including North Carolina, Maryland, and Ohio, had high percentages of leveraged funding. However, grants in those states were less targeted at distressed counties. As explained in **Section 5.4.6**, grants in economically distressed areas were less likely to leverage outside funding, making it difficult to draw conclusions about project performance based on funding structures.

Figure 5-12 displays the approximate[74] geographic distribution of ARC spending in telecommunications and technology across each county in the Region.

Figure 5-12. Approximate ARC Funding for Telecommunications and Technology Grants by County: FY 2004–FY 2010



Map Title: Sum of ARC Funded Programs by County with FY 2004 Distressed Counties
Note: Numbers are approximations evenly divided by county
Data Source: Appalachian Regional Commission

[74] Approximate spending by county was calculated by dividing funds evenly across all counties affected by each project. The figure is meant to be representative and should not be understood as an exact figure of spending by county.

5.5 GRANT PERFORMANCE

The at-close grant performance measures are the best way to show the number of people, businesses, organizations, and communities served by the grant because ARC collects these data for each grant issued. Taken as a whole, these measures indicate the extensive reach of ARC's grantmaking activities.

5.5.1 Performance Measures

ARC uses a mix of output and outcome measures for grant applicants to measure the projected performance of the project (see **Figure 5-13**). In the application, potential grantees supported their proposals by projecting a series of outputs and outcomes and then reporting the actual outputs and outcomes at the close of the grant. These measures allowed RTI to compare the performance at the closeout of the grant with what each grant projected at the outset. However, they do not necessarily capture the full impact of the grants because many of these projects may take several years to achieve their full impact on communities. **Section 6** (Survey Analysis) and **Section 7** (Case Studies) shed more insights on the long-term impacts of ARC's investments. The remainder of this section breaks down performance at the portfolio level and at the grant level.

5.5.2 Portfolio Performance

At-Close Performance Totals for the Portfolio

The $41 million in grants by ARC over the 7-year period served a wide range of people, organizations, and infrastructure investments in the Region including students, patients, businesses, and linear feet of fiber. **Table 5-7** shows the total at-close[75] performance numbers for all 310 grants during the study period, regardless of whether they had projected performance in the database.

The performance data show a diverse and widespread impact of ARC's grantmaking efforts during the study period. Some grants used paired performance measures, using outputs that were tied to outcomes such as students served and students improved. In theory, students improved should be no larger

[75] At-close refers to the closure of the ARC grant funding period, not necessarily the end of the project. In many cases, the funding period was just the pilot or start-up period for the project.

Figure 5-13. Performance Measures for the Telecommunications and Technology Portfolio

Single Measures: Outputs These outcomes do not have to be paired with specific outputs. The following outcomes can stand-alone.	Single Measures: Outcomes These outcomes do not have to be paired with specific outputs. The following outcomes can stand-alone.	
• Linear feet • Plans/reports • Businesses served	• Businesses created • Jobs created • Jobs retained • Leveraged private investment	• Programs implemented • Telecommunications sites • Households improved
See definitions below		
Paired Measures: The following outputs are paired with specific outcomes, which means that each outcome must be used with a specific, corresponding output.		
For example, if you use this output:		
Participants served	Then the recommended outcome to include is…	Participants improved
Patients served	Then the recommended outcome to include is…	Patients improved
Students served	Then the recommended outcome to include is…	Students improved
Workers/trainees served	Then the recommended outcome to include is…	Workers/trainees improved
Plans/reports created	Not always paired, recommended outcome to include is…	Programs implemented

Source: ARC. July 12, 2013. "Guidance for Performance Measures for ARC Projects." Washington, DC: ARC.

than students served; however, some grants tracked only students improved and did not track students served. This highlights the challenges of measuring performance while implementing grants and distinguishing between people served by a grant and those whose outcomes are improved by it.

Table 5-7. At-Close Performance of ARC Telecommunications and Technology Grants: FY 2004–FY 2010 (N=310)

Performance Measure	Amount At-Close	n
Businesses created—Outcome	101	11
Businesses served—Output	5,176	36
Households improved—Outcome	40,941	8
Jobs created—Outcome	2,849	41
Jobs retained—Outcome	759	6
Leveraged private investment—Outcome	$10,319,458	15
Linear feet—Output	756,494	10
Participants improved—Outcome	212,625	34
Participants served—Output	151,141	61
Patients improved—Outcome	279,554	8
Patients served—Output	285,994	9
Plans/reports—Output	52	18
Programs implemented—Outcome	108	34
Students improved—Outcome	59,490	87
Students served—Output	152,027	112
Telecommunications sites—Outcome	676	108
Workers/trainees improved—Outcome	10,058	57
Workers/trainees served—Output	22,510	60

Note: n indicates the number of grants that used the corresponding performance measures for their projected goals or at-close performance measures. Paired performance measures are highlighted in gray. Includes totals for all grants (N=310).

Source: ARC Telecommunications and Technology Grants FY 2004–FY 2010, RTI

Portfolio At-Close Performance Compared with Projected Performance

To measure the performance of grants relative to their projections, RTI analyzed the projected and at-close performance numbers to see how grants compared with their original plans. **Table 5-8** shows the projected and at-close performance numbers at the portfolio level (for the grants with complete information), how the at-close performance measures compared with the projections, and the number of grants that used each performance measure.

Table 5-8. Projected and At-Close Performance of all ARC Telecommunications and Technology Grants (n=256)

Performance Measure	Projected Amount	At-Close Amount	Percentage Attainment, %	Number of Grants that Used the Measure
Nonpaired Measures				
Businesses created—Outcome	140	101	72	10
Businesses served—Output	4,218	5,176	123	34
Households improved—Outcome	13,400	40,841	305	5
Jobs created—Outcome	2,175	2,827	130	32
Jobs retained—Outcome	792	759	96	5
Leveraged private investment—outcome	$76,959,190	$10,319,458	13	10
Linear feet—Output	721,754	714,254	99	9
Plans/reports—Output	52	52	100	18
Programs implemented—Outcome	88	107	122	29
Telecommunications sites—Outcome	608	673	111	100
Paired Measures				
Participants improved—Outcome	230,781	212,625	92	28
Participants served—Output	177,636	149,768	84	52
Patients improved—Outcome	323,098	279,554	87	7
Patients served—Output	375,622	285,994	76	8
Students improved—Outcome	47,286	59,390	126	75
Students served—Output	136,647	142,465	104	98
Workers/trainees improved—Outcome	12,788	9,945	78	48
Workers/trainees served—Output	13,831	22,247	161	51

Note: Only includes projects with complete data (n=256).
Source: ARC Telecommunications and Technology Grants FY 2004–FY 2010, RTI

The most frequently used performance measures across all projects were

- students served (101 projects),
- telecommunications sites (99 projects),
- workers/trainees served (54 projects), and
- participants served (53 projects).

Across all categories, the paired performance measures show that most categories met or exceeded their goals for at-close performance. With the exception of leveraged private investment, all of the performance measures showed at least a 70 percent attainment of goals for the portfolio as a whole. Some measures, such as households improved, were much higher than expected; therefore, the at-close measures are over 100 percent.

When taken as a whole, the projected and at-close performance of grants varied across categories. This variation is partially due to the challenge of predicting project outputs and outcomes in the grant proposal, as well as the long-term nature of some of the outputs and outcomes. Leveraged private investment and businesses created, for example, can take several years to reach their target and may not be adequately captured at the end of the grant period. In **Section 6.2.3**, we discuss the kinds of longer-term impacts grants had, as noted by the survey respondents. Finally, because of the highly diverse grantmaking across states and across types of telecommunications and technology projects, it is difficult to ascertain if and why certain types of grants reached their desired output levels. From our survey and case study findings, we see that operational issues across project types explain the degree of performance. For example, we found that staffing issues and lack of third-party funding are examples of challenges grantees faced in implementing projects (see **Section 6.2.2**).

5.5.3 Grant-Level Performance

At-Close Performance Compared with Projected Performance at the Grant Level

At the grant level, RTI defined several indicators to capture the gradations of success for grants:

- if a grant met or exceeded all of its goals
- if a grant met its goals
- if a grant reached within 85 percent of all of its goals

These indicators allowed us to understand gradations of project performance, and this section outlines how these indicators differ across different categories. **Table 5-9** shows that 55 percent of projects reached all of their goals at least within 85 percent of their projected outputs and outcomes. Of that 55 percent, 14 percent of projects exceeded all of their goals, which is a notable achievement when projects have multiple goals, and 50 percent of projects met or exceeded their goals.

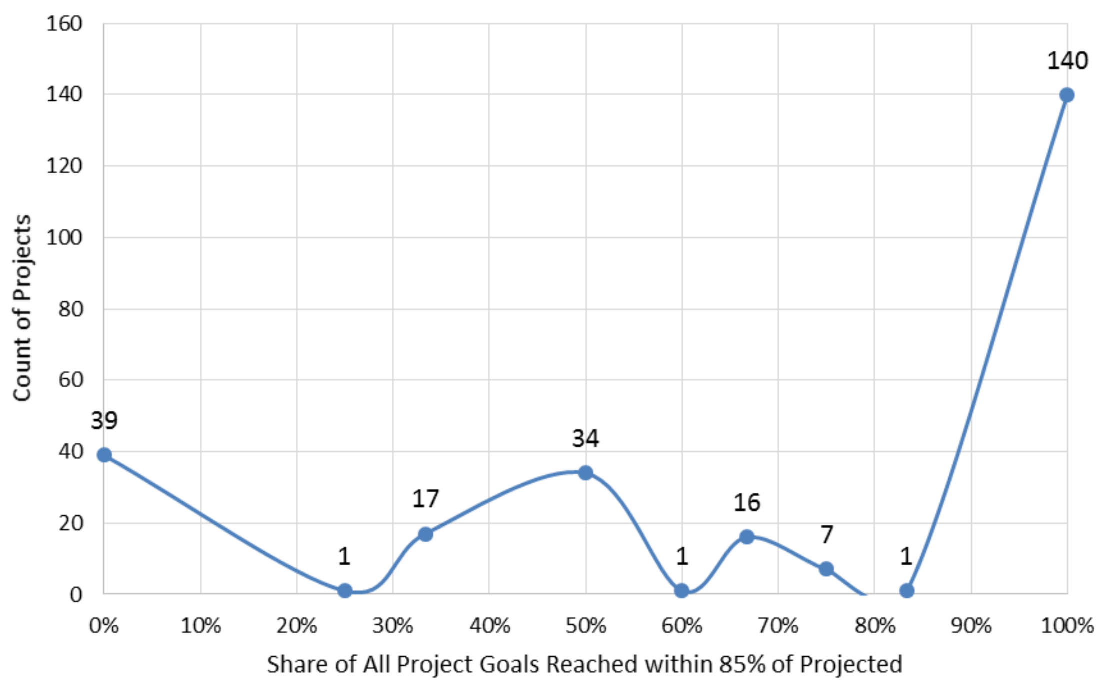
Table 5-9. Performance at the Grant Level (n=256)

	Reached within 85% of Goals	Met or Exceeded Goals	Exceeded Goals
Count of grants	140	127	35
% of all grants	55	50	14

Note: Includes projects with complete data (n=256). Projects can fall in multiple categories, so totals do not equal 256 or 100%.
Source: RTI, ARC.

Using 85 percent of an output or outcome as a threshold, RTI identified how many of the projects had reached their goals and what percentage of those goals had been reached. **Figure 5-14** shows the distribution of projects by the percentage of the at-close measures that reached within 85 percent of the projected goals.

Figure 5-14. Count of Grants by Share of Goals Reached within 85% of Projected (n=256)



Note: Only includes projects with complete data (n=256).
Source: ARC.net, RTI.

As the figure shows, 140 projects (55 percent of those with complete data) reached within 85 percent of all of their performance goals, while 39 projects (27 percent) did not reach any of their performance goals within 85 percent.[76]

Looking at both ends of this spectrum, we see interesting differences between the 140 projects that reached within 85 percent of their projected goals and the 39 that did not reach any of their projected goals. In this section, "reached" refers to coming within 85 percent of meeting a project's projected individual goals. **Table 5-10** outlines some of the characteristics of projects that reached their goals and those that did not.

Table 5-10. Characteristics of Projects that Reached 0% or 100% of their Projected Goals

	Share of Project Goals Reached within 85%[a]	
Characteristic	**0% Reached (n=39)**	**100% Reached (n=140)**
Average ARC funding	$136,192	$120,929
Most frequent primary beneficiaries	1. Training: 31% 2. Health: 23% 3. Education: 23%	1. Education: 31% 2. Local government: 21% 3. Community development: 19%
Most frequent functional framework	1. Indirect: 38% 2. Other technology: 36% 3. Adoption: 36%	1. Indirect: 46% 2. Applications: 29% 3. Adoption: 25%
Most frequent states	1. Alabama: 18% 2. Maryland: 15% 3. Mississippi: 12%	1. Alabama: 22% 2. Pennsylvania: 12% 3. Maryland: 11%
Most frequently used performance measures	1. Students served: 41% 2. Students improved: 36% 3.Workers/trainees served: 26% 4. Workers/trainees improved: 18% 5. Jobs created: 15%	1. Telecommunications sites: 41% 2. Students served: 36% 3. Students improved: 26% 4. Participants served: 24% 5. Participants improved: 23%
Percentage with a primary or substantial impact on distressed areas	41%	39%

[a] Goals reached defined as at-close performance measures coming within 85% of projected outputs and outcomes.
Source: ARC.net, RTI. Only includes projects with complete data (n=256).

[76] In this analysis, it is important to recognize that, in some cases, the at-close data are insufficient to capture relative success or failure of projects, because the effects are intended to be long term.

Projects that did not reach any of their goals received, on average, more funding from ARC and were most likely to be targeted toward training. Projects that reached their goals were most frequently in education and, on average, had smaller budgets. These differences could indicate that grants with larger budgets were more ambitious than grants with smaller budgets in their projected goals. Alternatively, some performance measures, such as telecommunications sites created, may be inherently easier to project, measure, and achieve.

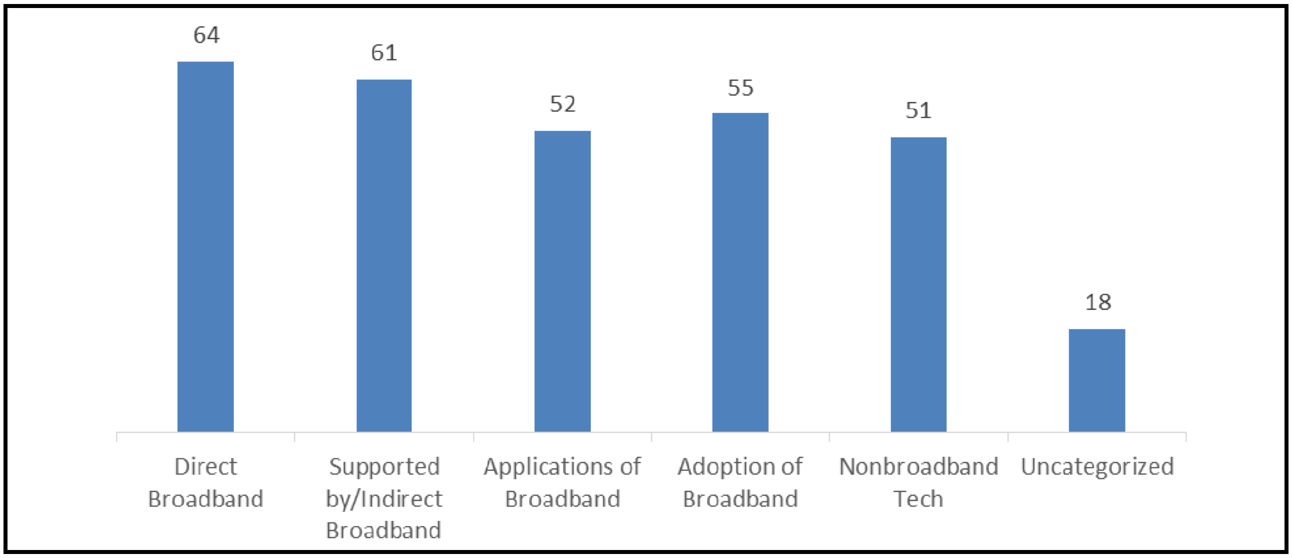
In fact, grants that did not reach within 85 percent of their goals often used performance measures that are more difficult to achieve in the short term, including students and workers improved and jobs created. Those that reached all of their goals tended to have more tangible goals, such as telecommunications sites created and participants served. This difference in goals indicates the difficulty of doing side-by-side comparisons across projects with different measures: those with more tangible, short-term outcomes might be perceived as more successful because their goals were more feasible to accomplish at the close of the grant.

Overall, the traits of the grant and the performance measures used have only a weak connection with grant performance, indicating that other unobserved factors are likely at play. Given the wide diversity of grants and limited contextual information, it is difficult to say why some grants reached within 85 percent of their performance goals and why some grants did not. **Section 6** and **Section 7** provide insights about specific challenges to implementation and factors that helped grants reach their performance goals. Finally, as we note throughout the report and in **Section 9.4.2**, telecommunications and technology investments are long-term endeavors. The survey shows that long-term impacts can be significant for grantees (see **Section 6.2.4**), and performance outputs and outcomes have often not had enough time to fully materialize by the end of ARC grants.

At-Close Performance Assessed by Grant Function

Projects with a direct or indirect broadband Internet component experienced the highest levels of performance, while projects with applications, adoption, or other technology components were in the next tier (see **Figure 5-15**). Projects that were uncategorized experienced the lowest levels of performance.

Figure 5-15. Share of Projects that Reached within 85% or Higher of Projected Goals by Function (n=256)



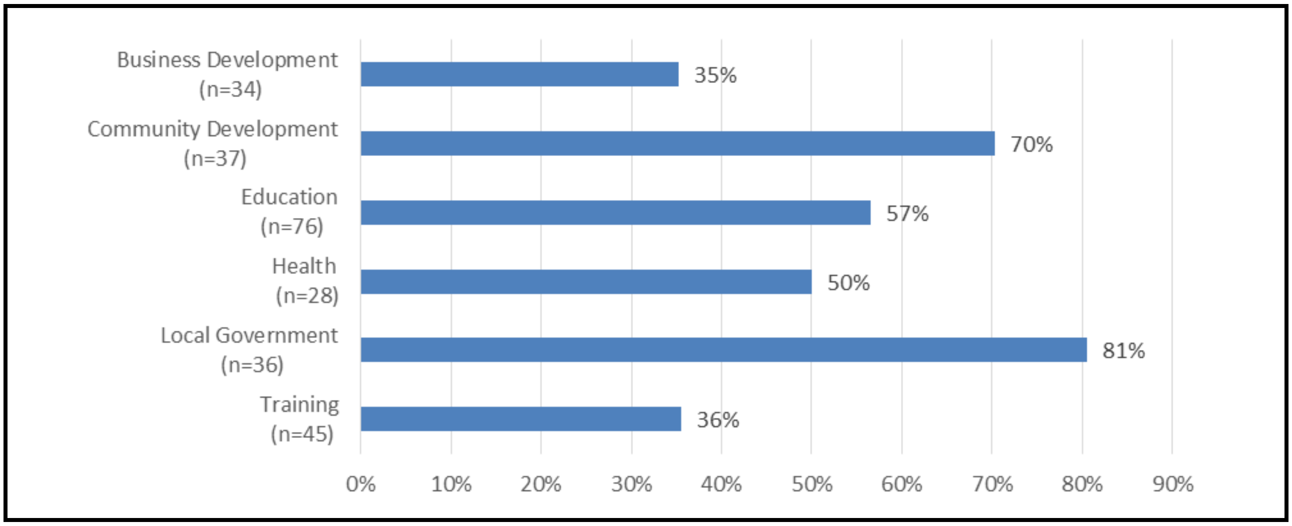
Source: ARC.net, RTI

In terms of beneficiary, local government and community development projects had the highest share of projects that reached within 85 percent of their goals, whereas training and business development projects had the lowest share of projects that reached within 85 percent of their goals (see **Figure 5-16**). As mentioned in **Section 5.5.1**, this difference could be a result of the inherent difficulty and uncertainty in projecting goals for measures that often fall in categories like businesses served, businesses created, leveraged private investment, workers/trainees served, and workers/trainees improved. Many of these impacts take several years to take hold, and as **Section 6.2.3** explains in more detail, these projects take more time to realize their full impact.

Understanding Performance of Multifunctional Projects

When constructing the functional framework for evaluation, RTI considered that projects could have multiple functions. For example: An EMR software effort coupled with a training program would classify as both an application of broadband Internet technology and an adoption program. RTI believes that it is important to look at how the performance of

Figure 5-16. Share of Projects that Reached within 85% or Higher of Projected Goals by Primary Beneficiary (n=256)



Source: ARC.net, RTI

multifunctional projects compared with the performance of single-function grants. RTI identified 101 multifunctional projects[77] within the portfolio, which it classified as having two or more functions in its framework. **Table 5-11** lists the number of projects that fall in each category.

Table 5-11. Number of Multifunctional Grants (n=256)

Functions	Projects
1	155
2	91
3	9
4	1

Source: ARC.net, RTI

Of the projects with complete data, those with more functional dimensions had roughly similar performance to those with a single function when comparing projected numbers to at-close numbers. **Table 5-12** shows the share of grants that met 85 percent of their goals, the share of grants that met or exceeded their goals, the share of grants that exceeded their goals, and the number of projects in each category.

[77] Number refers only to projects with complete data.

Table 5-12. Share of Grants Reaching Various Levels of Performance

	Grants, All Goals, %			
Number of Functions	**Reached 85%**	**Met or Exceeded**	**Exceeded**	**n**
1	56	52	16	155
2	53	45	11	91
3	56	56	0	9

Note: Includes projects with complete data (n=256). A single grant with four functions is not displayed in this table.

Source: ARC.net, RTI

Performance in Distressed Counties

Of the 310 projects included in the evaluation, 129 were designated as having a substantial or primary impact on distressed counties. ARC emphasizes making grants to projects that will affect economically distressed areas. These projects have unique challenges as mentioned previously in **Section 2.3.2**: they are not able to leverage as much outside funding and rely more on ARC funding. However, as **Table 5-13** shows, they perform on par with or better than the grant portfolio as a whole.

Table 5-13. Projected and At-Close Performance of ARC Telecommunications and Technology Grants with a Substantial or Primary Impact on Distressed Counties or Areas: FY 2004–FY 2010

Performance Measure	Projected Number	At-Close Number	Percentage Attainment, %
Businesses created—Outcome	111	69	62
Businesses served—Output	2,423	1,848	76
Households improved—Outcome	—	20,917	—
Jobs created—Outcome	1,090	1,901	174
Jobs retained—Outcome	735	735	100
Leveraged private investment—Outcome	$67,959,190	$9,434,217	14
Linear feet—Output	290,654	296,654	102
Participants improved—Outcome	83,101	81,570	98
Participants served—Output	108,195	119,547	110
Patients improved—Outcome	17,765	24,008	135
Patients served—Output	70,289	34,608	49
Plans/reports—Output	39	39	100
Programs implemented—Outcome	20	31	155

(continued)

Table 5-13. Projected and At-Close Performance of ARC Telecommunications and Technology Grants with a Substantial or Primary Impact on Distressed Counties or Areas: FY 2004–FY 2010 (continued)

Performance Measure	Projected Amount	At-Close Amount	Percentage Attainment, %
Students improved—Outcome	19,702	25,904	131
Students served—Output	41,841	45,816	110
Telecommunications sites—Outcome	196	244	124
Workers/trainees improved—Outcome	3,938	4,616	117
Workers/trainees served—Output	4,716	4,815	102

Note: Only includes projects with complete data that were designated as having a primary or substantial impact on distressed areas (n=111). Paired measures are highlighted in gray.
Source: ARC Telecommunications and Technology Grants FY 2004–FY 2010, RTI

As a whole, ARC grants to distressed counties or areas were likely to meet or exceed their performance goals. Only four performance measures had lower performance than the overall average (businesses created and served, patients served, and leveraged private investment), while 13 measures had equal or higher performance.

5.6 STATE PROFILES

This section offers profiles of each state's grant activity. Each state profile gives an overview of the allocation of grant funding, the most common types of projects, and general observations about grantmaking patterns in each state. It is important to note that states select their own priorities for grantmaking across all ARC program areas. Thus, these profiles simply reflect the grants that the states selected for telecommunications and technology projects.

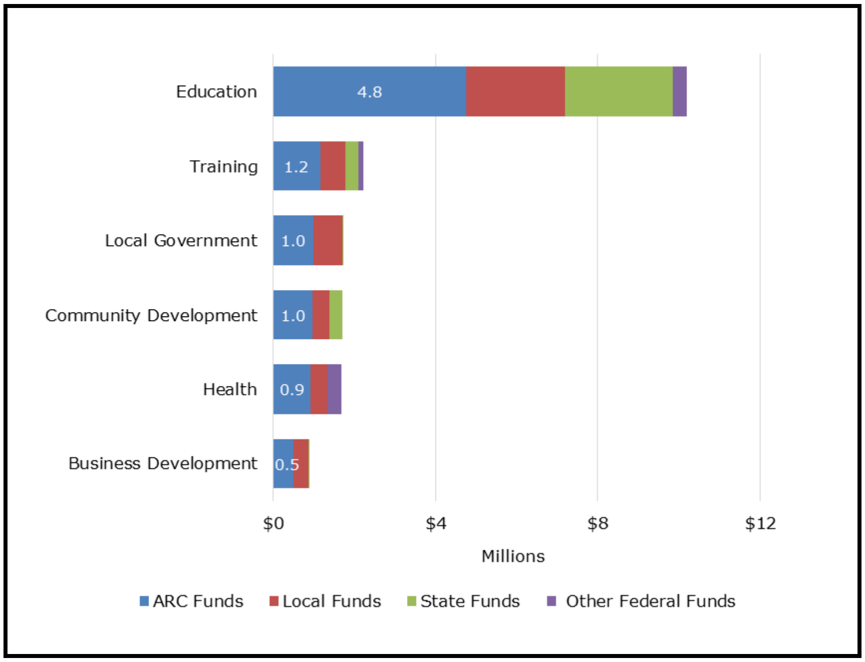
Alabama

Total number of Appalachian counties: 37

Total number of telecommunications and technology grants: 60
Total ARC investment in telecommunications and technology: $9.3M
Total investment in telecommunications and technology: $18.4M
Average total funding per project: $307,000

Most common beneficiaries:
Education (23)
Local government (10)
Community development (9)

Figure 5-17. Alabama Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: In 2010, Whatley Health Services received $166,000 from ARC to start a remote medical and dental clinic using telemedicine technology, bringing low-cost, effective medical care to people in isolated, rural regions of the state. At close in 2012, the project had served over 6,200 patients, and as of 2015, it has expanded to eight locations.

Notes:

- Alabama had the most grants (60) and received the most funding ($9.3M) from ARC in telecommunications and technology during this period.
- Forty-eight percent of ARC grants were designated as having a primary or substantial impact on distressed areas.

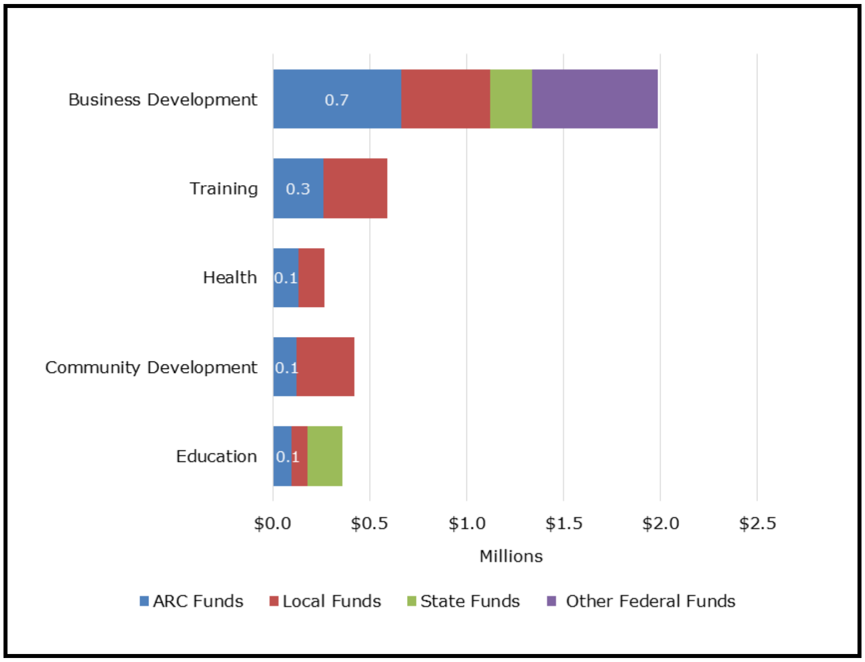
Georgia

Total number of Appalachian counties: 37

Total number of grants: 9
Total ARC funding: $1.3M
Total funding: $3.6M
Average total funding per project: $403,000

Most common beneficiaries:
Business development (3)
Education (2)
Community development (2)

Figure 5-18. Georgia Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: Coosa Valley Technical College Entrepreneurship Incubator received $198K from ARC in 2004. At its close in 2005, it had leveraged $4.9 million in private investment and created 46 jobs. As of 2015, the business expansion center is part of Georgia Northwestern Technical College and is integrated into the economic development mission of the college.

Notes:

- Nearly $1 million in ARC funding went to four large economic development projects for business development and workforce training.
- None of Georgia's projects met or exceeded their projected goals at close, but those surveyed had long-term effects after the closeout date, including job creation, entrepreneurship, and improved medical services that exceeded projected measures.

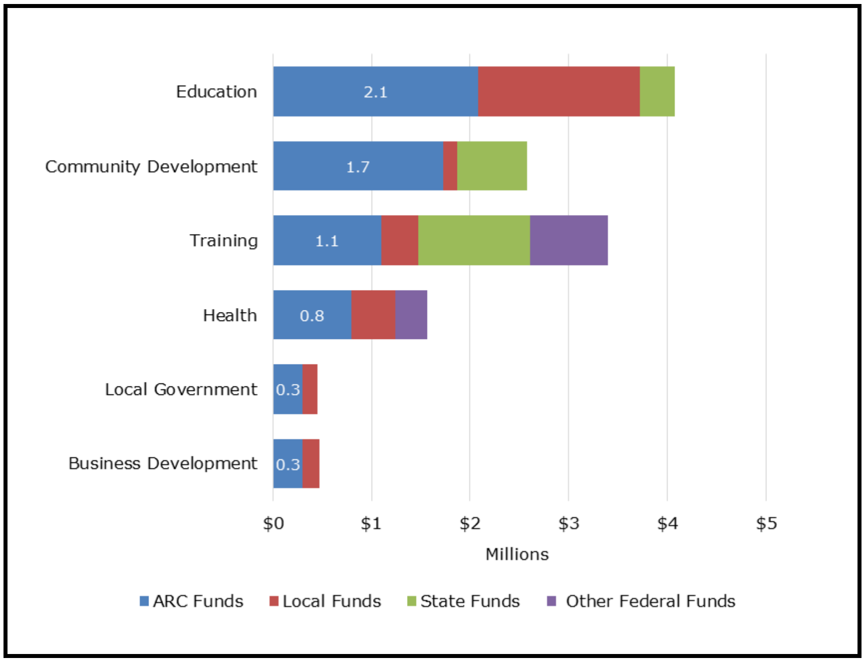
Kentucky

Total number of Appalachian counties: 54

Total number of grants: 27
Total ARC funding: $6.3M
Total funding: $12.6M
Average total funding per project: $465,000

Most common beneficiaries:
Training (8)
Community development (8)
Education (7)

Figure 5-19. Kentucky Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: In 2007, the Regional High Growth Training Center in Somerset, KY, received $500K from ARC as part of a $2.5 million investment in training electric line workers. The program trained, on average, 100 workers per year and prepared them to quickly advance as electric line workers.

Notes:

- Ninety-six percent of Kentucky's ARC grants had either a substantial or primary effect on economically distressed counties, the highest of any state.

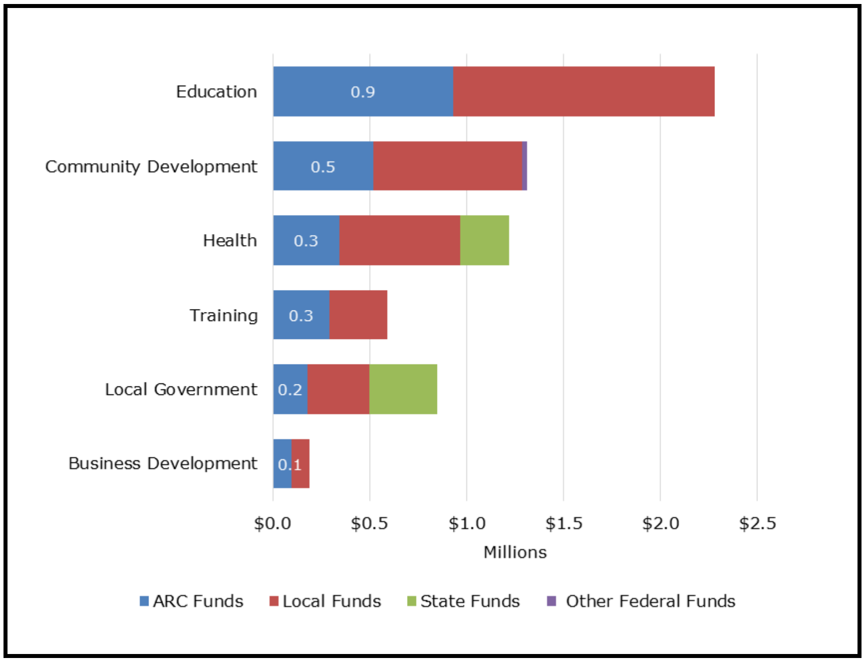
Maryland

Total number of Appalachian counties: 3

Total number of grants: 32
Total ARC funding: $2.4M
Total funding: $6.4M
Average total funding per project: $201K

Most common beneficiaries:
Education (17)
Training (6)
Health (3)

Figure 5-20. Maryland Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: Allconet2 Broadband to Business Electronic Infrastructure Equipment, Phase II (MD-14579-I). $1.2M total, $495K from ARC for physical infrastructure including towers for mobile data connections.

Notes:

- Maryland's telecommunications and technology grants primarily went to educational initiatives.
- Maryland's three Appalachian counties are designated as either transitional or competitive by ARC's economic development indicators.
- None of Maryland's projects had an impact on distressed counties or areas. None of Maryland's three Appalachian counties are considered distressed.

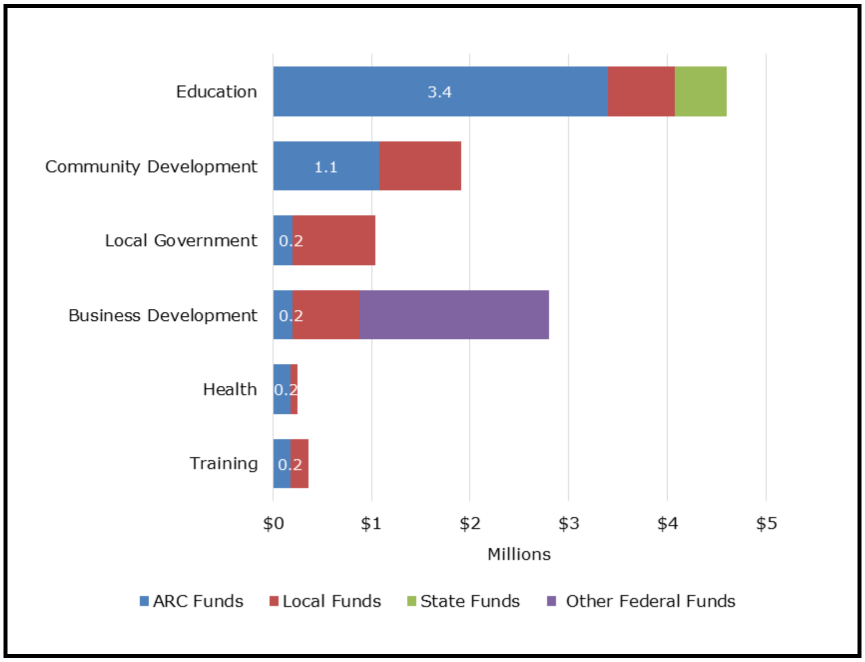
Mississippi

Total number of Appalachian counties: 24

Total number of grants: 24
Total ARC funding: $5.2M
Total funding: $11M
Average total funding per project: $457,000

Most common beneficiaries:
Education (12)
Community development (6)

Figure 5-21. Mississippi Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: The Okolona Public School District received a follow-up grant for 20 new computer stations, a new printer, and the addition of an electronic whiteboard to further enhance the existing technology facility. The upgraded equipment enabled over 500 students and nearly 100 adult participants to achieve specific benchmarks in computer use, academic, and vocational skill development.

Notes:

- Fifteen of the 23 projects involved equipment investments for education and training.
- Seventy-one percent of Mississippi's telecommunications and technology grants went to projects with a substantial or primary impact on distressed areas.

- ARC funded over 75 percent of the total budget for education projects in Mississippi, most of which affected distressed areas.
- The Tupelo/Lee County Regional Business Incubator leveraged nearly $2 million in other federal funds from the TVA and other federal organizations. Despite high levels of leveraged funding, its at-close performance measures were lower than projected.

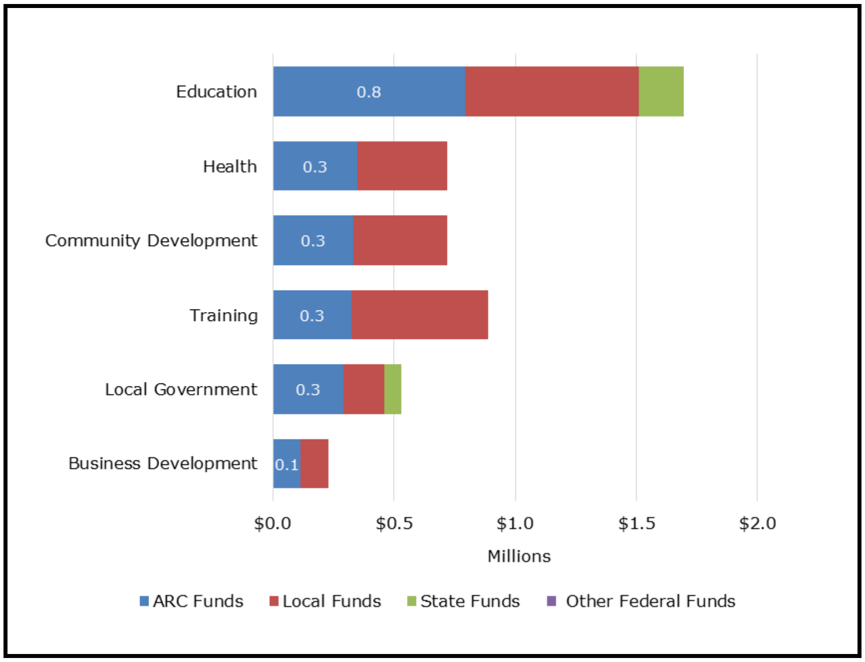
New York

Total number of Appalachian counties: 14

Total number of grants: 25
Total ARC funding: $2.2M
Total funding: $4.8M
Average total funding per project: $191,000

Most common beneficiaries:
Education (7)
Community development (5)
Local government (4)
Training (4)

Figure 5-22. New York Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: United Health Services received a $130K grant from ARC in 2005 to expand a virtual pediatric telemedicine center. With its seven new sites, it trained 162 professionals and served 282 patients within the first year of operation, meeting or exceeding all of its goals.

Notes:

- New York has no Appalachian counties designated as distressed, and no projects affected distressed areas.

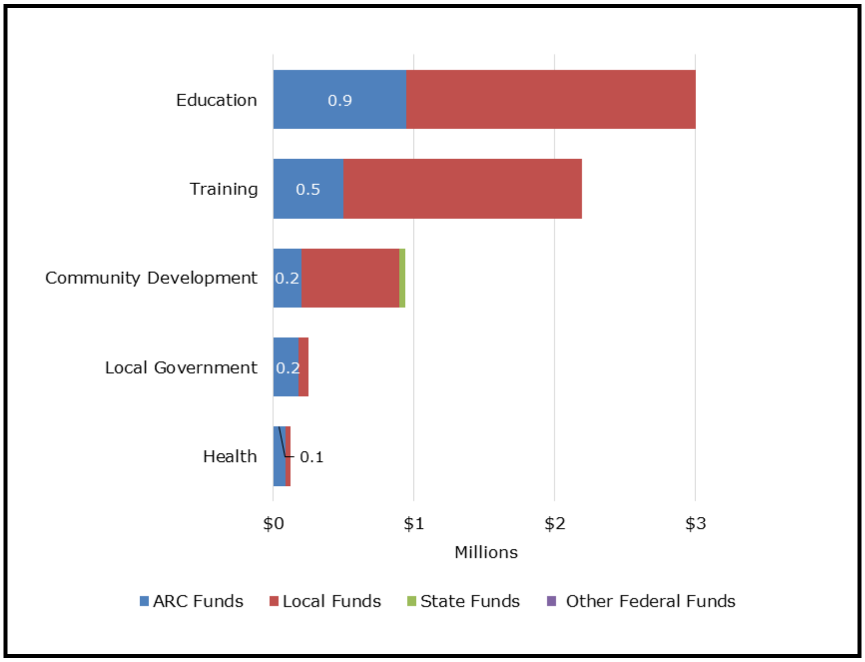
North Carolina

Total number of Appalachian counties: 29

Total number of grants: 8
Total ARC funding: $1.9M
Total funding: $6.5M
Average total funding per project: $815,000

Most common beneficiaries:
Education (3)
Training (2)

Figure 5-23. North Carolina Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: Only 1 of the 8 grants had a significant impact on distressed areas: 2007 Graham County Broadband Fiber Optic Extension: $200K from ARC went towards 77,000 linear feet of fiber and 12 new telecommunications sites to connect municipal services including the local library to broadband Internet.

Notes:

- All of the grants to North Carolina organizations were for equipment investments.
- Four of the eight grants were technology equipment for educational institutions, including laptops in classrooms.

Ohio

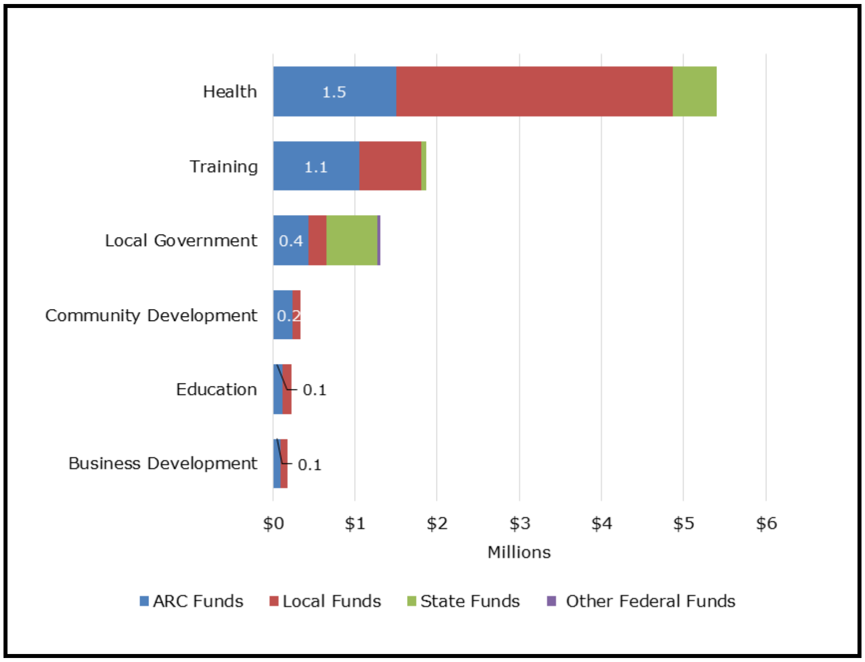
Total number of Appalachian counties: 32

Total number of grants: 21
Total ARC funding: $3.4M
Total funding: $9.3M
Average total funding per project: $444,000

Most common beneficiaries:

- Health (7)
- Training (7)
- Local government (3)

Figure 5-24. Ohio Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: ARC granted $1.5 million to seven health-related projects in Ohio during the 7-year period. Grantees included the East OH Regional Hospital, Ashtabula County Medical Center, Marietta Memorial Hospital, and Appalachian Primary Care.

Notes:

- Nineteen of the 21 grants were investments in equipment.
- Forty-eight percent of Ohio projects had a substantial or primary impact on distressed counties.

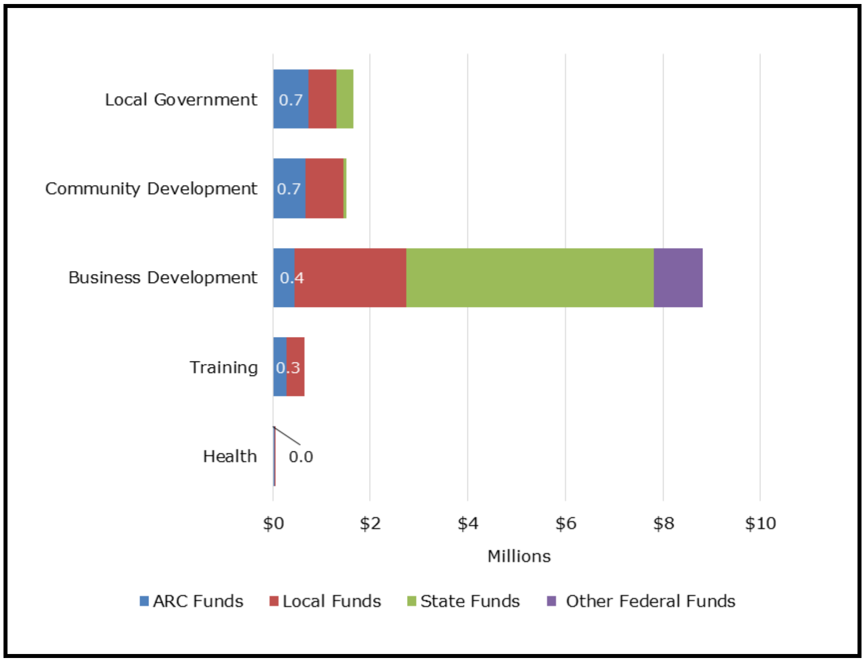
Pennsylvania

Total number of Appalachian counties: 52

Total number of grants: 29
Total ARC funding: $2.1M
Total funding: $12.7M
Average total funding per project: $437,000

Most common beneficiaries:
Local government (9)
Community development (7)
Training (7)

Figure 5-25. Pennsylvania Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: SEDA-Council of Governments received eight telecommunications and technology grants, the highest number of grants by a single recipient during the 7-year period.

Notes:

- Two of the largest projects in the portfolio were business development projects in Pennsylvania, each with budgets over $2.5 million, leveraging over 95 percent of non-ARC funding.
- Thirteen of the 27 projects involved purchasing equipment for a local network or computer lab.

33

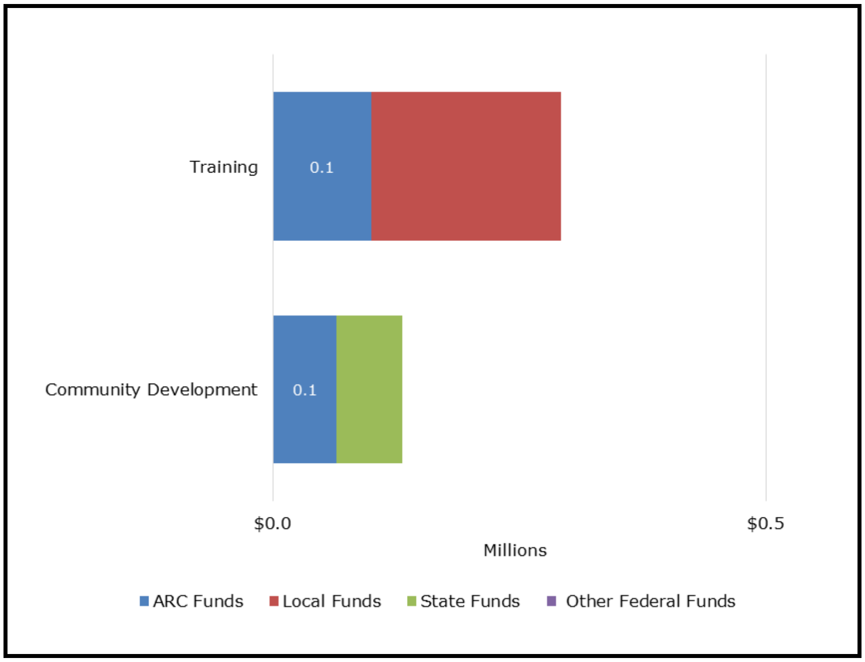
South Carolina

Total number of Appalachian counties: 6

Total number of grants: 2
Total ARC funding: $165,000
Total funding: $423,000
Average total funding per project: $211,452

Most common beneficiaries:
Education (1)
Training (1)

Figure 5-26. South Carolina Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: In 2007, Appalachian Council of Governments matched $65,000 in ARC funding to conduct a strategic telecommunications needs assessment and business plan. ARC funds underwrote the costs of personnel and consultants. The plan delivered detailed broadband inventories, needs analysis, recommended services and recommendations for future deployment of more high-speed broadband in the three-county region. This strategic plan laid the groundwork for Oconee County securing $9.6 million in follow-on funding from the National Telecommunications & Information Administration Broadband Technologies Opportunity Program in 2009.

Notes:

- South Carolina had the fewest grants (2) and the lowest amount of ARC funding ($165K) in telecommunications and technology over the 7-year period.

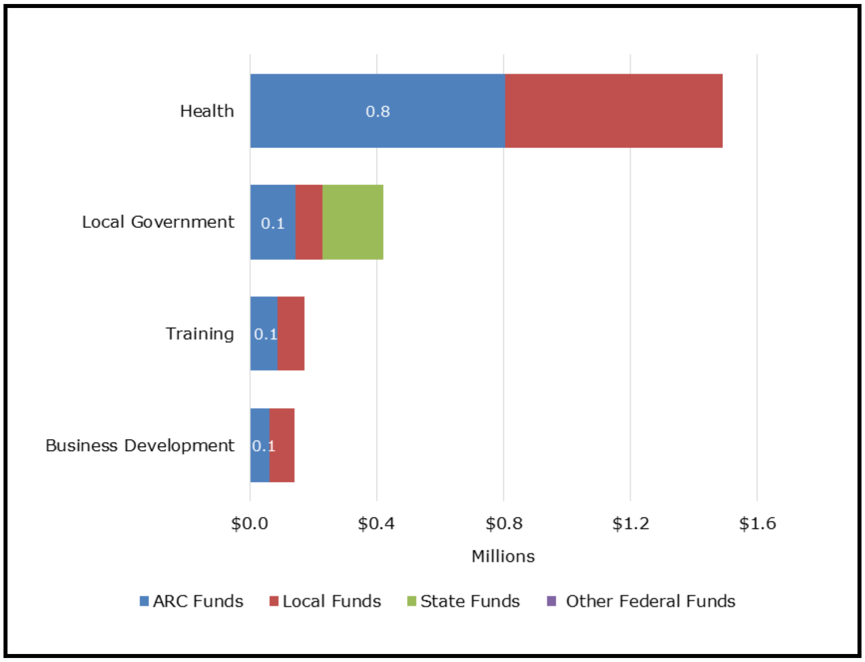
Tennessee

Total number of Appalachian counties: 52

Total number of grants: 10
Total ARC funding: $1.1M
Total funding: $2.2M
Average total funding per project: $223,000

Most common beneficiaries:
Health (3)
Local government (3)

Figure 5-27. Tennessee Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: In 2009, ARC made an $11K grant to the Southeast Tennessee Development District to upgrade GIS technology in Chattanooga. The program invested in software and equipment to bring the local GIS capabilities up to national standards to lead to more accurate planning, better infrastructure, and greater business competitiveness.

Notes:

- Forty percent of Tennessee's grants went to projects with a primary or substantial impact on distressed areas.

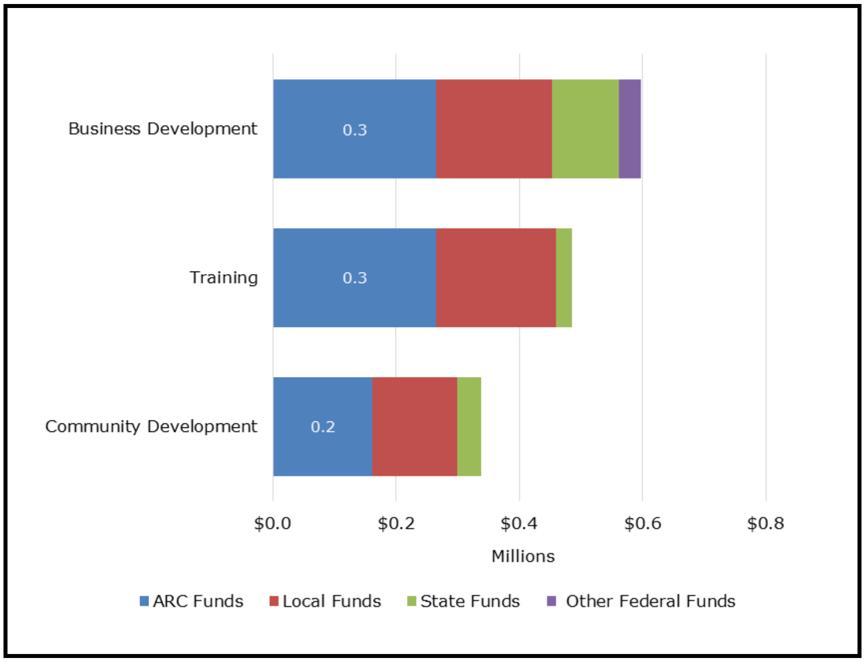
Virginia

Total number of Appalachian counties: 25

Total number of grants: 11
Total ARC funding: $692,000
Total funding: $1.4M
Average total funding per project: $129,000

Most common beneficiaries:
Business development (6)
Training (4)
Community development (1)

Figure 5-28. Virginia Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: In 2005, ARC granted $21.5K to underwrite the installation of 18,000 linear feet of "dark fiber" as part of the Richlands Municipal Area Network to improve Internet service in the downtown, expanding high-speed Internet access to businesses. At close in 2008, 37 businesses had connected to the fiber network.

Notes:

- Only 1 of the 11 grants to Virginia projects completed all of its projected performance goals.
- Five of the 11 Virginia grants were related to business development through e-commerce.

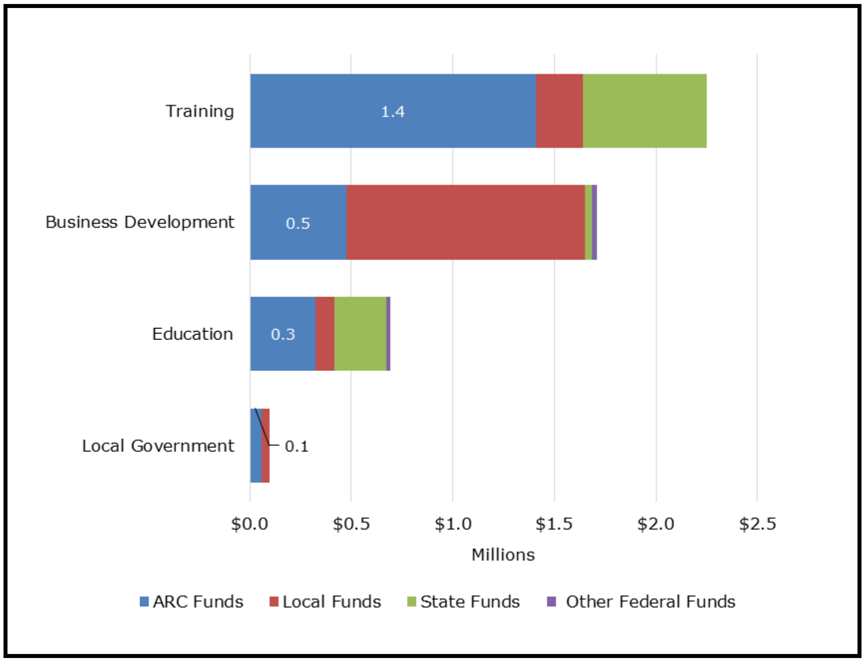
West Virginia

Total number of Appalachian counties: 55

Total number of grants: 12
Total ARC funding: $2.3M
Total funding: $4.8M
Average total funding per project: $396,000

Most common beneficiaries:
Training (5)
Education (3)
Business development (2)

Figure 5-29. West Virginia Funding for ARC Telecommunications and Technology Grants: FY 2004–FY 2010



Grant Spotlight: One of the largest grants was to start the Erma Byrd Higher Education Center, an initiative started by Forward Southern WV in 2007. As of 2015, it serves Bluefield State College, Concord University, and Marshall University, as well as New River Community and Technical College. It offers technical, bachelor's, and master's degree programs to local students.

Notes:

- Four of the grants were part of the ongoing Mission West Virginia STEPUP program, investing in community computer labs for workforce training.
- Eighty-three percent of projects in West Virginia had a substantial or primary impact on distressed areas.

5.7 SUMMARY FINDINGS

ARC's portfolio of grants served over 600,000 businesses and people, including 286,000 patients, 152,000 students, and 22,500 workers/trainees. ARC did not take a one-size-fits-all approach for this portfolio; states made decisions on priorities for ARC's approval. ARC made wide investments in terms of size, location, beneficiary, type of investment, and geographic location. It is evident from the large variation in grant activities that states have flexibility in how they approach telecommunications and technology. RTI's function and beneficiary framework offers a method to organize the diverse grants along the broadband Internet spectrum, understanding that programs affect a variety of civic organizations and ARC program goals. This framework speaks to the importance of engaging multiple actors and employing multiple strategies to improve the delivery and adoption of telecommunications and technology services.

At-close performance metrics are just one way of classifying how grants performed. When compared with projected outputs and outcomes, there is a wide range of results. Fourteen percent of grants in the portfolio exceeded the goals set forth at the beginning of the grant, 50 percent met the goals set forth at the beginning of the grant, and 55 percent reached within at least 85 percent of all goals established at the beginning of the grant. However, this does not mean that a certain percentage of projects were successful or unsuccessful. These are just one of many measures for evaluation, and as we explain in the survey results in **Section 6**, some grants have not had time to fully realize their benefits. Table 6-15 in **Section 6** demonstrates some of the outputs and outcomes of grants after the closeout period.

Grants tended to perform better, according to project closeout reports, when outputs and outcomes were more tangible, such as linear feet, telecommunications sites, plans/reports, and programs implemented. Impacts on people, such as students, participants, jobs, and households, are much more difficult to predict and take a longer time to show their effects. They are also harder to quantify. Therefore, it would be premature to conclude that projects with more easily quantified, tangible outputs and outcomes performed better. In the next section, we discuss how, over time, projects have culminated into larger and broader impacts that go far beyond the closeout date of the grant.

6 Survey Analysis

A survey of telecommunications and technology grant recipients allowed the team to capture impacts and insights from the ARC grants that are not recorded in the project closeout reports. Thus, the survey expanded our understanding of how the ARC grants affected communities and what kinds of conditions or circumstances may have helped enhance the grant's performance. RTI reached a total of 118 grantees, representing a 38 percent overall response rate for the survey. Respondents emphasized the long-term effects of projects in metrics such as jobs creation, business creation, and leveraged funding, as well as effects on community and capacity building. They offered insights into how projects had affected and continue to affect communities after the end of the grant period.

The survey asked respondents to reflect on the grant-writing and implementation process, challenges faced by the project, follow-on funding and impacts after the grant period, telecommunications needs for communities moving forward, and the condition of their communities.

Section 6.1 outlines the survey methods, **Section 6.2** summarizes the results and elucidates key findings, and **Section 6.3** brings together conclusions. Taken as a whole, this section discusses the following topics:

- methods in survey outreach, survey implementation, and the representative nature of survey responses compared with the project portfolio
- how funded organizations worked on the grants and the degree to which grants involved the community
- past, present, and future challenges in implementing telecommunications and technology projects in rural Appalachia
- sustainability of projects

- how projects' projected and at-close performance numbers are related to their self-reported strategies in grant management and implementation
- change in perceived economic conditions over the grant period, and the types of perceived secondary effects grants had on communities

6.1 SURVEY METHODS

Survey methods involved extensive outreach to ARC grantees during the course of the evaluation and survey design process. In this section, we explain the response rate and compare the pool of respondents with the overall ARC telecommunications and technology portfolio.

6.1.1 Survey Outreach

RTI pursued three phases of outreach:

1. grantee contact confirmation presurvey
2. automated reminders during the survey
3. targeted follow-up phone calls near the end of the survey

The first round of outreach was the most extensive. The primary goal of this effort was to identify the most appropriate contact to answer the questions in the online survey. We began this process in December 2014 and concluded it in February 2015. In some cases, this confirmation involved verifying ARC's contact information on file. In other cases, project contacts were out of date. Employee turnover, organizational shifts, and changes in contact information required an extensive outreach by the RTI survey team to identify the most appropriate person to fill out the survey. This outreach also allowed for RTI staff to inform target survey respondents about the survey to increase awareness of the survey launch and answer any preliminary questions.

The survey launched April 13, 2015, and closed June 30, 2015, a two and a half month time frame. We issued the survey to 310 grantees to encourage full participation by all grantees and thus a more robust dataset to analyze findings. During the survey period, RTI used the web-based survey platform to issue email reminders to potential respondents. RTI sent follow-up emails every 2 weeks to individuals who partially completed or had not started the survey. Individuals who completed their survey were not contacted again. During this survey period, RTI's survey team actively helped respondents clarify questions about the survey.

Toward the end of the survey period, RTI reached out to targeted nonrespondents to ensure representativeness of the survey sample. RTI monitored response rates for various subgroups of projects by state, target beneficiary, function, and year. For subgroups with low response rates, RTI called contacts to encourage them to complete the survey and responded to any questions or concerns they had about the survey instrument or the purpose of the study. This outreach permitted a more robust sample size and a broad representation of sample groups.

6.1.2 Survey Design

The survey was designed to illicit both greater detail about the operations and outcomes of the individual grants and a much stronger understanding of the broader conditions grantees face in their communities and how grantees perceive these conditions changing over time. We also designed the protocol to understand why and how grantees sought ARC funds and challenges faced in carrying out the grant. The survey design allows for analysts to better decipher nuances on the kinds of impacts communities experienced as a result of the grant and whether impacts were realized on time or not at all. Additional considerations the RTI team employed in designing the survey included appreciating future needs/challenges in the community when it comes to broadband Internet and technology adoption so that future ARC programming can be designed in alignment with documented needs in Appalachian communities.

Once the protocol was developed, RTI programmed the survey using Survey Gizmo—a web survey tool. Survey methodologists programmed and customized the online survey to preprogram as much data as possible tailored for each respondent to reduce the burden on respondents and error in responses. For example, each survey respondent viewed a survey with the title, grant number, time frame, etc., of the grant we were asking them to respond to. RTI designed the survey to be accessible on multiple online platforms, including tablets and mobile phones. For the few respondents who indicated that they preferred telephone interviews, RTI scheduled interviews and recorded responses online on behalf of these respondents.

The full survey questionnaire is included in **Appendix C**.

6.1.3 Survey Response Rate

Of the 310 projects used for the evaluation, RTI received a total of 118 responses for a response rate of 38 percent. Of the 118 surveys, 102 were marked as complete and an additional 16 surveys were partially complete. "Complete" is defined as the respondent moving all the way through the survey instrument and pressing submit in the online form. It does not mean that every single survey question was completed. When respondents attempt to skip a question, an automated prompt reminds them to answer the question, but if respondents skip again, they are allowed to move forward to the next question. Therefore, it is possible that a "complete" survey may have some questions skipped or left blank. For the sake of transparency, this report discloses response rate counts for each question.

As **Table 6-1** shows, the response rate for complete surveys is 32.9 percent, and adding the 16 mostly complete responses raises the response rate to 38.0 percent.

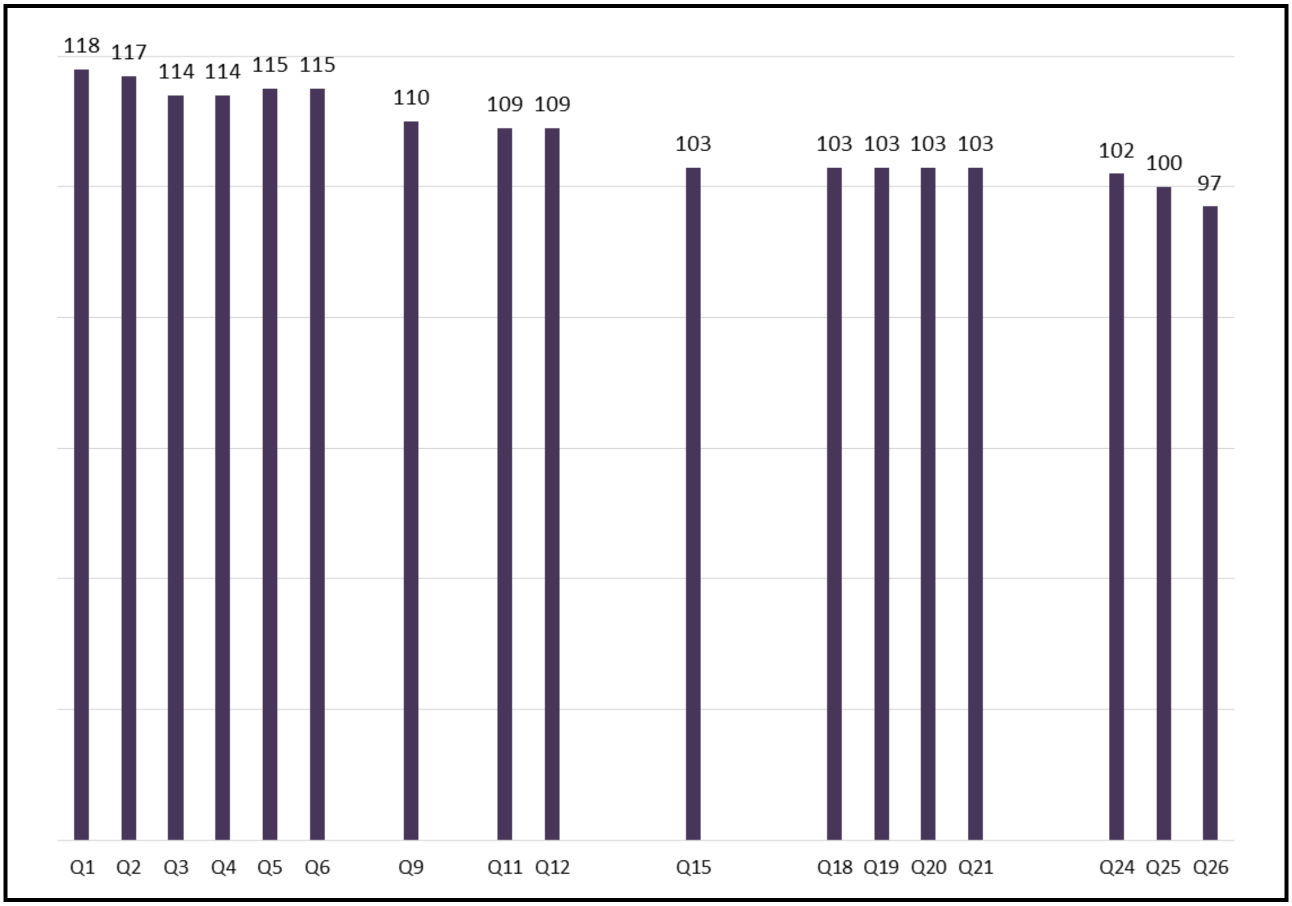
Table 6-1. Response Rates

"Complete" Responses (Response Rate %)	"Complete" + Partially Complete Responses (Response Rate %)
n=102 (32.9%)	n=118 (38.0%)

Source: RTI Survey

Between 97 and 118 respondents provided answers to questions that were applicable to all projects. Over the course of the survey, there was some survey attrition as respondents progressed through the questions. **Figure 6-1** shows the number of survey responses by question.

Figure 6-1. Survey Attrition, Number of Responses by Question

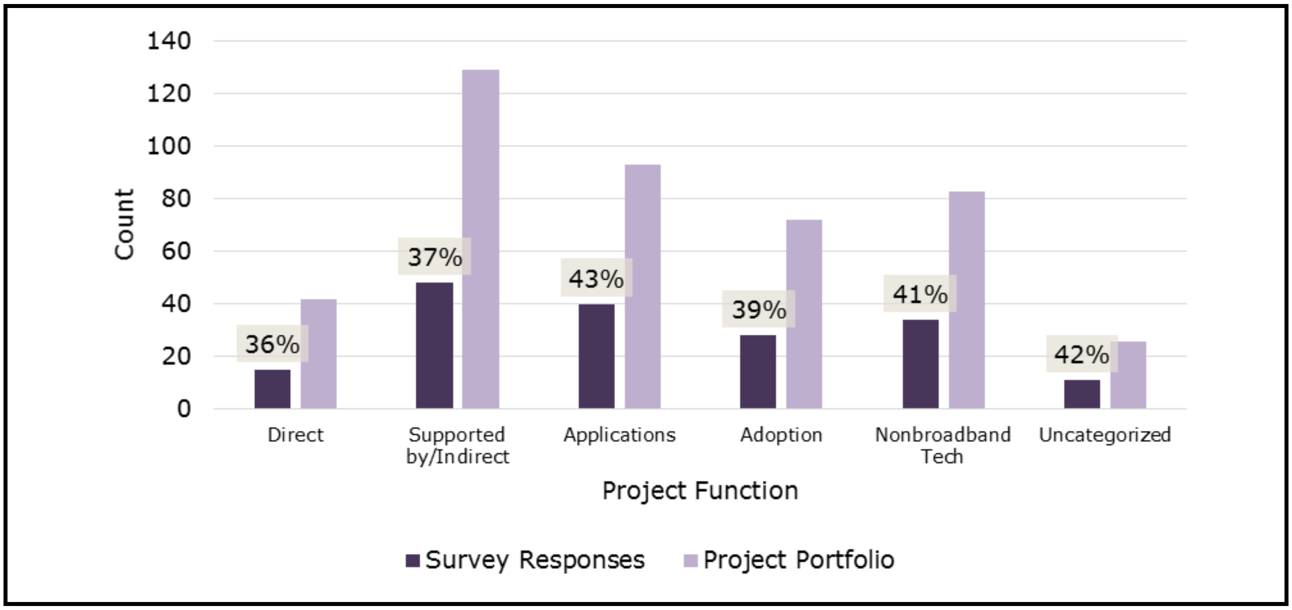


Note: The number of responses is displayed only for questions that apply to all respondents.
Source: RTI Survey

6.1.4 Comparing the Survey Population with All ARC Grantees

The survey population broadly represented the makeup of all 310 ARC grantees. In this section, we show the survey population as compared with the entire telecommunications and technology portfolio by traits such as function, target beneficiary, state, year of funding, and distressed area designation. The functional breakdown of survey responses is representative of the overall portfolio. **Figure 6-2** shows the survey responses by functional breakdown. Response rates ranged between 36 percent and 43 percent by functional framework category. No single category stood out as highly overrepresented or underrepresented.

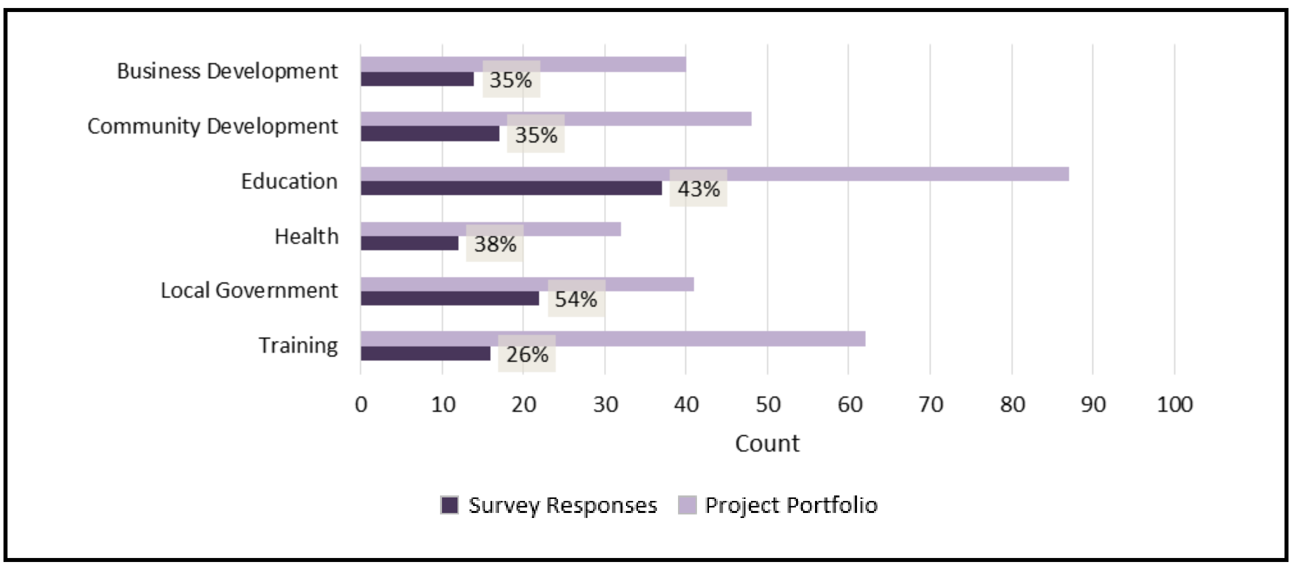
Figure 6-2. Survey Response Rate by Project Function (n=118)



Source: RTI Survey, ARC

Survey analysts also analyzed responses by each grant's target beneficiary. **Figure 6-3** outlines the survey responses by primary target beneficiary. Response rates ranged between 26 percent and 54 percent; local government beneficiaries had the highest response rate partially because of the relative ease of outreach and strong institutional memory of local government organizations.

Figure 6-3. Survey Response Rate by Target Beneficiary (n=118)



Source: RTI Survey, ARC

Finally, RTI acknowledged the value of multidimensional projects and broke down those that served more than one function in the framework. **Table 6-2** outlines the multifunctionality of the projects that make up the survey sample. The most frequent response (48) was for projects that were multifunctional with at least one telecommunications function, with a 40 percent response rate. The highest response rate was 50 percent for single-function projects that were applications of broadband Internet.

Table 6-2. Survey Respondents by Multidimensional Function (n=118)

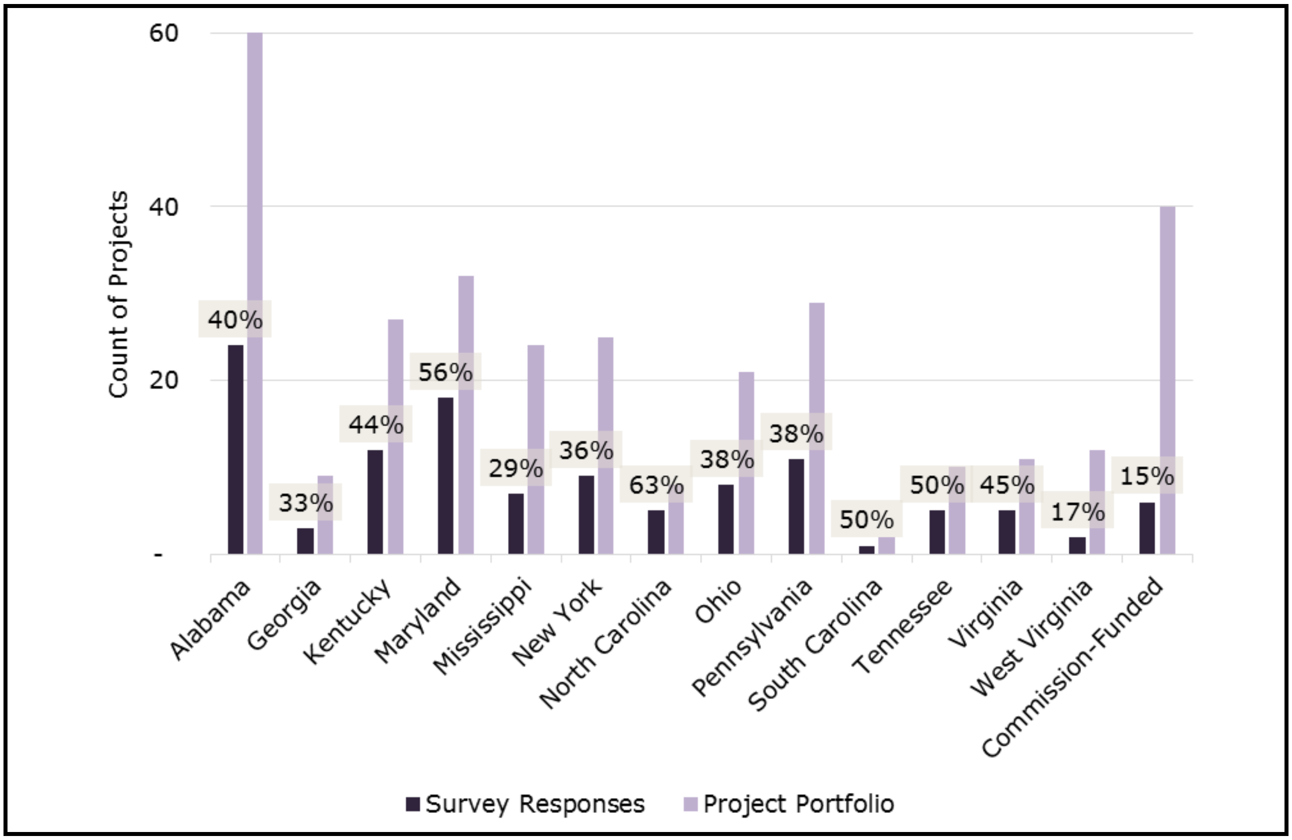
Function	Count	Representativeness of Project Portfolio, %
(1) Direct	8	27
(2) Indirect	9	29
(3) Applications	10	50
(4) Adoption	9	31
(5) Other technology	25	42
(6) Multifunctional with at least one telecommunications function	48	40
(7) All other multifunctional projects	9	43
Total	118	38

Source: RTI Survey, ARC

RTI achieved the highest response rates of over 56 percent from grantees in North Carolina and Maryland and the lowest at less than 17 percent from West Virginia and from Commission projects. Overall, RTI achieved a response rate of 50 percent or higher in four states and lower than 30 percent in only three. Low response rates in those areas were due to employee turnover or organizations that were no longer operational. **Figure 6-4** displays the survey response rate by state.

The highest number of responses by state were from Alabama, Maryland, Kentucky, and Pennsylvania, each with over 10 survey responses. The highest percentage of responses came from North Carolina, which had a lower total number of projects.

Figure 6-4. Survey Response Rate by State

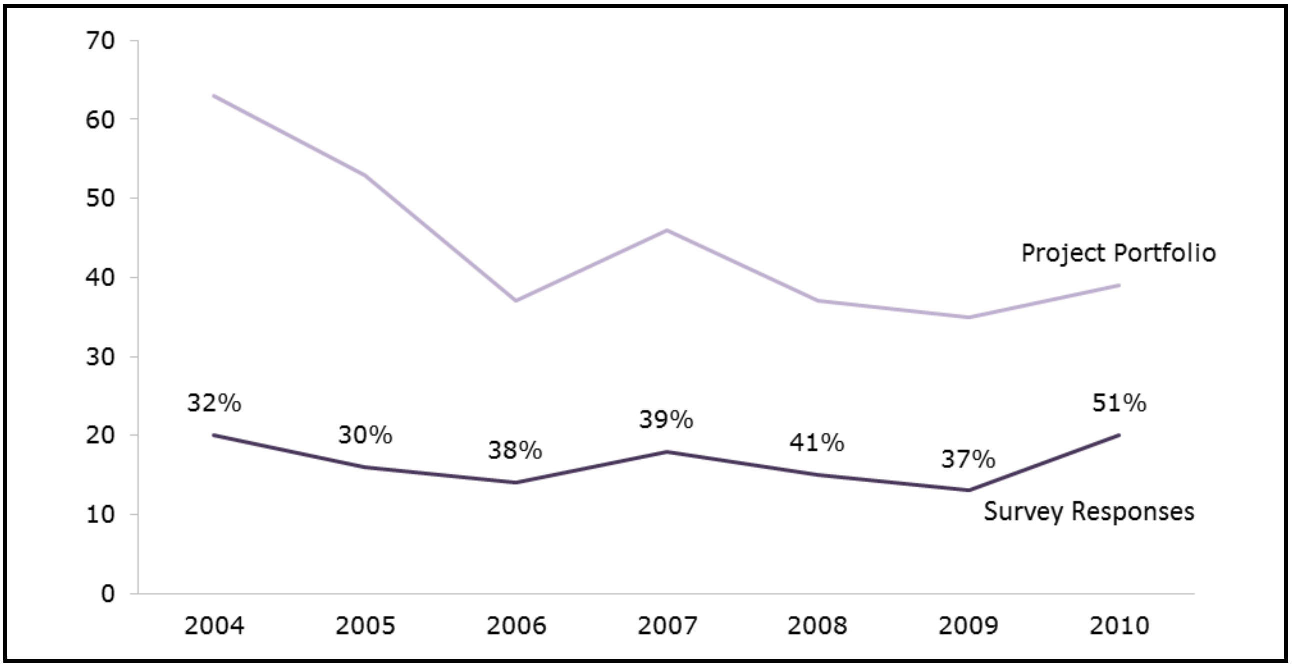


Source: RTI Survey, ARC

RTI expected to have a greater response rate from more recent projects, and as **Figure 6-5** shows, the survey response rate was stronger for more recent grants and is a result of better institutional memory and better access to contacts who remain in organizations that are familiar with the project. Projects from fiscal year 2010 had the highest response rate at 51 percent. It was more difficult for RTI to find appropriate contacts with institutional memory or records of projects from 2004 and 2005, leading to a lower response rate. The figure shows total number of projects, the number of survey responses, and the survey response rate by fiscal year of funding.

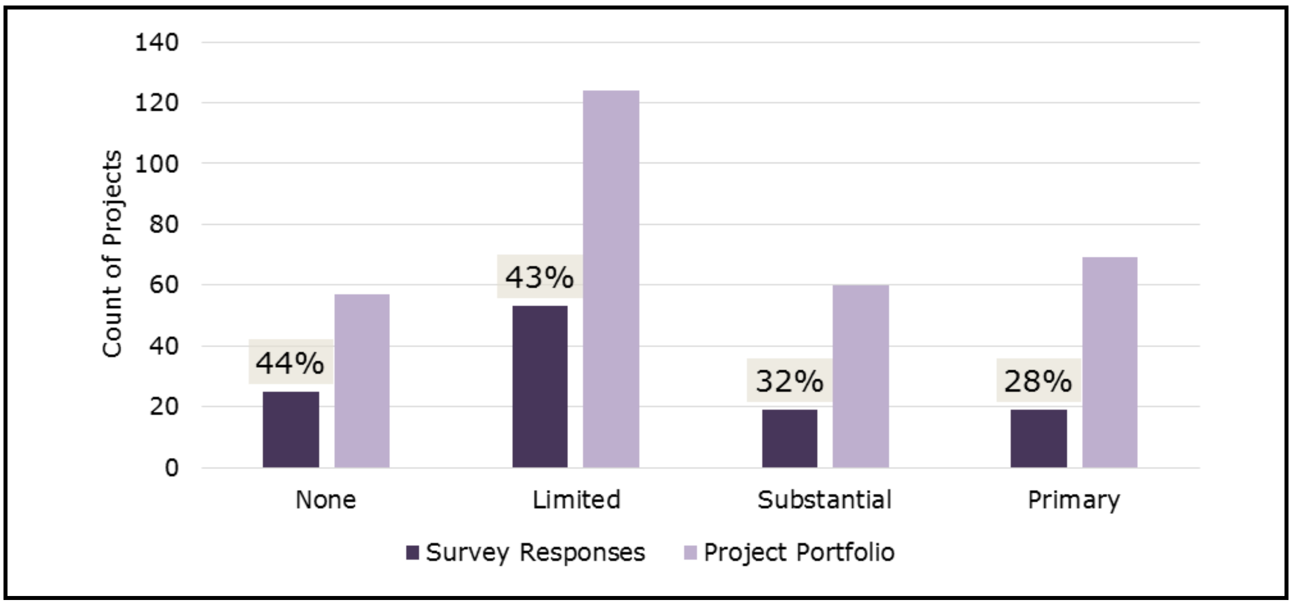
Finally, the survey received the lowest response rate from projects with a substantial or primary impact on distressed areas. As **Figure 6-6** shows, 44 percent of grantees for projects with no impact on distressed areas responded to the survey, and that number declines as projects approach substantial and primary impact. The largest number of projects and responses had a "limited" impact on distressed areas.

Figure 6-5. Survey Response Rate by Fiscal Year of Funding



Source: RTI Survey, ARC

Figure 6-6. Survey Response Rate by Impact on Distressed Areas



Source: RTI Survey, ARC

We had lower survey response rates for older projects, projects with a primary impact on distressed counties, and select states including West Virginia. Job training projects and Commission-funded projects are also less represented by the survey results.

Despite these traits being less represented in the survey population, the project traits as a whole are largely representative of the entire grant portfolio as a whole.

6.2 SURVEY ANALYSIS

The RTI team constructed the survey so that its findings would best help ARC expand its knowledge and understanding of the kinds of impacts its telecommunications and technology projects had and how ARC can improve its grantmaking in the future to positively affect Appalachian communities in the future. The answers to the questions in the survey helped the RTI team analyze impacts after project closeout and delve deeper into the nature of each project more closely. The survey findings illustrate the

- background and operations of each grant,
- impacts of the grants,
- sustainability of the initiative funded by the grant,
- community conditions before and after the grant expired, and
- future needs and challenges of Appalachian communities in telecommunications and technology.

After we profile the role of the survey respondent, we then analyze the survey findings for each of these themes in turn below. The survey protocol is in **Appendix C**.

6.2.1 Role of Survey Respondents in the Grant

Most respondents who filled out the survey were directly involved in managing the grant application, managing the project, or staffing the project. **Table 6-3** shows the detailed breakdown of each respondent's roles. Respondents who checked "other" were either successors in a certain position, grantee leadership and senior management, or cofunders. With 76 percent of respondents directly involved in the project (project manager, staff, or grant application/grant manager), the survey results are much more likely to reflect the actualities of the grant operations and realities about the degree to which grants affected the community.

Table 6-3. Respondent Role in the ARC-Funded Project (n=114)

Role	Count	Percentage
Project manager	33	29
Project staff	13	11
Grant application/grant manager	41	36
Staff with partner organization	6	5
Community member involved in or aware of the project	1	1
Local government employee involved in or aware of the project	6	5
Other	14	12
Total	*114*	*100*

Source: RTI Survey Q4

6.2.2 Grant Background and Operations

In this section, we augment the understanding of how ARC grants were designed and implemented by offering additional information on factors not captured in ARC's project database and discussed in **Section 5**. The grant application and implementation process varies across organizations, and different methods of grant management and project process can offer insight into project performance. Where possible, we couple the findings from the survey with data on project performance, as reported in the project closeout reports, to ascertain if certain operational or process features tended to derive higher or lower levels of performance. We also asked survey respondents about the kinds of resources that would have helped elevate the positive impacts of their grant.

Management and Technical Assistance

The majority of grantees undertook their projects with internal resources: 28 of 115 respondents (24 percent) indicated that they had contracted help in developing, implementing, managing, or evaluating the grant. Of those, seven projects (6 percent) contracted with an outside entity to help develop the grant proposal. Twenty-five of the respondents (22 percent) contracted outside help in managing, implementing, or evaluating projects. Four respondents indicated doing both.

RTI data analysts joined survey data with the ARC project database to examine any patterns among survey respondents who used technical assistance in grant writing or project implementation and project performance. Given that only 6 percent of respondents (seven respondents) used grant writing assistance (a very small sample size), it is very difficult to determine a meaningful association. However, we did examine the performance of these grants and did not find any indication that grants with technical assistance in grant writing outperformed other projects. The less formal grant application process may also have led to grantees needing less technical assistance as compared with other kinds of grant applications. **Table 6-4** shows that the use of outside technical assistance in implementing, managing, or evaluating the grant is not related to higher at-close project performance numbers.

Table 6-4. Project At-Close Performance for Projects with and without Technical Assistance in Implementing, Managing, or Evaluating Projects (n=96)

Technical Assistance	All Goals: Reached within 85%	All Goals: Met or Exceeded	n
Yes	43%	30%	23
No	57%	49%	65
Don't Know	*63%*	*63%*	*8*

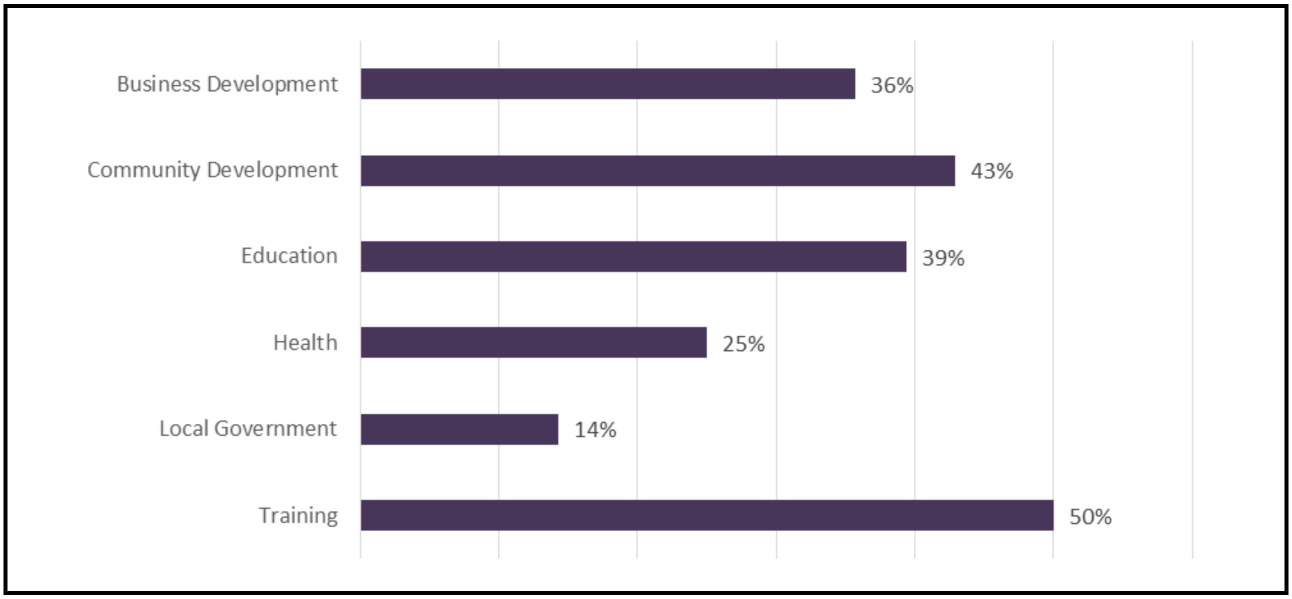
Note: Only includes projects with complete data and complete survey responses to Q5 (n=96).
Source: RTI Survey Q5, ARC

Community Involvement

In this section, we move from factors that illuminate how grants were crafted and implemented to more process-driven characteristics on how grantees engaged the community.

Community advisory groups are used in grants to help projects integrate the needs and functions of the community. On average, 35 percent of survey respondents indicated that their projects involved a community advisory group (Q9). Training projects were the most likely to use a community advisory group (43 percent), and local government projects were the least likely (14 percent). Education and community development projects also had high rates of community advisory group participation. **Figure 6-7** shows the use of community advisory groups by target beneficiary.

Figure 6-7. Use of a Community Advisory Group by Target Beneficiary of Projects



Source: RTI Survey Q9, ARC

To capture the effects of community advisory groups on project performance, RTI compared the at-close attainment of project performance goals of projects with and without community advisory groups. As **Table 6-5** shows, projects with an advisory group were more likely to reach their goals within 85 percent, but no more or less likely to meet or exceed them.[78]

Table 6-5. Project At-Close Performance for Projects with and without a Community Advisory Group

Community Advisory Group Participation	Reached within 85% of Goals	Met or Exceeded Goals	n
Yes	60%	43%	30
No	48%	44%	52
Don't Know	*70%*	*60%*	*10*

Note: Only includes projects with complete data and complete survey responses to Q9 (n=92).
Source: RTI Survey Q9, ARC

Challenges Encountered and Additional Resources Desired to Increase Impact

Respondents were given the option to identify challenges in carrying out the project. Of the 106 survey respondents, 47 reported facing some challenges in carrying out the project (45

[78] None of these differences were statistically significant.

percent). Thus, more than half of the respondents (55 percent) did not self-report any challenges.

Table 6-6 outlines the most frequent challenges cited by survey respondents. Issues with staffing dominate the challenges that grantees faced—a total of 22 when lack of expertise (9), time (8), and turnover (5) are combined. Difficulty in securing outside funding is the second most cited challenge: 12 respondents cited this as a challenge their project faced.

Table 6-6. Challenges in Carrying Out the Project (n=106)

Response	Count
Experienced challenges in carrying out the project	47
Of those:	
Third-party or additional resources did not come through	12
Staff lacked expertise	9
Staff unable to devote sufficient time	8
Staff turnover	5
Unexpected problems that made it difficult to devote attention to the ARC project	3
Lack of support from leadership	0
Other	31
No challenges in carrying out the project	59

Note: Respondents had the option to select more than one challenge; therefore, totals of detailed responses will sum to greater than 47.
Source: RTI Survey Q8

"Other" responses were the most common in response to this question with 31 respondents. This underscores the uniqueness of the challenges that each project faced. The following topics were themes within the other category:

- Poor communication with contractors or technical support resulted because of a lack of knowledge about technology.
- Demand for services was greater than anticipated: the grant could not adequately serve all of those who needed it.
- Financial issues related to the 2008 economic crisis were a challenge.

- Few or no providers of broadband Internet service served a region. Applications or technologies that depend on high-speed Internet cannot be fully effective without access to service, and a lack of competition among providers makes costs unaffordable.
  - One respondent highlighted the noticeable difference in pricing for their county versus the neighbor area: "We had three providers of Internet services in the county but none of their service areas overlapped meaning that there was no real competition and this helped increase costs above what was being charged in neighboring more populous counties."
- Lack of knowledge or awareness in the local community about technology creates barriers to adoption.

Augmenting the understanding of organizational challenges, we then asked respondents to rank the top three factors that would have helped the project have a greater impact. As expected, respondents most frequently cited more funding and more time as factors that would have helped the grant have greater impact. The responses are shown in **Table 6-7**.

Table 6-7. Top Factors that Would Have Helped the Project have a Greater Impact (n=109)

Factor	Weighted Score	Rank
More funding	159	1
More time	109	2
More awareness about the project	85	3
More flexibility in grant requirements	76	4
Greater community buy-in and/or support	62	5
Better technical assistance	44	6
Better trained staff	38	7
Greater support from organizational leadership	26	8
Other	20	9

Note: Score is a weighted calculation. Items ranked first are valued higher than the following ranks; the score is the sum of all weighted rank counts.
Source: RTI Survey Q10

Although it is not surprising that respondents would have preferred more money and more time, their comments on other highly ranked responses shed light on the nature of the issues that projects encountered.[79]

- *More awareness about the project*: Respondents cited low turnout at training events, difficulty with publicizing, lack of interest from some staff and community members, and time lags between the grant award and the community adoption of a project.
  - One grantee noted that there was nearly a 10-year lag between their grant-funded planning efforts and widespread adoption of the plan.
  - Another noted a contrast between great support from leadership and a lack of understanding among citizens about the project and its potential benefits.
- *More flexibility in grant requirements*: Some grantees mentioned the challenge of management and paperwork pertaining to the grant, and others expressed concerns about ARC's grant priorities.
  - "We had hoped that ARC would have emphasized investments in fiber optics technology rather than wireless broadband, as the fiber would still be viable today."
- *More cooperation from third parties*: Respondents commonly cited a general lack of cooperation or communication between all of the parties involved in a project:
  - poor coordination with existing telecommunications companies in reference to using existing infrastructure.
  - lack of oversight of information technology (IT) contractors, stemming from poor communication between project managers and contractors.
  - difficulty in sharing a long-term vision with middle managers
- *Greater community buy-in and/or support*: The responses were closely related to those about a lack of awareness about the project. A lack of community buy-in and support was often the result of misunderstanding the technical nature of a project.

[79] All responses below are taken from the open-ended responses to the RTI Survey Q10.

  - A common theme was a fear or lack of understanding about new technology; as a result, organizations were unwilling to support the project.
  - One respondent noted that access to adequate transportation limited participation in the project.

Common themes emerge from these responses that speak to the challenges of development work in rural areas. Some respondents explained that if community members are not familiar with technology, they are more likely to ignore offers for technical assistance and will be less likely to participate in or support the project. Leadership, communication, and community buy-in are essential to a project's success, and success can be difficult when there are barriers to participation.

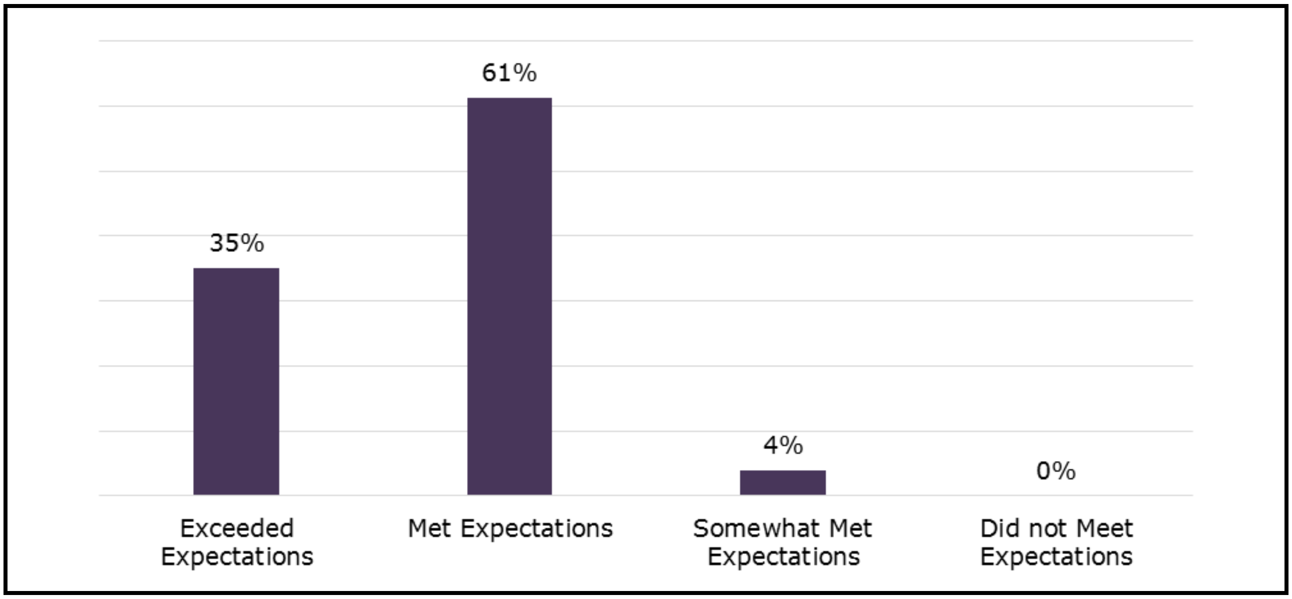
End-of-Project Evaluations

We got mix of results when we asked respondents if they conducted end-of-project evaluations. Thirty-seven percent reported that they did conduct end-of-project evaluations, 37 percent reported that they did not conduct end-of-project evaluations, and 27 percent did not know.

Meeting ARC's Expectations

To complement our understanding about a project's ability to meet expected goals at project closeout, we also asked respondents for their perception of whether their project met ARC's expectations. When asked about whether their project met expectations, 96 percent of survey respondents said their projects either met or exceeded expectations. **Figure 6-8** displays the responses from the survey. Despite the fact that nearly all survey respondents believed their projects met or exceeded expectations, only 50 percent of total projects in the portfolio met or exceeded stated project goals (see Section 5.5.3). Examining the survey pool alone, only 48 percent of the grants met or exceeded project goals. It is important to note that the perception of meeting or exceeding expectations does not always align with the performance metrics of each grant.

Figure 6-8. Did the Project Meet ARC's Expectations? (n=103)



Source: RTI Survey Q15

Most notably, no respondents identified their project as not meeting ARC's expectations. Additionally, respondents cited a diverse range of factors that led to the ability of the project to meet or exceed expectations. Common themes in their responses include the following:

- Greater demand than anticipated for technology and services
- Staff capability and willingness to use new technology
  - After listing efficiency gains across numerous county departments, one grantee summarized how their expectations were exceeded in direct relation to their staffs' improved ability to provide public services: "We continue to grow and be better connected for the service to our citizens."
- Increased human capital through training
  - One grantee saw how skill development transformed employers' responses: "The project proved there was interest and demand, even though the limited number of businesses participating at that time had very limited resources to support their own efforts. As the community (populace) developed widespread computer skills the introduction of computers in the workplace grew at a feverish pace."
- Support from state and local governments

- Local support from the community and business partners
  - For example, in one community a local organization "used resources and local partners to extend and expand the reach of the original project."
- Better communication, collaboration, and efficiency among stakeholders
  - Another grantee saw how the collaborative nature of the ARC support had unexpected, positive ripple effects on their area's long-term growth: "This grant required several partnerships to be formed between the local government, educational institutions, local power providers, and local economic development organizations. If no other impacts were realized, the benefits of pulling these groups together to work on a common problem and solution were lasting and important to our long-term economic development prospects."
- Strong leadership from program managers and project managers[80]

The results from these questions suggest ways that ARC can design grantmaking in the future to improve grant performance. Assuming ARC does not have more funding to allocate to grants, ARC can help grantees improve their performance in several ways. For example, allowing more time for grantees to establish and engage the community with their projects may result in more long-term impacts. Also, identifying ways to better systematize and automate reporting requirements will help grantees spend more time focusing on grant implementation. Encouraging grantees to boost their capacity and more proactively integrate communications and awareness building related to the grant may help improve participation and thus have more widespread impacts. Community advisory groups may help achieve with this effort. Lastly, working with grantees to help increase organizational capacity with staffing may also prove fruitful.

6.2.3 Project Impacts

Moving from operations, management, and implementation of the grants, we also asked survey respondents to reflect on the kinds of impacts that the grant may have had on the community. These questions were designed to illicit information

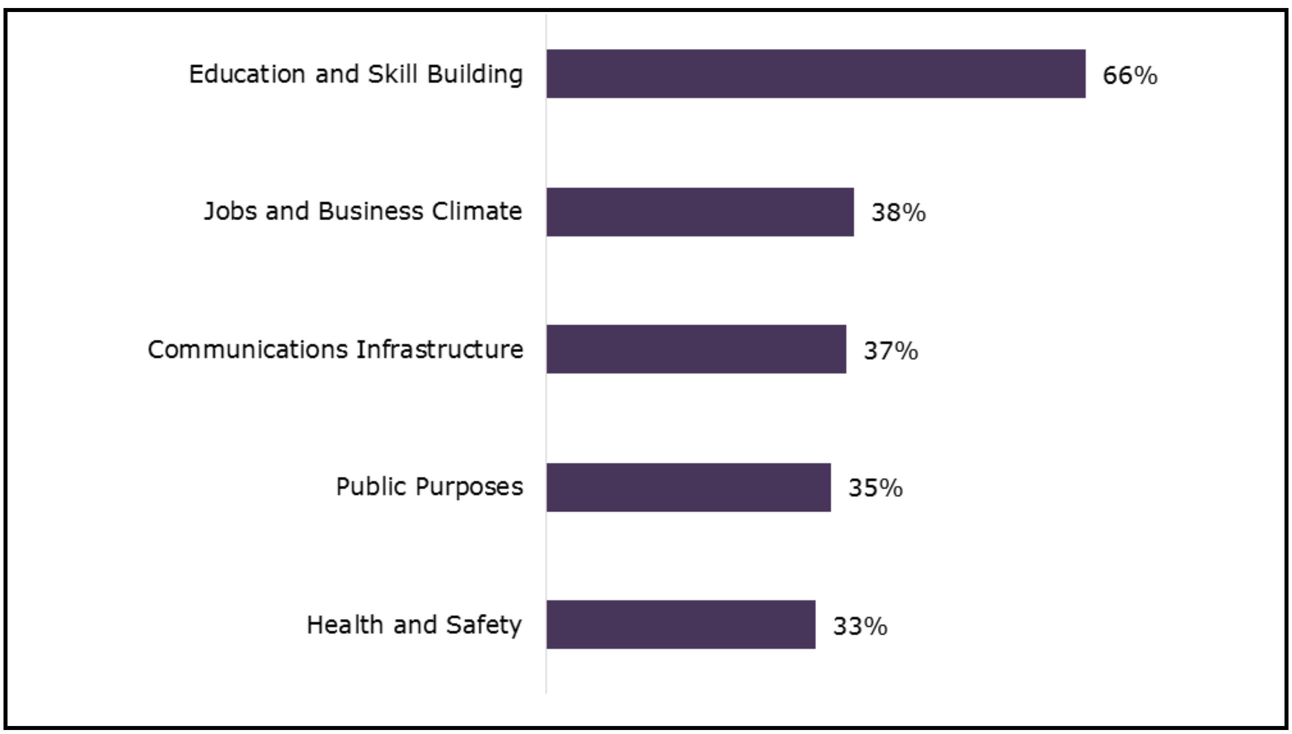
[80] RTI Survey Q16

on broader kinds of impacts that are not tracked as part of the output and outcome data required in ARC reporting. Thus, these survey findings complement ARC project data.

We asked survey respondents to indicate if their project has impacts along broad themes important to communities, including health and safety, public purposes, education and skill building, job and business climate, and communications infrastructure. Question 13 in the survey received 106 responses, each of which reported an impact in at least one of the following categories. Note that respondents could choose more than one category so there is overlap. We also asked respondents about any improved coordination within the community as a result of the ARC grant. We explore the details of each of these topics below.

Education and skill building was the most common category for impacts of projects: 66 percent of all respondents reported improvements in this area. **Figure 6-9** lists in detail the types of impacts that projects reported under each of the above categories. Some projects had impacts in multiple categories; therefore, totals do not sum up to 100 percent.

Figure 6-9. Types of Impact of Projects (n=106)



Note: Because respondents had the option to choose more than one response, results total more than 100%.
Source: RTI Survey Q14

Within each category, we then explored the types of impacts that communities experienced as a result of the grant. We discuss each of these in further detail by theme.

Communications Infrastructure

Thirty-nine survey respondents indicated that their projects had an impact on communication infrastructure. According to survey respondents, service delivery to an organization's clients or customers was the most frequently cited communications-related impact (**Table 6-8**). This was a common effect in projects we reviewed for the evaluation. ARC grants in this portfolio tended to improve local government and local business climate through broadband Internet infrastructure, allowing both businesses and governments in these communities to better communicate with and serve clients.

Table 6-8. Types of Communications Impacts (n=39)

Broad Impact	Count of Respondents	Percentage of Category Total
Better service delivery to your organization's clients or customers	21	54
Better broadband Internet service for schools or other organizations	14	36
Better broadband Internet for other community organizations	13	33
Better broadband Internet for hospitals or other health care facilities	11	28
Better broadband Internet service for libraries	9	23
None of the above/not relevant	9	23
Better broadband Internet service for households in the Region	4	10

Note: Because respondents had the option to choose more than one response, results total more than 100%.
Source: RTI Survey Q14

Similarly, schools, educational institutions, and community institutions benefitted from better broadband Internet access. Understandably, households experienced the lowest level of benefit from ARC grants. Given households are more dispersed, especially in rural areas, they are the most difficult to extend infrastructure to. Instead, ARC grants tended to focus on organizations and institutions within the community that could reach more people.

Jobs and Business Climate

Modern business requires access to advanced telecommunications technology to access suppliers and markets, and local economic development depends on a good business climate that encourages business to locate and grow in a region. Survey results show that ARC grants had the most impact in creating a better business climate for entrepreneurship and for companies (see **Table 6-9**). Likely as an extension of building a stronger business climate for new and established businesses, ARC grantees cited that more jobs were created as a result of the improved telecommunications and technology infrastructure.

Table 6-9. Types of Jobs and Business Climate Impacts (n=40)

Broad Impact	Count of Respondents	Percentage of Category Total
Better climate for entrepreneurship	24	60
Better business climate for companies	22	55
More jobs for a town or region	17	43
Better broadband Internet service for business	12	30
More home-based businesses	6	15

Note: Because respondents had the option to choose more than one, results total more than 100%.
Source: RTI Survey Q14

Education and Skill Building

Education and training projects were among the most common projects, accounting for 149 total grants, nearly half the ARC telecommunications and technology portfolio. Seventy survey respondents (66 percent of total) indicated their grant had impacts in this area. Accordingly, education and skill building was also the most frequently cited impact among survey respondents. Among those who identified it as an impact, they most frequently said that students or workers were better prepared for the workforce (see **Table 6-10**). Closely related, respondents indicated that grants improved computer and broadband Internet skills and improved the level of job skills in

Table 6-10. Education and Skill Building (n=70)

Broad Impact	Count of Respondents	Percentage of Category total
Students or workers better prepared for the workforce	45	64
Improved computer, broadband Internet and/or social media skills	42	60
Improved the level of job skills for people in a town or region	40	57
Improved the educational level of people in a town or region	34	49
Students better prepared for post-secondary education	33	47
None of the above/not relevant	5	7

Note: Because respondents had the option to choose more than one, results total more than 100%.
Source: RTI Survey Q14

the town or region. Almost all (64 out of 70) respondents indicating education and skill building as an impact said that the people in the community were either better educated or better prepared for higher education as a result of the project. Improvement in education and skills related to technology is essential for preparing workers for jobs in the twenty-first century, and ARC's grantmaking has helped better prepare them for good jobs according to the survey.

Public Purposes

Of the total portfolio, 89 projects benefitted either community development or local government services, and 37 survey respondents indicated impacts on public services. The survey helps reveal how ARC funds helped improve public services. As shown in **Table 6-11**, the primary benefits experienced by communities were in improved planning to help facilitate growth and development and better communication between government and citizens. GIS mapping and access to online services were also indicated as impacts of ARC grants. These kinds of impacts are important because they can have a ripple effect in a local community. They improve civic engagement and streamline government services, making the area more business friendly and improve quality of life.

Table 6-11. Public Purposes (n=37)

Broad Impact	Count of Respondents	Percentage of Category Total
Improved planning capacity of a town or region to help facilitate community or economic growth	17	46
Improved communication between local governments and their citizens	17	46
More online services provided by government, such as paying water bills or taxes, obtaining permits, making reservations, etc.	10	27
Better GIS applications that yield improved information about local or regional infrastructure	9	24
None of the above/not relevant	9	24

Note: Because respondents had the option to choose more than one, results total more than 100%.
Source: RTI Survey Q14

Health and Safety

Thirty-five respondents (33 percent) said that health and safety impacts resulted from ARC grants. The impacts of ARC grants for health projects fall into two categories (see **Table 6-12**). First, health grants improved health care for clients at health facilities through technologies like telemedicine, EMRs, and advanced imaging. Additionally, they improved public safety through services like E-911 and improved response systems with global positioning system (GPS) technology. These basic services are essential to community development.

Table 6-12. Health and Safety (n=35)

Broad Impact	Count of Respondents	Percentage of Category total
Improved health care for clients	24	69
Improved public safety for residents	20	57
None of the above/not relevant	3	9

Note: Because respondents had the option to choose more than one, results total more than 100%.
Source: RTI Survey Q14

Reviewing these broad impacts experienced by communities in more detail reveals how telecommunications and technology investments result in impacts that are integral to community economic development. Impacts range from improved public health and safety, public services, education, and skills development to improved business climates and job creation. This range of impacts also reflects the diversity in the ARC telecommunications and technology portfolio. It shows that diversity of investments did result in a diverse range of impacts, all integral however to the growth and development of Appalachian communities.

Community Collaboration Impacts

Despite the fact that only 35 percent of projects had a community advisory group, 80 percent of survey respondents reported that their grant helped facilitate new relationships somewhat or a lot.

In addition to looking at the types of impacts on communities, we also inquired about the impacts that grants may have had on community collaboration. One of the indirect benefits of ARC projects is that they can help build new relationships and strengthen partnerships in communities. One of the survey questions revealed that despite the fact that only 35 percent of projects had a community advisory group, 80 percent of survey respondents reported that their grant helped facilitate new relationships somewhat or a lot.

As we analyzed this question to decipher the kinds of broader impacts communities experienced, we found that 37 out of 87 projects that noted community-related impacts (43 percent) indicated that participants were cooperating better with others to address community issues. Thirty-six percent of the respondents indicating they experienced community impacts said that participants feel more connected to the community. Thirty-three percent thought they were more likely to take on community leadership roles. Twenty-eight respondents out of the 87 indicated that they did not have other kinds of broader community impacts. **Table 6-13** shows the number of projects that had these kinds of impacts on participants.

In addition to the collaborative responses in the survey, respondents cited "other" impacts such as

- better connections between employers and potential employees in skilled fields,
- better awareness and understanding of technology in the community,

Table 6-13. Broader Impacts on the Community (n=87)

Broad Impact	Count of Respondents	Percentage of Category Total
Participants in the project are better at cooperating with others in the community to address issues	37	43
Participants feel more connected to the community than they did before	31	36
Participants in the project are more likely to have a leadership role in addressing community issues	29	33
No broader impacts	28	32
Other	18	21

Note: Because respondents could select more than one impact, totals sum to more than 100%.
Source: RTI Survey Q17

- better outcomes for local entrepreneurs and small businesses, and
- better connections and opportunities with local school districts and other surrounding organizations.

The survey shows that the projects had broad spillover effects in the local community, increasing civic engagement and capacity, as well as affecting other organizations in the community and surrounding areas.

Respondents provided an optimistic picture, when asked how much, if at all, the ARC-funded project helped facilitate new relationships in their region across organizations that might not otherwise have strong ties. In fact, 80 percent of respondents stated that the ARC project facilitated new relationships, while only 20 percent thought that the project did not facilitate new relationships very much or at all. In one community, access to needed new resources strengthened "the partnerships between the [named organization] and our participating school districts by demonstrating that the [named organization] was willing to seek funding to benefit students in their district. We also were able to expand the STEM programs that we offer to school districts." The ties in this community's education system were bolstered as a direct result of the ARC grant.

Perceived Community Change

Survey Question 7:

In your own words, as you reflect on the project, has the town or region changed as a result? In other words, if this grant had not happened, would the town or region be different than it is today? Please explain.

In addition to understanding the role that ARC grants played in fostering community collaboration and relationships, RTI sought to understand how survey respondents perceived change in their community. We asked, "As you reflect on the project, has the town or region changed as a result? In other words, if this grant had not happened, would the town or region be different than it is today?" Of the 102 responses to this question, 87 percent of the comments provided described positive changes, while other respondents offered mixed answers that reflect the complexity of socioeconomic issues in their community. Responses that relayed positive change for their community as a result of the ARC grant centered on three themes:

- Increased capacity
  ARC's investment within their community increased the capacity of local institutions to deliver better services, meeting a broad array of ongoing, local needs. This improvement was found across educational institutions, public entities, health care facilities, nonprofit organizations, and private businesses.
- Bolstered economic viability
  The support received through ARC bolstered the economic viability of the area by targeting fundamental roadblocks to workforce development and business recruitment, among other important growth opportunities.
- Catalyst for longer-term transformation
  ARC's funding is considered by many respondents as a catalyst for longer-term transformation. Targeted projects are often described as the first steps that underpin larger, enduring efforts that have shifted the way communities have progressed.

The benefits experienced as a result of these projects led the majority of survey respondents to highlight the community-wide spillover effects of the financial resources. For example, the betterment of a local hospital's technological infrastructure not only contributed to vast health care provision improvements, but also stabilized the hospital as the area's largest employer. Grant recipients spoke to the tangible assets gained through ARC's presence and often highlighted the more intangible impact of their community's increased connectivity. We explore each theme briefly.

Respondents said that investments in technology improvements immediately added to the grant recipients' abilities to not only access more information, but also to take direct action based on the new knowledge to the greater benefit of their community members.

Increased Capacity of Local Institutions

The diverse capacity-building needs within ARC-funded communities cut across entities providing public services, those charged with human capital development (in schools and jobs), and organizations specifically focused on residents' health and safety. Respondents said that investments in technology improvements immediately added to the grant recipients' abilities to not only access more information, but also to take direct action based on the new knowledge to the greater benefit of their community members. For example, one grantee explained how municipalities can now better evaluate, plan, and manage the road infrastructure assets currently in place. A regional hospital affirmed how "thousands of patients are now receiving better healthcare as their records are integrated, and thus safer and more easily accessible." ARC's support has provided these professionals with technical adeptness that respondents say has had an immediate impact on the local communities' well-being.

Alongside current capacity building, a number of survey respondents highlighted how these enhanced abilities have shaped their future outlook about their community. For instance, a school system made a firm connection between the ARC-provided technological advancements and their students' preparation for future job opportunities. Similar sentiments are found for the workforce. Specifically, for one community "the electric utility sector would [otherwise] be without trained linemen to replace the retiring workforce." Respondents said that their ability to understand not only the current state of their community, but also how community needs may change is critical to their communities' stability.

From relatively small feats such as online payment options to larger-scale economic development and job creation efforts, the investments were highlighted as critical to the private sector's viability.

Bolstered Economic Viability

Twenty percent of survey respondents identified their ARC project as a key piece of necessary support to local businesses in need. From relatively small feats such as online payment options to larger-scale economic development and job creation efforts, the investments were highlighted as critical to the private sector's viability. The following direct quotes underscore how important these grants were perceived to be for the local business community:

"At the time of the grant award, broadband Internet service in this community was extremely limited, if not entirely unavailable. … The ARC grant 'bridged a critical gap' in our community's history, and today the community is economically stronger as a result of the ARC investment."

"Our region has changed for the better with a greater appreciation of entrepreneurship and the support for small business development. If the funding had not occurred there would be potentially 400 less jobs and $30 million less in capital investment in this region."

"The region has changed in that an employer now has a pool of trained qualified candidates to fill skilled positions at their business. Any time a business can grow that is good for the community. Similarly, the training provided employment opportunities for the target population that did not exist prior to the grant."

Another respondent noted the ability of their rural community to now attract high-tech businesses and entrepreneurs, which enabled better health services and educational opportunities. Bustling businesses have meant widespread community benefits, in some cases according to respondents.

One respondent noted candidly, "without this assistance, many would have simply not used technology."

Catalyst to Longer-Term Transformation

About 15 percent of the comments describe ARC projects as the foundational step that catalyzed critical future action within their area. One respondent noted candidly, "without this assistance, many would have simply not used technology." ARC's funding, in some cases, spurred a culture of collaboration that has remained active after the grant ended. Specifically, one grantee elaborated, "A number of key stakeholders became aware of the need for constantly striving for better and more widely available broadband service across the county. Several of these stakeholders worked together to determine how they can work with providers to improve service. Participation by members of key stakeholder groups established a network in the county that comes together to address other community issues."

One respondent described how "[t]his project was an early example of Internet adoption for business purposes. Other [adoptions] have happened since, we think because of ground broken in this project."

For one community, "the grant led to an aggregation project that improved telecommunications access for key health care providers along with ancillary benefits that accrued to under-served areas."

In some examples, ARC's project is used as a model for others within the community. One respondent described how "[t]his project was an early example of Internet adoption for business purposes. Other [adoptions] have happened since, we think because of ground broken in this project." Beyond ARC's funding as the prime community example, these projects spurred future activity. For one community, "the grant led to an aggregation project that improved telecommunications access for key health care providers along with ancillary benefits that accrued to under-served areas." In another area, the barriers to future technology-related investments were significantly lower: "we were able to provide a better wireless Internet service, however since that time, we placed fiber in the area and have since provided more to those schools beyond this service."

In other instances, respondents expressed mixed feedback about how their communities have fared as a result of the ARC grant, revealing both positive and negative community circumstances. The comments recognize the significant contextual influence of entrenched socioeconomic challenges over the accomplishments of ARC grants. One respondent underscored this mixed sentiment well: "Without what the grant provided to connect us to a reliable, low latency, broadband network we would [have] had to make significant system changes that would result in more local taxpayer money that we don't have or can't foreseeably raise to meet the needs of a continually connected culture. We still have needs, many populated areas are still without and without service being brought to them; the likelihood of a service provider making steps that way are very slim." In a similarly difficult position, another respondent illustrates how new educational opportunities are, unfortunately, resulting in local brain drain: "There is no doubt the ARC grant made a difference in the community. By providing students the opportunity to use distance learning while earning a degree from a two year program. Unfortunately, the job base is not available for those utilizing the technology to stay [...] most students must leave the region in order to find good paying jobs." This tension represents an important reality check: ARC grants are not operating in isolation to broader scale dynamics that affect the expected outcomes of these targeted resources.

"Without what the grant provided to connect us to a reliable, low latency, broadband network we would had to make significant system changes that would result in more local tax payer money that we don't have or can't foreseeably raise to meet the needs of a continually connected culture."

This tension represents an important reality check: ARC grants are not operating in isolation to broader scale dynamics that affect the expected outcomes of these targeted resources.

Finally, 12 respondents offered a neutral perspective regarding changes in their community as a result of ARC's involvement. The broader poverty challenges seemed untouched as a result of this project for these respondents. In particular, one grantee lives in a region that "still has one of the poorest health statuses in the nation. The economy, education and health care systems are sparse and not sufficient, yet the population does not generate enough tax base to make significant change." These kinds of comments touch on the difficult and persistent issues in many Appalachian communities such as poverty, lack of quality access to health care and education, and low availability of job opportunities.

6.2.4 Sustainability and Reported Impacts of Projects after the ARC Grant

We now present information about the sustainability of the project after ARC's funding expired. We also report on noted impacts from survey respondents since ARC project closeout.

Seventy-seven percent of respondents (79 projects) intended to continue the project work after the grant period. Of those, 57 projects (55 percent of respondents) had follow-on funding to support project-related activities. Together, they raised approximately $7.9 million in follow-on funding at the end of the ARC grant period. Forty-six projects specified where they received funds. **Table 6-14** outlines the variety of other sources of funding.

Table 6-14. Funding Sources after ARC Funds (n=46)

Funding Source	Count of Respondents	Amount of Funding, $
Some other source of federal funds	14	2,950,000
Private sector	12	1,650,000
State government	20	1,143,000
Other	14	1,062,000
Nonprofit or foundation	9	687,000
County government	15	402,000

Source: RTI Survey Q21

The most frequent source of funds was state government (20 projects), but the largest amount of funding came from other federal agencies ($2.95 million). Respondents cited other sources including

- internal revenue from operations, including health systems and tuition payments;
- local governments; and
- E-rate funding for schools.

Some projects, particularly grants to draft strategic plans, continued to have effects in the community after the grant funding period but did not require additional direct funding.

Impacts since Project Closeout

Survey respondents were more likely to have collected data since project close than to have done a project evaluation. While 48 percent of grantees documented impacts since project close, only 37 percent conducted an end-of-project evaluation. For the 52 projects that document measures of impacts since the project closed, RTI aggregated their impacts in **Table 6-15**.

Table 6-15. Documented Impacts since Project Closed (n=52)

Impact Type	Sum of Impacts	Count of Respondents
Businesses created	124	5
Businesses served	2,116	12
Households improved	287	8
Jobs created	2,883	8
Jobs retained	415	6
Funding leveraged	$72,754,002	5
Linear feet of broadband Internet established	113,040	2
Participants improved	4,659	7
Participants served	4,719	9
Patients improved	1	1
Patients served	212,345	4
Plans or reports created	17	6
Programs implemented	105	14
Students improved	19,070	12
Students served	49,646	25
Telecommunications sites established	2	2
Workers/trainees improved	1,412	9
Workers/trainees served	3,067	12

Note: Paired output/outcome measures are shaded in gray.
Source: RTI Survey Q13

These numbers demonstrate impacts occurring after the original ARC funds were spent and the grant period closed. Some projects had multiple documented impacts. Although the methods used to document the impacts after project close likely varied widely, these results illustrate that ARC projects have a long-term impact on communities that is not limited to the grant period.

Some of the stated impacts after project close, such as businesses created (124), are higher than the original at-close performance measures (101 businesses created—outcome). This example offers insight into the long-term impacts of projects after the close of the grant. There are more examples of projects that had significant increases in performance numbers after the close of the grant.

Highlights include the following:

- The Burson Center for Business Development raised $69 million in capital investment, created 789 jobs, and served over 1,400 businesses in Georgia.
- Coosa County GPS Water System Mapping leveraged $400,000 in private investment and installed 18,000 linear feet of new fiber in Alabama.
- The Tri-County Telecommunications Master Planning initiative stated, "As a result of this initiative, as well as the resulting implementation initiative, health care providers, schools, and small business/entrepreneurs have access to quicker, more reliable, and significantly less expensive Internet access. This has produced a benefit for health care, education, and economic development." It has served 200 businesses and over 10,000 students in South Carolina since the close of the grant period.
- The Ashtabula County Medical Center EMR system has served 5,000 patients in Ohio since the close of the grant. The grant manager said, "The implementation of electronic medical record[s] at Ashtabula County Medical Center was the smoothest launch seen in the Cleveland Clinic system." Additionally, the grant allowed the clinic to use its funds to invest in other critical health technologies.
- The Northwest NC Advanced Materials Cluster has served 500 students and 175 workers/trainees at Wilkes Community College. Additionally, it has contributed to local business and job growth in western North Carolina.

These totals in **Table 6-15** are limited only to the subset of 52 projects that documented impacts after the grant period. The true impacts of the portfolio are likely larger.

The after-close impacts as indicated by the survey illustrate the fact that many of ARC's investments in telecommunications and technology were only beginning to have effects at the close of the grant period. Projects with goals that were hard to attain in the short term, such as job creation or student improvement, showed significant impacts in the long term that were not captured in the original project data. Additionally, adoption of telecommunications technology is a slow process and requires community education, involvement, and buy-in, which occurs over a longer time period than the initial grant.

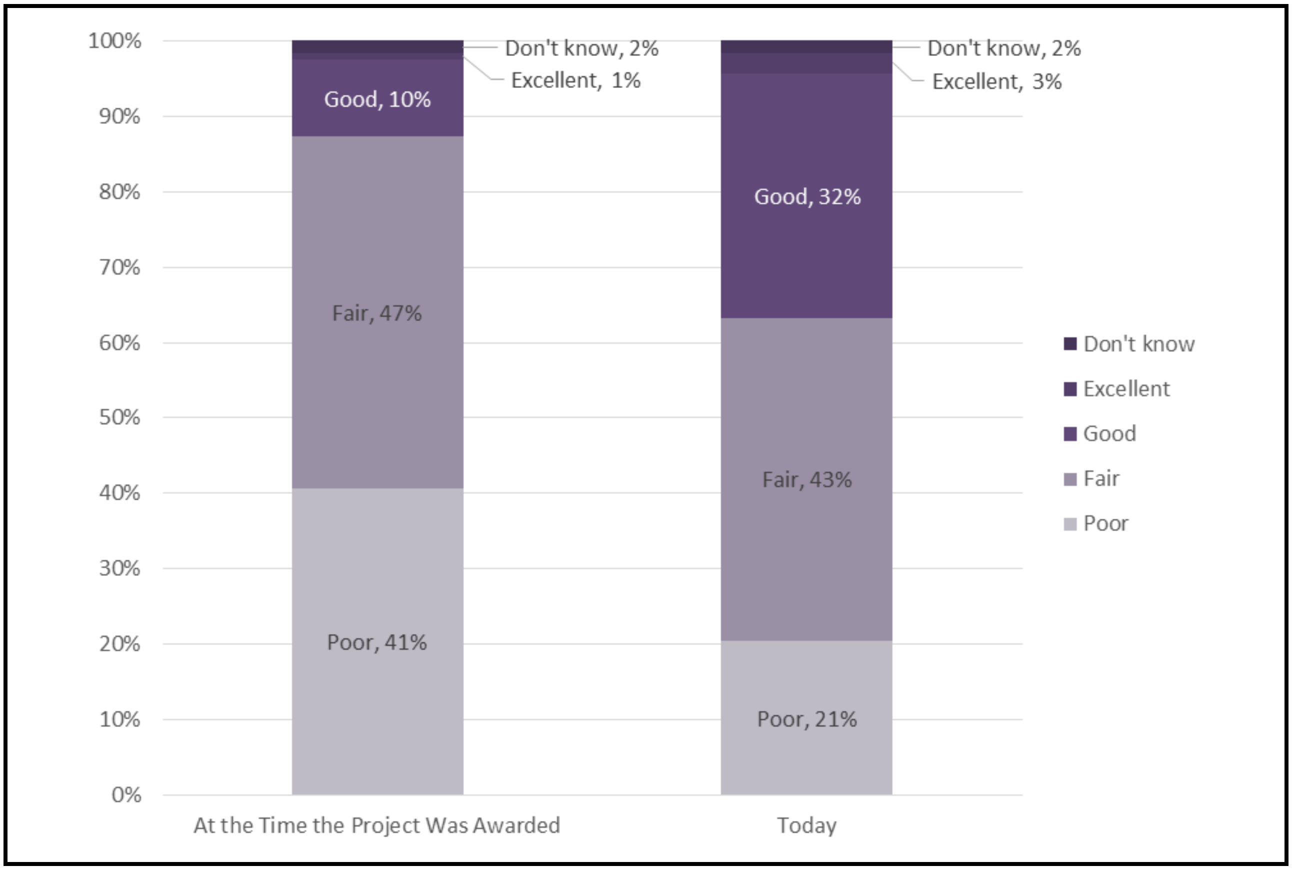
6.2.5 Economic and Social Conditions in Communities

The RTI team sought to gain a more expansive understanding of the conditions in communities at the time of the ARC grant and at the time of the survey. Survey respondents were asked to compare the economic conditions and quality of life at the time the grant was awarded with conditions today. We do not make a correlation with the ARC grant and a change in these more holistic community conditions. However, we do think this evaluation can help gauge, generally, if conditions in Appalachian communities are improving.

Survey respondents were asked first about the state of the community's economic conditions at the time the grant was awarded. Additionally, they were asked how those economic conditions compare with the economic conditions today. Those findings are displayed in **Figure 6-10**.

At the time the grant was awarded, 41 percent of communities had self-described poor economic conditions and 47 percent had fair economic conditions. Many of the grants were made during the 2008 economic recession, making it more likely that communities would describe a difficult economic climate. Only 11 percent of communities had good or excellent economic conditions. Today, the conditions of these communities have improved quite substantially: 35 percent of respondents described their economic conditions as good or excellent. The percentage of communities with poor conditions was cut in half.

Figure 6-10. Economic Conditions in the Town or Region that the Grant Targeted (n=117)



Source: RTI Survey Q1, Q2

The overall breakdown of economic conditions shows broad improvement for communities during this time frame. Looking at the individual project level supports this broad improvement:

- Fifty percent of projects reported an improvement in economic conditions between the grant award and the present.
- Forty-three percent of projects reported no change.
- Seven percent reported worsening of economic conditions in the community.[81]

The Sankey chart in **Figure 6-11** highlights specifically how communities' reported economic conditions changed over time. The left-hand bar shows communities' economic conditions at the time of the grant, the Sankey diagram shows if

[81] One hundred fifteen respondents provided both the economic conditions at the time the project was awarded and the economic conditions today.

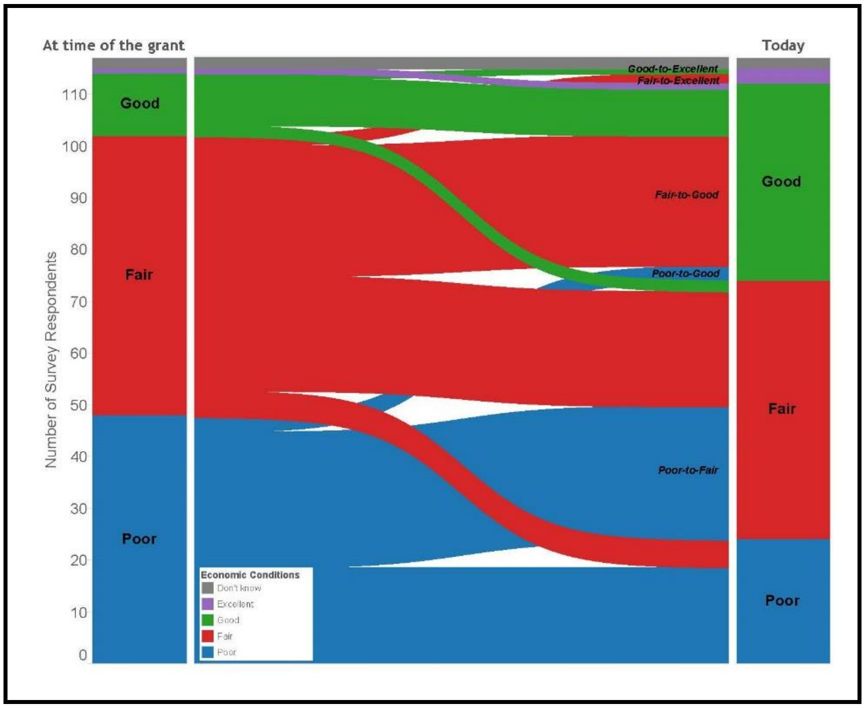


Figure 6-11. Sankey Chart Showing the Change in Economic Conditions for Survey Respondents (n=117)

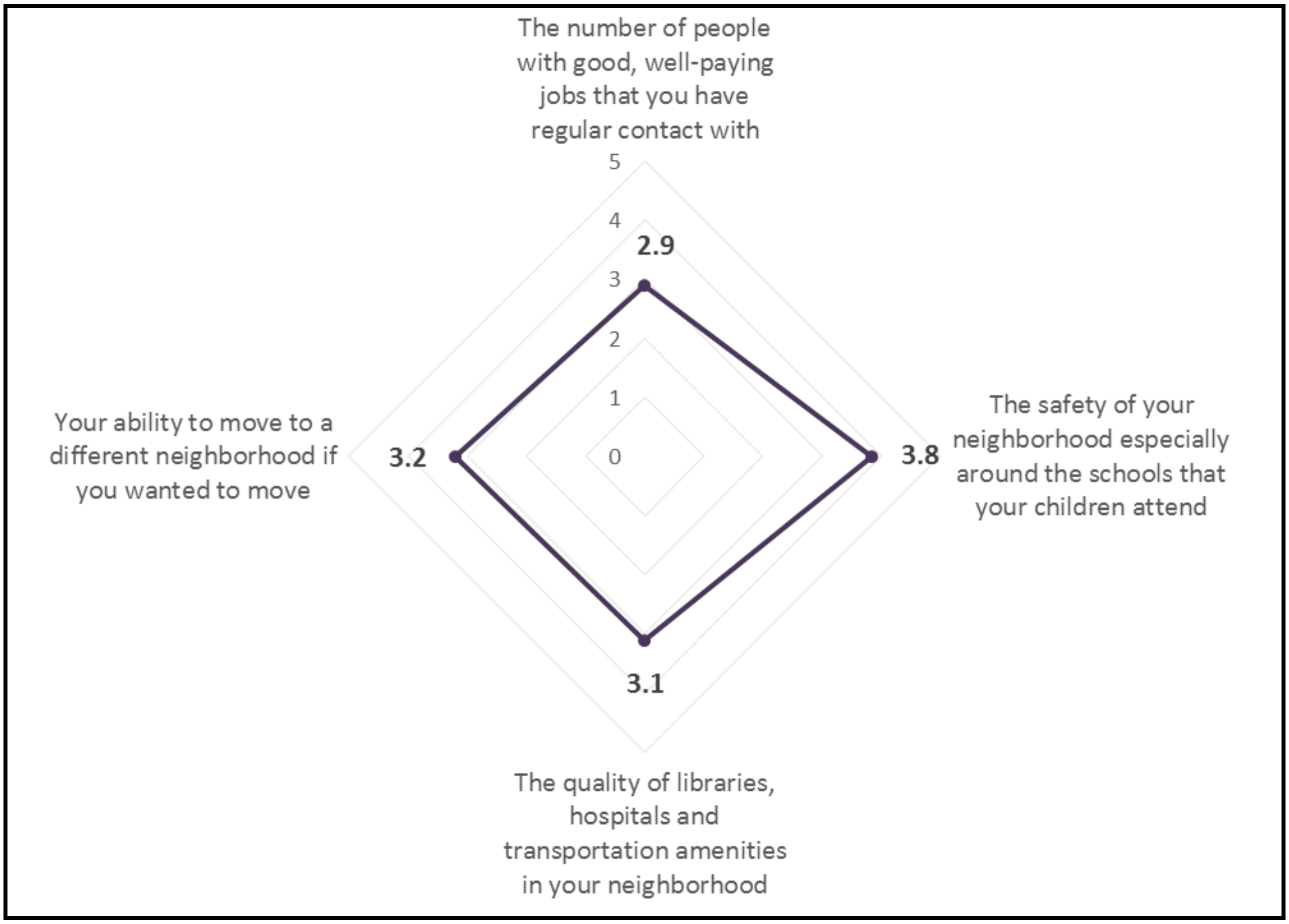
Source: RTI Survey Q1, Q2

communities changed conditions, and the right-hand bar shows communities' economic conditions today. For the communities with "poor" economic conditions at the start of the grant (see the blue left-hand bar and corresponding flows), most have experienced improved conditions today as seen by the flows from poor to fair or poor to good. The figure illustrates that communities' economic conditions are quite dynamic over time. As mentioned above, 50 percent of communities reported improved economic conditions from the time of the grant award to today. The groups of projects with improved conditions are labeled in the Sankey chart in the figure.

To capture additional measures of well-being in communities, the RTI team asked about the current degree of satisfaction of residents along several dimensions—mobility, jobs, safety, and institutions/infrastructure—on a scale from 1 to 5. **Figure 6-12** shows the average responses for each of the four dimensions.

Safety is the highest rated aspect of everyday life (3.8), while good-paying jobs is almost a point lower at 2.9. Ability to move and the quality of infrastructure and institutions such as libraries, hospitals, and transportation amenities both ranked in the middle with 3.2 and 3.1, respectively. These findings indicate that access to good jobs remains most challenging for community members as they seek to improve their quality of life.

Figure 6-12. Average Satisfaction of Residents with Different Aspects of Everyday Life



Note: Scale from 1 to 5 with 1 being extremely unsatisfied and 5 being extremely satisfied.
Source: RTI Survey Q3

6.2.6 Future Needs and Challenges in the Community as They Relate to Broadband Internet and Computers, and Technology

The survey concluded with a series of questions about future needs and challenges in the community as they relate to broadband Internet, computers, and technology. The questions asked about needs in terms of infrastructure, increasing adoption of the Internet, and improving education. We explore the results within each topic area below. The findings from these questions may be useful to ARC as it considers priorities for future funding in a telecommunications and technology portfolio.

In terms of telecommunications and technology infrastructure, the most cited need is to support faster broadband Internet (71), which is closely followed by the need for a telecommunications infrastructure to better reach underserved households (69). These are both large barriers to entry in rural areas because of the cost of installation and low potential return on investment.

Sixty-two respondents said that replacing outdated computers or technologies was the third most important unmet need (see **Table 6-16**).

Table 6-16. Needs Related to Telecommunications and Technology Infrastructure (n=102)

Need	Count of Respondents	Percentage of Category Total
Infrastructure investment to support faster broadband Internet speeds and service	71	70
Infrastructure investments to reach households currently unserved by broadband Internet networks	69	68
Replacing out-of-date computers or technologies in schools, hospitals, libraries, and local government.	62	61
Investing in retrofitting facilities, such as internal wiring, so they can better support wireless broadband Internet access	46	45
More technical support personnel in the community or organization to maintain equipment	30	29
Other	1	1
Don't know	3	3

Note: Because respondents could select more than one impact, totals sum to more than 100%.
Source: RTI Survey Q24

Examining adoption needs reveals a different set of challenges for the Appalachian Region. **Table 6-17** lists the most commonly cited challenges for adoption. Lower costs for consumers is the top need for increasing adoption of broadband Internet telecommunications (69 percent of respondents) and with digital literacy is second (56 percent of respondents). These results differ from those reported by the Pew Research Center in 2013, which showed that relevance and literacy issues were the largest deterring factors for Internet nonusers

Table 6-17. Needs Related to Adoption of Broadband Internet Telecommunications (n=100)

Need	Count of Respondents	Percentage of Category Total
Lower monthly broadband Internet fees for consumers	69	69
Improving digital literacy for citizens	56	56
More competition among broadband Internet providers	53	53
Other	3	3
Don't know	8	8

Note: Because respondents could select more than one impact, totals sum to more than 100%.
Source: RTI Survey Q 25

and high costs were less of an obstacle.[82] However, lower median household incomes in the Appalachian Region mean that costs of Internet service are a larger obstacle than in other parts of the country. Organizations and users in the Region understand the value of Internet access, but the cost is a significant burden to adoption. One grantee, in particular, noted how necessary the resources to cover the "last-mile infrastructure" are to reach some of the most underserved populations in their area.

Education and training needs as identified by survey respondents are shown in **Table 6-18**. The two most cited needs are more training for teachers (57 percent) and for people in community assets like libraries and health care facilities (54 percent). Teachers, health care providers, and library workers have secondary effects by improving education and knowledge among students and residents, which, in turn, leads to better educational outcomes. Opportunities to better understand privacy, intellectual property, and other data management issues are high priorities for the survey respondents as well (48 percent). A respondent from the health care field illustrated their experience: "In health care, the concerns over privacy and archiving are big issues that we are struggling with. The resources to help with this have eluded us."

[82] Zickhur, Katherine. September 15, 2013. "Who's Not Online and Why." Pew Research Center. Accessed at http://www.pewinternet.org/2013/09/25/whos-not-online-and-why/ on August 15, 2015.

Table 6-18. Needs Related to Education for Broadband Internet (n=97)

Need	Count of Respondents	Percentage of Category Total
More training for teachers so they can better use computers and broadband Internet in the classroom to improve educational outcomes	55	57
More training for people working in libraries, health care facilities, or other community organizations to help them better use computers and broadband Internet to carry out their missions	54	56
More education on the issues of privacy, intellectual property, and archiving information	47	48
Other	6	6
Don't know	20	21

Note: Because respondents could select more than one impact, totals sum to more than 100%.
Source: RTI Survey Q26

These results can help inform future investments by agencies like ARC that continue to work in telecommunications and technology in a rural setting. Basic infrastructure and equipment, lower broadband Internet fees, and better training for teachers and citizens will lead to increasing returns on investment for telecommunications and technology by overcoming some of the obstacles mentioned above.

6.3 SUMMARY FINDINGS

The survey results offered a deeper perspective on the challenges organizations faced in managing and implementing projects. Insights from the survey uncover a layer of understanding about the barriers to telecommunications and technology deployment and adoption in rural areas, including challenges with traditional telecommunications providers, creation of citizen awareness, and ability to anticipate levels of demand for technologies that people are not familiar with. These challenges continue to exist, and with the fast-moving telecommunications landscape, they will evolve into new challenges in the future.

At the same time, they shed light on the widespread and long-term impacts that go beyond the limited ARC grant period. Organizations have been able to overcome challenges that may have made a project look less successful in an early stage, and ARC's investments have had long-lasting effects after the grant period. Seventy-seven percent of the grantees surveyed intended to continue their projects after the end of the grant period, and 55 percent were able to secure follow-on funding to do so. Further, close to half of the projects had documented quantitative impacts since the close of the project, across all of the metrics used by ARC in evaluation. They raised millions of dollars in private investment and added thousands of jobs to their local economies. Their reported metrics are large and indicate a significant, measurable lasting effect of ARC's grantmaking efforts in telecommunications and technology.

The survey results also provide an important complement to the project database measures: they offer an indication of some of the intangible benefits and the long-term ripple effects that may not have been captured in the project closeout numbers. Survey respondents who indicated the strongest positive economic change in their communities did not necessarily have the highest average project performance numbers, and overall improvement in the regional economy was not necessarily associated with projects meeting their stated performance outputs and outcomes.

Furthermore, the projects have had a secondary effect on community building. Half of the respondents indicated a positive economic change in their communities, and 80 percent indicated that they were able to better facilitate new relationships. Better education and skill building, job preparedness, local leadership, and coordination among local businesses and organizations are just a few of the widespread ripple effects that this portfolio of investments has had on Appalachian communities.

7 Case Studies

ARC's telecommunications and technology investments occur at the nexus of complicated, multidimensional contexts that cannot be comprehended solely through ARC's internal grants management reports or survey data. Exploratory, field-based case studies of select projects bring into sharper focus the mix of programmatic, environmental, technological, and social human factors that ensure the benefits of technology-enabled development in Appalachia.

Although each project is unique to its time and particular context, the broader challenges and opportunities they address are common to many of the rural, low-density, and economically distressed counties in Appalachia and beyond.

Between FY 2004 and FY 2010, ARC invested $41 million in 322 diverse technology-focused projects throughout its 13-member states. Although each project is unique to its time and particular context, the broader challenges and opportunities they address are common to many of the rural, low-density, and economically distressed counties in Appalachia and beyond. The RTI team conducted comparative case studies of a select sample of ARC's technology project portfolio in early summer 2015 to the following ends:

- Provide empirical documentation of reported outcomes.
- Develop a deep and fuller understanding of unique and cross-cutting factors affecting/facilitating project success.
- Build on that understanding by triangulating case study findings with primary data collected through the survey and archival analysis of ARC grants management system and project records to generate robust recommendations for enhancing the positive outcomes of projects funded by ARC.
- Emphasize rural, underserved and/or economically stressed communities.

Section 7.1 describes the process employed in selecting cases for in-depth study, the design and protocol followed for the site visits, and the common set of core questions used to facilitate comparison of themes and findings across the projects studied. **Section 7.2** provides detailed write-ups for each project visited during the case studies. Summary findings comprising cross-cutting themes and lessons learned complete this chapter (**Section 7.3**).

7.1 METHODS

In this section, we describe the criteria for case study selection and summarize the cases selected.

7.1.1 Case Selection

The entire FY 2004 through FY 2010 technology project portfolio was considered in selecting cases for in-depth analysis and site visits. Forty projects passed initial screening criteria that included the following traits:

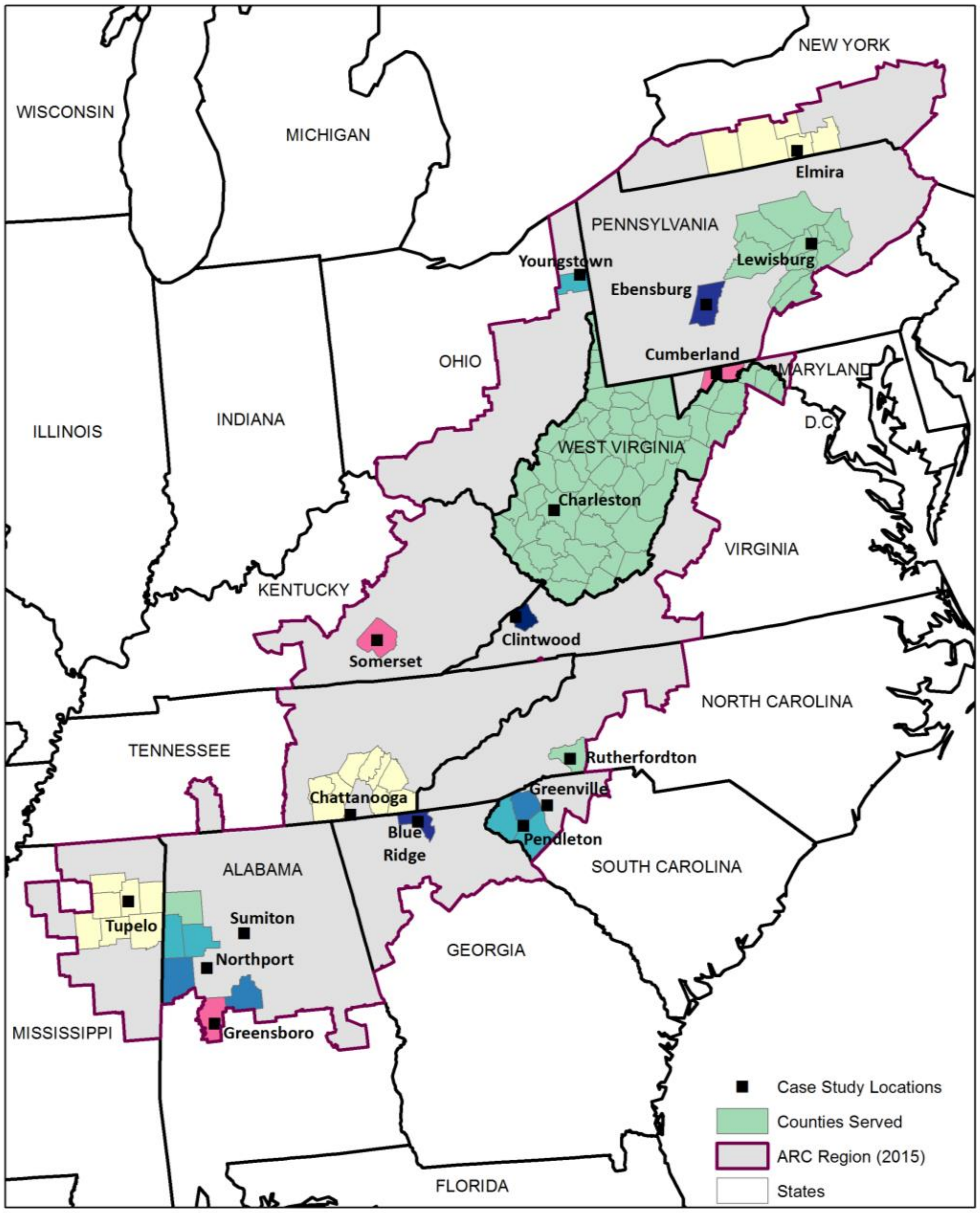
- Projects benefited distressed communities.
- Projects had potential to serve as a model for similar efforts.
- Projects used a novel approach.
- Projects were of a scale and duration that support lasting and meaningful impact.

The 40 candidate projects were arrayed across a matrix of project functions and beneficiaries to ensure the selection of a final sample that was broadly representative of the full spectrum of ARC technology projects. We also selected cases that represented: all 13 ARC member states; a range in funding amounts and time horizons; and level of rurality. ARC staff provided additional information that helped narrow the candidate pool. Some projects were eliminated when efforts to contact the grantee organization or to identify individuals with sufficient project knowledge proved unsuccessful.

This rigorous screening process identified 18 projects[83] for analysis. The case study locations are shown in **Figure 7-1**.

[83] Two projects were managed by the same grantee, West Alabama Regional Commission. These two are joined in the first case study and defined as Phase 1 and Phase 2 occurring in 2005 and 2008, respectively (AL-15117 and AL-16021).

Figure 7-1. Map of Case Study Locations



Source: RTI and Appalachian Regional Commission

Fifteen of the projects were selected as potential exemplars of success; three now-defunct projects represent projects that might offer a diagnostic of factors that contribute to less imitable outcomes. **Table 7-1** summarizes the project titles, the beneficiary focus, the technology function focus, the project year, and funding amounts.

Table 7-1. ARC Project Case Study Characteristics

State—Project #	Project Title	Beneficiary Focus[a]	Technology Function Focus[a]	Project Year	ARC Funds/ Additional Funds
Alabama—15117-1[b]	GIS for West AL Water Systems	Community development	Nonbroadband technology	2005	$150,000/ $40,000
Alabama—16021[b]	GIS for West AL Water Systems II	Community development	Nonbroadband technology	2008	$100,000/ $100,000
Alabama—15246[c]	Marion County Schools Telecommunications	Education	Direct broadband	2005	$360,000/ $90,000
Alabama—16551	Whatley Health services Medical/Dental Equipment	Health	Application of broadband	2010	$165,678/ $41,419
Georgia—14430	Fannin County Workforce Development	Training	Broadband support and adoption	2005	$263,000/ $327,200
Kentucky—15584	Regional High Growth Training Center	Training	Direct broadband	2007	$500,000/ $229,000
Maryland—16489	Allegany County Public School Smart Board	Education	Broadband support and adoption	2009	$20,000/ $20,000
Mississippi—15079	Three Rivers Electronic Filing System	Local government	Broadband support and application	2005	$200,000/ $844,504
New York—15778	Schuyler—Chemung—Tioga BOCES Educational Opportunities Network	Education	Direct broadband	2007	$199,732/ $235,422
North Carolina—15787	Rutherford County Broadband Expansion	Local government	Direct broadband and broadband support	2007	$178,920/ $76,680
Ohio—16785	Youngstown Ohio Works & Riverbend Industrial Park Broadband Access	Business development	Direct broadband	2010	$91,318/$ 91,318

(continued)

Table 7-1. ARC Project Case Study Characteristics (continued)

State—Project #	Project Title	Beneficiary Focus[a]	Technology Function Focus[a]	Project Year	ARC Funds/ Additional Funds
Pennsylvania—14772	SEDA-COG Promoting Technology Adoption for Progress (PTAP)	Local government	Broadband adoption	2004	$150,000/ $162,500
Pennsylvania—15955	Cambria Connected	Community development	Direct broadband	2008	$225,000/ $267,180
South Carolina—15688	Tri-County Telecommunications Master Planning Initiative	Community development	Broadband adoption	2007	$65,000/ $66,000
South Carolina—15687	Tri-County Technology College Technology Infrastructure Pendleton Campus	Training	Broadband support	2007	$101,401/ $191,503
Tennessee—16340	Regional Economic Development GIS Upgrade	Local government	Broadband support and application	2009	$11,055/ $11,055
Virginia—16032	Dickenson Center for Education and Research Equipment	Training	Broadband support	2008	$100,000/ $25,162
West Virginia—16063	West Virginia State Museum Education	Education	Broadband adoption and application	2008	$200,000/ $235,000

[a] Definition pulled from the broadband evaluation framework developed by RTI in partnership with ARC.

[b] These projects were managed by the same grantee, West Alabama Regional Commission, and have been combined into a single case study. They are discussed as Phase 1 and Phase 2 of the case in Section 7.3.1.

[c] The original project is not in operation; however, the network is operating as Cambria Connect and is delivering services to county government with plans to transition to fiber.

Source: ARC Telecommunications and Technology Database FY 2004–FY 2010

7.1.2 Site Visits

We invited individuals identified as potential key informants for selected projects to participate in interviews for the purpose of documenting the process and outcomes of specific case study projects. We scheduled visits in May, June, and July 2015 at dates and times convenient to the interviewees in all cases except two. The RTI team conducted one project interview over the telephone (AL-14256), and one was conducted in a virtual meeting format (WV-16063). Objectives for the visits/interviews included the following:

- demonstration of project or tangible evidence of its implementation
- interviews with the project leaders and stakeholders to illicit information about challenges encountered, successes experienced, and long-term impacts on Appalachian communities.
- collection of archival or ancillary materials.

7.1.3 Internal and External Validity

We applied a consistent research design and interview process using a common set of structured and open-ended questions (see **Appendix E**) to provide internal validity and allow for elucidation of cross-cutting themes common to the projects. We addressed external validity by selecting projects that adequately represent the spectrum of ARC telecommunications and technology projects undertaken from FY 2004 through FY 2010 (see **Table 7-1**). We carefully assessed the stratification of projects at both ends of the success continuum and with regard to technology function, geography, scope, span, and cost to increase the external validity and robustness of findings. Deployment of the same two-person team to all sites ensured the consistency of interpretation that is critical to comparative analysis.

We used evidence from other studies to frame the questions for interviewees to help us build on the latest understanding of the contribution of certain factors and situations toward the success of technology-based economic and community development projects. Triangulation of findings across field research, primary data collected through surveys, and analysis of archival information from ARC grants management system/project records and from other public sources increased the robustness and reliability of cross-cutting themes and factors that emerged as highly relevant to project outcomes.

Consistent types and sources of data contribute to the interpretation and generalizability of findings. All demographic and economic data cited in tables found in the individual case studies were sourced from the most recent information available from the U.S. Census[84] or, in the case of unemployment data, from the Bureau of Labor Statistics.[85] Sources for local information used in community profiles are cited in individual case studies. Economic status descriptors, including "Distressed," "At Risk," "Transitional," "Competitive," or "Attainment," are defined and applied to counties by ARC.[86]

7.1.4 Site Visit Follow-Up

We provided primary contacts at each project drafts of their particular case study and asked them to verify that the final case study reports accurately capture information exchanged in the interviews. We thank all individuals who graciously shared their experiences, perspectives, insights, and recommendations related to using telecommunications and technology to improve the prospects of Appalachian communities.

7.2 CASES

7.2.1 GIS for West Alabama Water Systems Phase I and Systems Phase II

Community Profile

The West Alabama Regional Commission (WARC) comprises Bibb, Fayette, Greene, Hale, Lamar, Pickens, and Tuscaloosa Counties. WARC is a legislatively established organization created to coordinate region-wide projects in these seven counties. Each county except Greene and Tuscaloosa engaged in ARC's investments with the region. The population of the region is approximately 300,000, two-thirds of whom reside in Tuscaloosa County. As a growing, largely urban (74 percent) county with an economy dominated by manufacturing and service jobs, Tuscaloosa stands apart in the greater region that

[84] U.S. Census Bureau. No date. Quick Facts Beta 2.0. Accessed at http://quickfacts.census.gov/qfd/index.html on August 1, 2015. Note that the percentage of the population over 65 years is as of July 1, 2014; data related to high school graduation, per capita income, and poverty are numbers are based on the most recent year available.

[85] U.S. Bureau of Labor Statistics. No date. Local Area Unemployment Statistics Map. Accessed at http://data.bls.gov/map/MapToolServlet?survey=la&map=state&seasonal=s on August 1, 2015.

[86] Appalachian Regional Commission. 2015. "Distressed Designation and County Economic Status Classification System, FY 2007 – FY 2016." Accessed at http://www.arc.gov/research/SourceandMethodologyCountyEconomicStatusFY2007FY2016.asp on August 1, 2015.

is 79 percent rural, characterized by declining population, and is a natural resource–based economy.[87]

The other WARC counties underperform compared with state and national averages on various factors affecting economic vitality, including lower educational attainment, lower per capita income, and higher levels of poverty (see **Table 7-2**).

Table 7-2. WARC Counties' Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2014)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Bibb County	−1.8	14.3	77.5	17,427	7.1	18.1
Fayette County	−2.1	19.0	74.9	18,494	7.6	19.9
Hale County	−3.7	16.9	77.4	18,812	8.9	25.6
Lamar County	−3.3	19.9	6.1	19,026	7.1	18.6
Pickens County	3.1	18.1	79.7	17,153	8.4	27.2
Tuscaloosa County	3.9	11.4	86.6	22,637	6.8	18.9
Alabama	1.4	14.9	83.1	23,680	7.4	18.6
United States	3.3	13.0	86.0	28,155	6.1	21.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Natural resource–based occupations in agriculture and forestry remain mainstays in the more rural counties, while manufacturing trades and services dominate in Tuscaloosa, where Mercedes and Airbus form the nexus of a growing

[87] West Alabama Regional Commission. 2012. "The West Alabama Economic Development District Comprehensive Economic Development Strategy." Accessed at https://www./warc.info/component/rsfiles/download?path=Planning%20Documents/CEDS2012%20Final%203web.pdf on August 1, 2015.

cluster.[88] Within the rural WARC counties, progress has been uneven, as seen in **Table 7-3**.

Table 7-3. Changes in WARC Counties and ARC Economic Status

FY Year	Bibb	Fayette	Hale	Lamar	Pickens	Tuscaloosa
2005	Distressed	Transitional	Distressed	Transitional	Distressed	Transitional
2010	At risk	Transitional	Distressed	Transitional	At risk	Transitional
2016	At risk	Transitional	Distressed	At risk	At risk	Transitional

Source: ARC Data Reports

Project Synopsis

WARC developed regional capacity for more efficient water system operations particularly through ARC's grant support for equipment, software, and personnel in 2005 and 2008. In 2005 WARC partnered with three of its most economically distressed counties—Bibb, Hale, and Pickens—to create highly accurate inventories and maps of rural water features in 15 separate water systems (Phase 1). Phase 1 totaled $150,000 in ARC funding alongside a local match of $40,000. A second phase of funding, in 2008, folded in Fayette and Lamar Counties. Phase 2 brought together local and ARC resources totaling $200,000. All water system–related infrastructure and features were mapped with Trimble GeoXT handheld GPS units, validated on the ground, and uploaded into computers equipped with ArcGIS software. WARC then created highly detailed paper maps and populated a regional database with digital shapefiles specific to each separate water system.

Greene County joined these efforts in 2012 with funding from the Delta Regional Authority. Separately, the water authorities serving Tuscaloosa County and its municipalities elected to map their system independently of WARC.

Site Visit Findings

Accurate and comprehensive information on underground utilities underwrites more efficient and cost-effective operations, disaster recovery, and community development. Region-based planning and development often involves multiple

[88] Western Alabama Regional Commission. 2012. "District II Comprehensive Economic Development Strategy." Accessed at http://warc.info/planning-a-development/documents on August 1, 2015.

service providers, particularly in the case of rural water systems. Poor or missing information can slow service calls and repairs that affect residential homes and businesses alike.

As noted by the WARC team in a recent report on rural water systems mapping, obtaining these critical sources of information and translating that data into GIS functions are complex, time-intensive, and resource-heavy efforts. In particular, this report stresses the complications inherent in GIS utility mapping fieldwork: weather conditions, satellite position, landscape features, and human-made features all affect the accuracy and ease of data collection.[89] Despite such challenges, WARC obtained a fully vetted database that includes the locations of all meters, control valves, system valves, water mains, fire hydrants, pumping stations, tanks, wells, generators, springs, and treatment plants in each of the counties.

As a result of these efforts, planning, development, and customer service departments can regularly use highly accurate information.

Volunteer fire departments use the maps to serve their communities faster and lower insurance rates by optimizing the location of new hydrants.

According to the participants, past water system information was often incomplete, inaccurate, or missing prior to the ARC-supported projects. After these projects, each water department has copies of area maps and shapefiles for use within their offices' GIS systems. As a result of these efforts, planning, development, and customer service departments can regularly use highly accurate information. For example, hazard mitigation plans for the seven WARC counties have been revised, incorporating the updated data. Volunteer fire departments use the maps to serve their communities faster and lower insurance rates by optimizing the location of new hydrants. These resources were also shared with the Alabama Department of Environmental Management and the Alabama Rural Water Association.

Despite this progress, participants explained that the larger goal of consolidated utility planning and management remains unsatisfied for several reasons. At the local level, continued skill development is difficult to access even though WARC offers training to municipal and county personnel in maintaining and using the GIS data. Furthermore, integration of WARC data into

[89] Mayo, Melissa. Western Alabama Regional Commission. "Enhancing Water Department Efficiency Using GIS and GPS to produce quality maps of rural water system features." ArcUser Online Publications. Accessed at http://www.esri.com/news/arcuser/0408/bamah2o.html on August 1, 2015.

a statewide platform by the Alabama Department of Economic and Community Affairs has not occurred.

Lessons Learned

A diverse and highly informed panel convened for this site visit. The attendees included representatives from WARC's Community and Economic Development, Transportation Planning, and GIS Departments. Collectively, they have extensive experience working with distressed communities and with the state and federal agencies that support efforts in those communities, including ARC. In reviewing the development and implementation of these projects and aspects of post-project evaluation, they offered the following insights and suggestions:

- Regional efforts are valuable: The challenges of technology adoption can be mediated by attention to pace and provision of technical support and training of users and adopters targeted within a specific geographic scope.
- Passive resistance can be a limiting force: Technology infrastructure projects are about more than engineering and deployment. Inadequate attention to nontechnical decision makers and public outreach results in problems with project management. As such, widespread education and adoption depend on securing the information needed to ensure the ongoing accuracy of the system itself and translating this information to everyday users and stakeholders.
- Highly qualified team members adapt to multiple roles: Each member of specialized teams in rural settings often plays multiple roles. The WARC team was impressive in the span and depth of their technical knowledge and their understanding of and commitment to the local context in which their efforts are applied. Without an engaged team, the necessary data collection would have faltered, and the ongoing usability of the database would decline.
- Demand for ARC support continues: WARC leaders stated that a "perfect next grant" would support a phased project to map all public utilities in the region. Despite declining population in many of the rural counties, services in these areas are needed and are being extended into previously unserved areas. Representatives from some member counties also noted the demand to expand the mapping database to include layers for gas and sewer systems. One vendor of alternative rural sewer treatment systems requested the

data, demonstrating the value of the information beyond public sector planning.

- Funding partners and implementation partners can learn from each other: WARC was one of ARC's first GIS mapping grants, creating a situation where WARC and ARC learned together. WARC leaders think they would have benefited from access to best practice models that were not yet available.

7.2.2 Marion County Schools Telecommunications

Community Profile

Marion County is located in the northwestern part of Alabama on the Mississippi border. ARC denotes Marion County as a transitional county. Like many Appalachian counties, it underperforms both its state and the nation on key economic and demographic metrics (see **Table 7-4**). Population is declining and the median age is increasing, with nearly 20 percent of the population older than 65 years. Marion also differs significantly from the state in educational attainment metrics: 22 percent of people in Alabama have a college degree compared with only 10 percent in Marion County, mirrored by an 8.5-point gap in high school graduation rates between the state and county.

Table 7-4. Marion County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population ≥ 65 Years**	**Educational Attainment (≥ HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Marion County	−1.6	19.8	74.6	19,576	8.7	20.9
Alabama	1.4	14.9	83.1	23,680	7.4	18.6
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

In 2002, Marion County Schools secured funding from ARC for T1 equipment to connect five high schools to enable distance learning, professional development training for teachers, and dual enrollment for students with Bevill State Community College (BSCC). Repeated efforts over 2 years to get the T1 equipment working were unsuccessful. To correct the issues, BSCC secured ARC funding in 2005. The four main campuses of BSCC and two instructional sites offer college courses and applied technology opportunities to over one-quarter million people in a seven-county area.[90] The grant to BSCC underwrote the costs of deploying 40.7 miles of publicly owned fiber optic line and related equipment to network local schools in Guin, Brilliant, Hamilton, Hackleburg, and Bear Creek. With strong support from leadership of BSCC and the Marion County government, personnel at BSCC assumed responsibility for managing the project. The total amount of the grant was $450,000; $90,000 in local funds and $360,000 in ARC funds. For reasons detailed below, this project closed in 2012 without a successful deployment of the fiber network.

Site Visit Findings

Marion County totals fewer than 2,000 high school students dispersed among five schools, [91] which creates a need to use technology to ensure access to distance learning options and professional development support for the educational workforce. Specifically, participants hoped that a distance learning system dependent on a new fiber network would provide new options for students dually enrolled with BSCC and allow the high school educators to share teaching resources among the schools.

Immediate challenges regarding ownership rights of way for buried fiber and poles for aerial attachment slowed the deployment of the fiber. The county-wide scale of the project alongside the need to involve multiple utility providers and municipalities further complicated the fiber installation. Additional delays resulted when a tornado devastated two

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[90] Bevill State Community College. "History." Accessed at http://www.bscc.edu/about/history.php on August 1, 2015.

[91] Hig-Schools.com. "Alabama High Schools." Accessed at http://high-schools.com/directory/al/#cities-in-state on August 1, 2015.

Marion County towns (Hackleburg and Haleyville).[92] According to participants, concerted efforts to get insurance companies to assist with replacing the destroyed poles and aerial fiber were unsuccessful. The project was closed a year later in September 2012, 7 years after it was initiated.

Educational entities working closely with municipalities and county administrators scaled a significant learning curve related to right-of-way issues, limitations of fiber infrastructure, and the inherent difficulties of advancing technology in a highly rural setting.

Although this grant was terminated without establishing the fiber network, the project had two notable positive outcomes. Two high schools ordered and successfully installed Blackboard Learning Management Systems, allowing students to log into educational materials. Educational entities working closely with municipalities and county administrators scaled a significant learning curve related to right-of-way issues, limitations of fiber infrastructure, and the inherent difficulties of advancing technology in a highly rural setting.

Lessons Learned

The project team found that diligent planning processes both prior to soliciting a grant and immediately after obtaining grant funding are critical to ongoing success. Specifically, former project members offered the following detailed lessons:

- A representative and stable project team is necessary for implementation success: A project team that reflects the diverse interests of stakeholder groups and the technical expertise within the county would enable the next steps required for this scale of fiber installation. Additionally, turnover within the project team delayed important implementation. Therefore, commitment to remain a part of the team until the project is completed must be a priority for future partnership models.
- Contingency planning is crucial: Legal considerations, key personnel turnover, technology glitches, and disasters can hinder long-term, large-scale projects. Best practices include identifying priority success factors within the project and then developing alternatives for addressing problems related to these project elements.
- Structured guidelines help grantees plan effectively: Project planners would benefit from primers, toolkits, and model agreements to guide their interactions with advisors and vendors about technical projects. This is particularly true in fiber deployment planning with

Legal considerations, key personnel turnover, technology glitches, and disasters can hinder long-term, large-scale projects.

[92] National Oceanographic and Atmospheric Administration. 2013. "Historic Tornado April 27, 2011." Accessed at http://www.srh.noaa.gov/bmx/?n=event_04272011Evening World on August 1, 2015.

unique legal issues to telecommunications projects, such as rights of way, access to aerial polls, and buried conduits. Alongside such guidelines, strong documentation of the project provides direction for future efforts and supports post-project evaluation learning.

7.2.3 Whatley Health Services Medical/Dental Equipment

Community Profile

Hale County, located in western Alabama, is part of the Tuscaloosa metropolitan statistical area. Greensboro is the county seat of Hale County and the location of Hale County Health Center (HCHC). Challenges facing the county and Greensboro are significant: with the loss of several major employers, more than 50 percent of residents now work outside the county.[93] Significant declines in population are projected to continue, having dropped more than 10 percent since 2000 to the current level of 15,406.

The county is challenged to attract and retain professional service providers, as evidenced by Hale County having the largest shortfall of primary care physicians in Alabama in 2014.[94] Performance on other key metrics points to additional concern for the county's prospects, as Hale underperforms Alabama and the nation on educational attainment, unemployment, per capita income, and percentage living in poverty (see **Table 7-5**). Other distinguishing community characteristics include large segments of the population that can be described as minority (59 percent African American), disabled (25 percent on disability), and solitary older adults (11 percent of all households are citizens older than 65 years and living alone). Thirty-nine percent of Hale citizens receive Medicaid assistance.[95]

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[93] U.S. Census. American Community Survey. 2009-2013. "Commuting Characteristics." Accessed at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF on August 1, 2015.

[94] Robert Wood Johnson Foundation. 2014. "County Health Rankings and Roadmaps." Accessed at http://www.countyhealthrankings.org/app/alabama/2014/measure/factors/4/map on August 1, 2015.

[95] Alabama Department of Public Health. April 2013. "Selected Health Status Indicators: Hale County." Accessed at http://adph.org/ruralhealth/assets/Hale13.pdf on August 1, 2015.

Table 7-5. Hale County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2014)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014) ***	**Poverty**
Hale County	−3.7	16.9	77.4	18,812	8.1	26.6
Alabama	1.4	14.9	83.1	23,680	6.4	18.6
United States	3.3	13.0	86.0	28,155	6.1	21.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

Whatley Health Services Inc. (WHSI) is a private, nonprofit, federally qualified community health center headquartered in Tuscaloosa. This institution's mission is to provide primary health care services to the medically underserved residents in western Alabama. WHSI began in 1977 as a once-a-week, free clinic and now provides comprehensive medical care through 12 fixed and one mobile facility serving eight counties and two dental facilities. WHSI overall serves more than 26,000 patients annually, including approximately 20 percent of the region's homeless population. WHSI uses Medicare, Medicaid, and fee for service to meet the challenges of providing services on a needs-adjusted sliding fee scale.

ARC funding in 2010 equipped a new satellite facility of WHSI, HCHC in rural and distressed Hale County, with medical and dental equipment and health-information technology. Alongside the medical and dental equipment, computer workstations, scanners, servers, and other technology improvements were introduced at this site to enable electronic medical record keeping, produce specialized reports, and track the necessary treatments for chronic diseases. This updated equipment also ensured that staff followed evidence-based treatment plans. ARC awarded $165,678, 80 percent of the total needed to equip and fully staff the new facility.

Site Visit Findings

WHSI expanded after 2001 when a similar organization terminated its services. The Health Research Service Administration (HRSA) of the U.S. Department of Health and Human Services asked WHSI to expand its services and fill this gap in health care supply to low-income residents. As a result, with HRSA and HCHC funding, WHSI built a full-service permanent facility in 2009. Funding from ARC in 2010 supported the equipment and technology necessary for the center’s operations. This comprehensive medical and dental care facility opened in January 2011 in Greensboro, the county seat and location of the Hale County Hospital.

WHSI is a successful project that enabled the delivery of comprehensive medical and dental services in a severely underserved rural community.

WHSI is a successful project that enabled the delivery of comprehensive medical and dental services in a severely underserved rural community. For example, according to participants, the adoption of electronic dental records was facilitated by ARC-funded training. Although there was an initial loss of productivity as the new system was implemented, doctors and staff recognize the benefits of being able to share records in real -time with colleagues, graph individuals’ health trends, expedite reporting, and empower patients. Other benefits cited for HCHC patients include improved accuracy and security of records and the ability for patients to leave the office with a hard-copy report that details their visit, treatment plan, and instructions.

Telehealth services link WHSI patients and personnel with specialized services, projects, and programs in urban medical centers. This has strengthened the relationship between WHSI and the larger medical research and training community.

ARC funding also enabled redundant connectivity services that link the HCHC to the full WHSI network of 12 locations in eight counties. In a medical context, redundancy ensures continuity of services. Furthermore, telehealth services link WHSI patients and personnel with specialized services, projects, and programs in urban medical centers. This has strengthened the relationship between WHSI and the larger medical research and training community. For example, local AIDS patients receive education and support services remotely through a partnership with the Medical School at the University of Alabama at Birmingham (UAB). The value of the telehealth option for specialist consults is particularly compelling given the demographics of the Center’s low-income patient population. For many of their patients, the lack of personal or public transportation or the ability to pay for it would otherwise prohibit access to major medical services.

Significant progress has been made toward the project's broader goals, but some projected outcomes have required adjustment. Although the number of patients served at the improved dental facilities continues to grow, efforts to recruit an additional part-time dentist have been unsuccessful. Historically, when WHSI had a dental staff vacancy, they recruited a dentist from the UAB Dental School; however, no graduates have committed to positions in the past 3 years. According to WHSI leaders, other recruitment efforts targeting dentists from schools and practices outside of Alabama have been stymied by the lack of reciprocity in licensing between Alabama and other states.

Although WHSI was not successful in adding the part-time dentist, they were able to use funding to strengthen the Center's medical resources. When the new center first opened, it employed a full-time dentist 4 days per week, a part-time nurse practitioner 3 days per week, and an internal medicine practitioner 5 days per week. ARC funding also supported the addition of a full-time family medicine practitioner.

WHSI currently serves 5,000 patients, and 80 percent of patients are seen on multiple occasions. This amounts to approximately one-third of the county's residents.

Participants said delays in medical and dental personnel recruitment are a partial explanation for why WHSI did not meet its original goal to serve 8,300 patients in the first 2 years. WHSI currently serves 5,000 patients, and 80 percent of patients are seen on multiple occasions. This amounts to approximately one-third of the county's residents. WHSI leaders acknowledged their expanded outreach and public awareness campaigns to grow their patient population. For example, to overcome the perception that the Hale Center serves only patients in need of public assistance, WHSI rebranded its image by partnering with Blue Cross and other private insurance providers. They view this effort as clear communication of WHSI's interest in also serving the county's insured population.

The full use of telemedicine continues to be hampered by a plethora of rules, regulations, permitting, licensing, and credentialing requirements that impede WHSI's ability to deliver some services, such as mental health.

The lack of ubiquitous high-speed broadband Internet services limits the full realization of investment in HCHC. WHSI leaders also stated that beyond availability, the full use of telemedicine continues to be hampered by a plethora of rules, regulations, permitting, licensing, and credentialing requirements that impede WHSI's ability to deliver some services, such as mental health. WHSI leaders suggest that ARC might consider offering planning grants to support organizations' development of and advocacy for policies and reforms needed to use telemedicine across applications and geographic boundaries.

Lessons Learned

Insights shared by WHSI leaders can inform future efforts to improve health care access and delivery in rural communities and more specifically inform the use of technology and telehealth. These suggestions include the following:

- Creativity is needed to attract expertise to rural regions: ongoing and multifaceted partnerships with schools and institutions that train the targeted medical, dental, and research personnel are needed to recruit health care professionals to rural locations. For example, WHSI works proactively to increase awareness and interest among prospective providers by partnering with UAB to pilot telehealth research and care programs, providing rural residency opportunities, serving on admission committees for incoming students, participating in Rural Medical Scholars programs, and teaching classes on rural medicine and dentistry.
- Technology is only part of the answer: Technology allowed WSHI to expand its patient care services; however, the center has faced unsuccessful efforts to deliver mental health services. Externally mediated regulations along with burdensome intake and service approval processes not yet adapted to virtual platforms introduce tangible hurdles for WHSI's full realization of the investment's potential impact.

7.2.4 Fannin County Workforce Development

Community Profile

Seasonal tourism and a declining manufacturing industry introduce instability in Fannin County's economy. Currently, Fannin County's two largest manufacturers employ only a total of 121 people.[96] All of Fannin's municipalities are losing population, and the number of residents older than 65 years is double that of the state and the nation. Furthermore, the area underperforms both the state and the nation on metrics of educational attainment, poverty, per capita income, and overall population growth (see **Table 7-6**).

Table 7-6. Fannin County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2014)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Fannin County	0.3	24.6	79.0	19,164	8.1	23.0
Georgia	4.2	12.0	84.7	25,182	6.1	18.2
United States	3.3	13.0	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

The need to diversify and grow opportunities for employment in Fannin County is shared by other Appalachian counties in the region, and workforce training to support a more diversified economy is seen as pivotal to improving the employment prospects of Fannin County residents.[97,98] In 2005, when Fannin received an ARC Workforce Training grant, the area was considered "transitional." In FY 2016, Fannin County has

[96] Northwest Georgia Regional Commission. Community and Economic Development. 2012. "Northwest Georgia Regional Comprehensive Economic Development Strategy." Accessed at http://www.nwgrc.org/wp-content/uploads/2012_NWGRC_CEDS_Draft_revised.pdf on August 1, 2015.

[97] Fannin County Economic Development Authority. 2009 "Partial Update for the 2025 Comprehensive Plan." Accessed at https://www.dca.ga.gov/largefiles/OPQG/2009/FanninCo.BlueRidgeCi.McCaysvilleCi.MorgantonCi.Prtl.pdf on August 1, 2015.

[98] University of North Georgia. 2014. "North Georgia Regional Education and Economic Development Task Force Summary." Accessed at http://www.caes.uga.edu/center/caed/pubs/documents/Fannin_1203.pdf on August 1, 2015.

declined to an "at risk" status.[99] This fall mirrors a trend across the state where 30 of the 37 Georgia counties in the Appalachian Region moved to a more challenged status (see **Table 7-7**).

Table 7-7. Change in Georgia Appalachian County Economic Status 2004–2016

Year	Distressed	At Risk	Transitional	Competitive	Attainment
2004	0	0	29	5	3
2016	3	12	20	2	0

Source: ARC Data Reports

Project Synopsis

Bolstered by the success of previous ARC support to establish broadband Internet service in the Region's underserved communities, the Fannin County Development Authority (FCDA) committed $327,200 to match ARC funding of $263,000 in 2005. The project focused on renovations and equipment for a workforce training facility in a former Levi Strauss manufacturing facility in Blue Ridge, Georgia. An unexpected opportunity to sell this facility to a different company, bringing more than 100 jobs back to the county, necessitated the relocation of the workforce training facility to a new, more remote location. Upon completion of the facility and its opening in 2005, training and business support programs were implemented in collaboration with Appalachian Technical College (ATC), University of Georgia Small Business Consulting, Blue Ridge Mountain Arts Association, and the Fannin Literacy Action Group. Offerings included credit and noncredit courses, small business counseling, business training for arts-based enterprises, and literacy programs.

Upon completion of the facility and its opening in 2005, training and business support programs were implemented in collaboration with Appalachian Technical College (ATC), University of Georgia Small Business Consulting, Blue Ridge Mountain Arts Association, and the Fannin Literacy Action Group.

First-year metrics included 75 enrolled students, resulting in 40 graduate licensed nurse practitioners and 320 hours of consulting for 110 clients. The ARTS association offered two sessions of the Core Four Business Training to 29 participants,

[99] Appalachian Regional Commission. County Economic Status and Distressed Areas in Appalachia. "County Economic Status and Distressed Areas in Appalachia by State, FY 2016." Accessed at http://www.arc.gov/appalachian_region/countyeconomicstatusanddistressedareasinappalachia.asp on August 1, 2015.

and the literacy program served 185 students. This strong start was interrupted by a midstream withdrawal of ATC as a partner. In addition, the remote location of the facility caused issues for many attendees. The project eventually ceased operations as a result. The equipment, software, and computers were transferred to North Georgia Technical College, and the furniture was repurposed for use by FCDA.

Site Visit Findings

As noted in Fannin County's Comprehensive Plan, the role of tourism in their economy is limited, and broader demographic and economic improvements must be achieved through improved educational attainment and diversifying the skill mix through workforce training programs.[100] According to participants, the development of such programs in the old Levi Strauss facility in the most populous section of the county, purchased by FCDA, was a step toward filling the workforce development demands.

Fannin County then transferred much of the software and equipment to the North Georgia Technical College for use in computer, cosmetology, medical, and emergency medical technician training programs. The resources are used for their original purpose, however, not in the originally planned facility.

As a result of the opportunity to sell the Levi Strauss facility, which meant new local jobs, FCDA relocated the planned workforce development training center to a vacant elementary school that had been used as a satellite location for Rinehart College until their operation closed. Unforeseen questions regarding accreditation and an inability to attract enough full-time equivalent students to justify the expense of operations led ATC to withdraw from the program. Fannin County then transferred much of the software and equipment to the North Georgia Technical College for use in computer, cosmetology, medical, and emergency medical technician training programs. The resources are used for their original purpose, however, not in the originally planned facility.

Lessons Learned

Although FCDA fell short of its workforce training program goals, participants nonetheless offer lessons that can benefit other organizations planning to implement similar initiatives:

- A balanced commitment among partners is important: FCDA provided the vision and the initiative to obtain funding but needed long-term

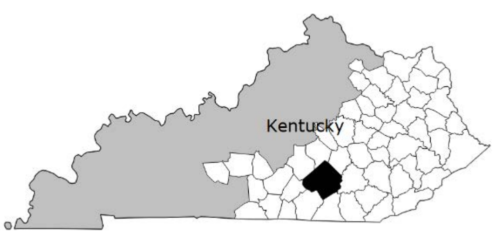
[100] Fannin County Economic Development Authority. 2009 "Partial Update for the 2025 Comprehensive Plan." Accessed at https://www.dca.ga.gov/largefiles/OPQG/2009/FanninCo.BlueRidgeCi.McCaysvilleCi.MorgantonCi.Prtl.pdf on August 1, 2015.

The decision to use an available, old elementary school in a remote location limited potential participation.

partners who were committed to seeing the project past the start-up period.

- Community resources must be well located and accessible to maximize participation: Rural remoteness limited the accessibility of the newly available training resources. The decision to use an available, old elementary school in a remote location limited potential participation.
- Best practices for contingency planning and adaptability would benefit project leaders: Prompted by their experiences with the workforce development center project, FCDA suggested that leaders from all ARC projects could benefit from cross-cutting guidance on how to plan for and adjust to unexpected events that affect priority factors in project implementation.
- Persistence pays off: FCDA and other community leaders have persisted for more than a decade to deliver a permanent workforce training solution to the county. When work to build the multipurpose education facility failed, they proactively petitioned to obtain technical education and training from a different institution, subsequently securing the full-time presence of a satellite campus of the North Georgia Technical College and the state funding needed to operate its local programs.

7.2.5 Kentucky Regional High Growth Training Center



Community Profile

Pulaski County is part of the 10-county, 14-municipality Lake Cumberland Area Development District (LCADD), located in south-central Kentucky. Thirty percent of the population in this district lives in Pulaski County, the third largest in the state. Long dominated by textiles, the local economy is now much more diverse, with emerging tourism ($111 million in 2010) and agriculture sectors.[101] ARC considered Pulaski County "at risk" between FY 2007 and FY 2016. Although the county has lower unemployment than the state average, it has higher poverty and lower per capita income (see **Table 7-8**).

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[101] Lake Cumberland Area Development District. 2013. "Comprehensive Economic Development Strategy 2013." Accessed at http://lcadd.org/manager/index.php?option=com_content&task=view&id=33&Itemid=52 on August 1, 2015.

Table 7-8. Pulaski County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2014)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty Rate**
Pulaski County	1.2	17.2	79.9	20,667	7.6	23.3
Kentucky	1.7	14.4	83.0	23,462	8.5	18.8
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

Local leaders founded the Regional High Growth Training Center as a response to a need for power line workers to install, maintain, and repair electric power and telephone lines and fiber optic cable. Industry projections showed more than 20 percent of linemen eligible for retirement within 2 years. A planning group determined that this was an opportunity to address a pressing industry need, create job opportunities needed in this economically depressed region, and upgrade skills through apprentice-level training.

A diverse group of public and private stakeholders partnered to develop the proposed training center, including Somerset Community College (SCC), South Kentucky Rural Electric Cooperative Corporation (SKRECC), and the Somerset Pulaski County Development Foundation (SPCDF). SPCDF partnered with the Pulaski County Fiscal Court to obtain a Community Development Block Grant (CBDG) of $1,000,000 toward the total construction costs of $2,479,000 for a utilities lineman training center. Other contributions included $500,000 from ARC; $500,000 from the U.S. Economic Development Administration; $50,000 from SKRECC, who obtained an additional $429,000 from the U.S. Department of Agriculture's Rural Economic Development Loan and Grant program; and SPCDF provided the land.

The LCADD coordinated the project, which included public contributions such as infrastructure, water, and highway improvements. SCC leased the training center, developed the curriculum, and coordinated the education training programs. When completed, the facility had 10,000 square feet of office space and 38,000 square feet of training facilities. Classes began in August 2008.

Site Visit Findings

Once local leaders had identified the need for electrical line worker training, partners faced challenges in coordination and funding. The project coordinator regularly brought the partners together for discussion of any problems that arose. Community college representatives developed the training program using best practices from other lineman training programs and a curriculum donated by the American Electric Power Company to the Kentucky Community and Technical College System.

The curriculum is rigorous and competitive. To apply, an applicant must have a high school diploma or a General Educational Development (GED). Classes run for 32 weeks and include industry-standard training in the following tasks: climbing utility poles, hanging wire, operating a truck (bucket and digger type), making service connections, and ensuring workplace safety.

Experienced linemen average $75,000, plus generous benefit packages and overtime, which often amounts to earnings over $100,000 per year.

Upon graduation, the Kentucky Department of Labor provides an apprentice certificate to graduates who qualify to become journey linemen with an average salary of $35,000 and the ability to gain at least 10 percent overtime during the year. In addition, advancement to Journey Lineman 2 is possible during the next few years, taking salaries to nearly $65,000 plus overtime. Experienced linemen average $75,000, plus generous benefit packages and overtime, which often amounts to earnings over $100,000 per year.

After 6 years, 807 individuals have been enrolled in the Center, 591 have completed certification and 502 were employed as linemen as of December 2014.

After 6 years, 807 individuals have been enrolled in the Center, 591 have completed certification and 502 were employed as linemen as of December 2014. The center provides five basic lineman training sessions each year with a potential class size of 25, as well as two advanced lineman training sessions with a typical class size of 9. During the first 2 years, 50 students received training. The program has also been proactive in reaching out to both genders to ensure both men and women benefit from lineman training and subsequent job opportunities.

The program is active and planning to expand. Currently, five people are employed by the center, and the Cumberland Workforce Investment Area recently received grant funding for two new training programs at the center in (1) smart grid installation and operation and (2) energy audit training. This training will help utility companies in Kentucky compete in the growing smart grid and clean technology market and provide the local workforce with high-paying jobs in the future.[102]

Lessons Learned

This project has been successful in coordinating local stakeholders and creating competitive, high-paying jobs for over 500 people in Kentucky.

This project has been successful in coordinating local stakeholders and creating competitive, high-paying jobs for over 500 people in Kentucky. The following factors contributed to the success of this project:

- Matching critical needs with solutions that can deliver: A community needed jobs and had a ready pool of potential students and trainees. The local electric co-op was a strong supporter of the project and was set to benefit by employing skilled graduates. As a result of the program, trainees were prepared for high-paying jobs and addressed a local workforce need.
- Strong partnerships yield strong solutions: Many different parties came together to develop and finance efforts that were in their individual and collective interests. None of the partners expected sole credit for successes.
- Coordination rather than control is critical in multipartner efforts: The coordinator of the development project from the development district office kept

[102]Lake Cumberland Area Development District Board of Directors. 2013. "Comprehensive Economic Development Strategy 2013: Mapping the Progress of the Lake Cumberland Area Economy." Accessed at http://lcadd.org/manager/index2.php?option=com_docman&task=doc_view&gid=135&Itemid=87 on August 1, 2015.

everyone on target. Once launched, the center was managed by the community college that was highly capable of providing the curriculum, training, and oversight of the program.

- Be expansive in targeting beneficiaries: In this industry, lineman jobs are populated predominantly by males, and outreach has targeted that gender. Careful consideration should be given in training programs as to whether there are options for work modifications or use of alternative techniques to expand opportunities to include qualified members of both genders.
- Pragmatic, strategic projects can bring together parties with different needs and address a pressing need in the short term: This model for public–private partnerships can lead to a long-term vision and build collaborative capacity among stakeholders.

7.2.6 Allegany County Public School Smart Board

Community Profile

Allegany County is located in Maryland's northwestern panhandle. When compared with the state of Maryland, it has high unemployment and low median income and is the only county in the state experiencing net population loss.[103] By ARC's measurements, the county has been designated as "transitional" since 2002. The economy is in transition, as the employment focus shifts progressively from its historical base of large-scale manufacturing, mining, and agriculture to small manufacturing, sustainable energy, information technology, and tourism.[104] This economic transition requires an investment in education to prepare workers for skilled jobs. Although educational attainment at the high school level is comparable to state and national averages, the region has a lower rate of college graduates (see **Table 7-9**).

[103] Alleghany County Commission. 2014. "Alleghany County Comprehensive Plan." Accessed at https://www.maryland.gov/PDF/OurWork/CompPlans/Allegany/14_CMP_Draft_Allegany.pdf on August 1, 2015.

[104] Frese, John (ed.). 2006. "Reality Check Plus Participant Guidebook Western MD Section." National Center for Smart Growth Research and Education. Accessed at http://smartgrowth.umd.edu/assets/documents/rcp/western_maryland_guidebook_section.pdf on August 1, 2015.

Table 7-9. Allegany County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty, % 2009–2013**
Alleghany County	−2.1	18.9	87.3	21,211	7.6	17.4
Maryland	2.9	13.4	88.7	36,354	6.1	9.8
United States	2.5	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau; * Bureau of Labor Statistics Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population > 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

To improve classroom instruction at the high school level, the Board of Education (BOE) purchased 200 Smart Boards for 20 classrooms to support instruction in science and technology, beginning with Algebra I. ARC contributed 50 percent of the funding for the $40,000 project, with the remainder coming from the BOE. Lead teachers took approximately 15 hours of training before placing the Smart Boards in classrooms and then trained other teachers. The goal was to see a 20 percent increase in the number of students receiving a passing score on the Maryland State Assessment for Algebra/Data Analysis, with 509 of the 651 students taking Algebra in the Smart Board equipped classrooms. Outcomes available in summer 2010 included the following:

- Classrooms with computer-connected Smart Boards offered access to engaging teaching websites and knowledge outside their classroom. Teachers used them to tailor the educational materials to the needs of the students.
- Using Smart Boards, teachers could face their students rather than the blackboard and were better able to manage their classrooms. Students are engaged by digital presentations and are able to obtain materials for small group or independent work on the topic the teacher has just presented to them.

- Students gained knowledge in using digital tools to communicate and interact with teachers.
- Smart Boards allowed real-time monitoring through multiple choice tests that students click through as material is being presented.

Site Visit Findings

Successful use of classroom technology such as Smart Bards requires school systems to continually upgrade their information networks and training capacity for teachers.

Successful use of classroom technology such as Smart Bards requires school systems to continually upgrade their information networks and training capacity for teachers. Allegany County was an early adopter of the anchor tenant strategy for encouraging broadband Internet deployment, signing on with Allconet, an advanced educational network, when it came online in 1994.[105] The Smart Board project was another step in the long-term, continued use of educational technology in Allegany County, much of which was funded in part through other ARC grants.

Math teachers saw that the interactive Smart Boards drew students into a more engaged learning process.

The BOE's Chief Information Officer worked with the educators in the county to gain the equipment and training capacity to enable the Smart Board equipment to enhance the learning environment of the classroom and the capability of teachers to develop interactive lesson plans for students. He contributed much of the success of the project to the train-the-teacher model, where teachers were encouraged to train colleagues on the new technology. He said that teacher–student engagement while using the Smart Boards led to an increase in student achievement. Math teachers saw that the interactive Smart Boards drew students into a more engaged learning process and the result was an increase in math scores.

Lessons Learned

This project provides a best practice model in the effective deployment of new technology in an educational setting. The success of this model was bolstered by (1) its appropriate use of good research design and evaluation to document impact and (2) its creative use of pilot projects to engage trainers, teachers, and students. Successful expansion of the project documents it as a win-win for all involved and points to the following lessons:

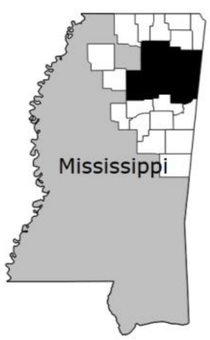
[105] Columbia Telecommunications Corporation. 2012. "Broadband in Alleghany County: Status, Opportunities, and Strategies." Prepared for Alleghany County Public Schools, Board of Education.

This was a phased project in which a major community anchor institution was integral to effecting positive change in its own operation and performance and in the broader community.

- Leadership that is cross-cutting and continuous leads to success: This project was advantaged in having an organized and knowledgeable person at the helm that was involved in managing access, deployment, and adoption for the entirety of the period. This was a phased project in which a major community anchor institution was integral to effecting positive change in its own operation and performance and in the broader community. Having the Chief Information Officer involved on so many levels was important to the effort's success.
- Engaging and empowering adopters is fundamentally important: Teachers were involved in every aspect of this project, acknowledging the critical role they play in adoption of educational technology. Including teachers in testing and selecting electronic boards and other tools, and following a train-the-trainer model built internal champions and mentors who were critical to the success of the project.

7.2.7 Three Rivers Electronic Filing System

Community Profile



Three Rivers Planning and Development District (TRPDD) was established by local government and business leaders in 1972 as a nonprofit organization to promote economic development and short- and long-term planning and provide services for social and economic development in an eight-county region in northeast Mississippi. As needed, activities extend to adjacent counties.

The TRPDD eight-county region contains multiple Appalachian counties designated as "at risk" or "distressed." TRPDD leaders characterize employment historically in the region as low-skill, low-wage manufacturing. Only 77 percent of TRPDD residents are high school graduates, below state and national averages. Reflecting the low wages, per capita income underperforms the national average in all TRPDD counties. The region has a larger population over 65, and some counties have experienced significant population decline over the last 4 years (see **Table 7-10**).

Table 7-10. Three River Planning District Counties' Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per capita Income, $**	**Unemployment (June 2014)**	**Poverty, %**
Calhoun County	−1.5	17.3	68.2	17,034	8.4	23.7
Chickasaw County	−0.4	15.3	72.0	16,677	10.7	25.3
Itawamba County	0.3	17.3	76.7	18,106	8.2	15.7
Lee County	3.1	14.0	82.9	21,799	8.1	22.7
Monroe County	−2.4	17.2	76.7	18,167	10.8	21.6
Pontotoc County	2.7	13.7	76.4	18,576	7.5	14.0
Union County	2.3	15.5	76.1	19,273	6.8	23.5
Mississippi	0.8	13.9	81.5	20,168	8.5	22.7
United States	3.3	13.0	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

Guided by a vision of bringing all member counties fully online, TRPDD secured a $200,000 grant from ARC in 2005 to implement electronic filing throughout its service region. Matched by $844,504, this grant underwrote the acquisition and upfitting of a central data room in Tupelo Mississippi (Lee County) to support a multicounty data management network. In addition, $7,500 was provided to each of the region's three distressed counties help them acquire necessary computer and software components. The remaining 10 Appalachian counties purchased computer equipment and software packages at their own expense.

Site Visit Findings

TRPDD operates a centralized data and network support center in Tupelo, located in a building that was renovated in 2005 with local funds and upfitted with ARC-funded servers and other hardware and software. TRPDD operated as an Internet service provider (ISP) in 2005 and was able to tie other data sites into the central Tupelo location. Through bulk purchases of computers, TRPDD was able to reduce the per-unit price by $300and exert informed quality control on partner counties, some of which lacked IT personnel, servers, or even computers in their courthouses. Initial implementation and operations went well, with the filing application software developed and maintained by a private vendor. A critical challenge arose when the vendor fraudulently hacked counties' records to create problems the vendor would have to solve for a fee. Subsequent legal battles resulted in judgment against the vendor and the dissolution of the vendor's company. Two factors are cited in the successful recovery of the effort: TRPDD had the financial strength that allowed it to persevere in the case. It struck a partnership with Mississippi State University to develop an alternative open source software solution that could be upgraded as needed, which continues to be in use 10 years later.

It struck a partnership with Mississippi State University to develop an alternative open source software solution that could be upgraded as needed, which continues to be in use 10 years later.

The original plan called for the project to enable records in all participating counties to be filed electronically for use by government officials. The value of this was graphically demonstrated during a visit to the archives section of a partner county's courts, where volumes of paper records store information from before digitization in 2000. Staff today report more than 100 information requests each day from lawyers, banks, and real estate agents. Beyond the physical resources required to produce and maintain the records, the county benefits in time saved by automated key word searches featured by digital records. Other benefits are volume purchase of hardware and a common software platform that improved standardization and quality control.

Today, TRPDD's network serves multiple operations in 13 counties, five planning and development districts, and 15 different court systems. Local stakeholders attribute the electronic filing system grant to seeding these developments. TRPDD leaders characterize this project as being highly

Today, TRPDD's network serves multiple operations in 13 counties, five planning and development districts, and 15 different court systems. Local stakeholders attribute the electronic filing system grant to seeding these developments.

successful and critical to longer-term development of e-government in the region.

TRPDD leaders point to the 2005 ARC grant as underwriting e-government capacity in northeastern Mississippi and creating opportunities for significantly improved services and cost savings. They rate ARC a "tremendous partner for improving local government efficiencies."

TRPDD leaders point to the 2005 ARC grant as underwriting e-government capacity in northeastern Mississippi and creating opportunities for significantly improved services and cost savings. They rate ARC a "tremendous partner for improving local government efficiencies," pointing to the following outcomes of efforts initiated in 2005:

- Point-to-point wireless data transmission system connecting four towers in Monroe County is backhauled to the TRPDD network center in Tupelo, allowing annual savings of $50,000.
- Centralization of technical services and quality control, with TRPDD technical staff approving all vendors and supplying technical support for 16 counties, some of which have no IT staff.
- With the advent of cloud platforms, TRPDD has reduced the number of physical servers from 48 to 12 by offering virtual hosting services.
- Operation of a state-of-the-art hybrid cloud at the Tupelo network center supports secure backup of sensitive records, such as Medicaid and child support. The service can be customized to the data needs of the client.
- Fragmented GIS mapping services are available, but plans are underway to centralize and complete GIS offerings for the region.
- Web sites for member counties and municipalities have been developed and maintained in the network by TRPDD. This was supported by a separate ARC grant.
- Technical support is offered for E-911.
- Accounting software and support is provided for counties and municipalities.
- Support and training for a district-owned court management system. An effort to transition to public records access over the Internet is underway; importantly this will provide three levels of tiered access: (1) the public; (2) judges, court staff, and Clerk of Court; and (3) Clerk of Court only. This effort was supported by a separate ARC grant to acquire the additional servers.
- In partnership with the U.S. Economic Development Administration as a funding partner, online tax and car

registration have been made available to residents in the region.

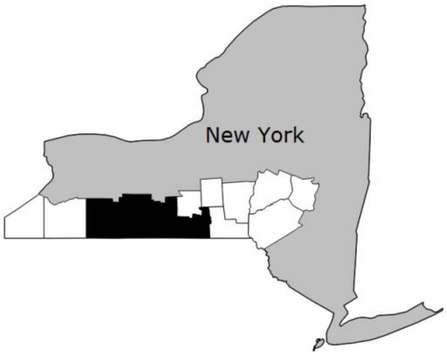
TRPDD operates on the premise that collaboration and partnership are essential to progress. The success of this approach is evidenced by the organization's receipt of a top performer award from the National Association of Development Organizations 12 times, and the long-term director of TRPDD named one of the top economic developers in the nation for 2015. Beyond awards, TRPDD credits its innovative government capacity to its role in applying collaboration, leadership, and vision in the 2007 recruiting coup that brought 2,000 Toyota jobs to Tupelo.

Lessons Learned

TRPDD points to the value of regional planning, open systems solutions, and persistence in pursuit of goals when challenges arise:

- Switching to open-source software gave TRPDD the ability to customize and update it as needed and the capacity to avoid the sort of vendor issues that TRPDD initially experienced. Leaders suggest that ARC should exercise particular care when investing in software to help awardees avoid being trapped in using applications beyond their useful life.
- Citing equipment costs as their biggest concern, TRPDD leaders noted the importance of ARC's flexible approaches to allow grant recipients to modify plans and make necessary changes to encourage project success. The dynamic nature of developments in technology can result in the need for midstream hardware adjustments, so flexibility needs to be an explicit contingency.
- An unacknowledged tension exists between the value of consolidating technical services to expedite technology adoption in a low-capacity setting and the desirability of encouraging greater development of local capacity to manage the integration of technology into operations: While northeastern Mississippi has benefited from the centralization of IT as it relates to major elements of e-government services, smooth operation of the composite network and many of the operations it supports depends on a highly specialized four-person staff.

The dynamic nature of developments in technology can result in the need for midstream hardware adjustments, so flexibility needs to be an explicit contingency.



7.2.8 Schuyler-Chemung-Tioga Board of Cooperative Educational Services (BOCES) Educational Opportunities Network (EON)

Community Profile

Schuyler, Chemung, and Tioga Counties are located in southwestern New York and contain 21 school districts that collaborate through a BOCES. A total of 37 BOCES share educational resources in rural areas of New York. All three counties have high school graduation rates above the state average, and the region has relatively low unemployment and poverty rates (see **Table 7-11**).

Table 7-11. Chemung-Schuyler-Tioga Counties' Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	Population Growth (2010–2013)	Population > 65 Years	Educational Attainment (> HS Graduates)	Per Capita Income, $	Unemployment (June 2014)	Poverty, %
Chemung County	−1.2	16.7	88.8	25,329	6.1	15.7
Schuyler County	0.7	18.6	89.1	24,173	6.1	11.5
Tioga County	−2.5	17.4	90.9	27,230	5.8	9.3
New York	1.6	14.4	85.2	32,382	6.2	15.3
United States	3.3	13.0	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

Twenty-one school districts located in Southern New York comprise Greater Southern Tier BOCES, a regional educational cooperative operating in Schuyler, Chemung, Tioga, Steuben, and Allegany Counties. In cooperation with local partners including surrounding school districts, the BOCES received two grants from ARC. The first grant in 2007 underwrote personnel and telecommunications line service costs associated with the provision of Internet2 services for county school systems: Internet2 is a fiber optic network designed for research and education. The network expanded service to 35,000 students in 21 school districts and allowed for the implementation of course-specific programming. ARC funded $149,732.00 of the effort, and local partners funded $156,830.

The second ARC grant of $50,000 in 2009 developed and delivered distance learning programs for both teachers and students using the fiber optic network. This grant was matched by $79,000 from local partners. The grantee and its partners worked with schools, teachers, and individuals and with the New York State Education Research Network (NYSER NET) to develop a cost-sharing model to reduce expenses and expand programs for schools.

Site Visit Findings

Schools were able to offer specialized language classes, including Spanish, Mandarin, and American Sign Language. One student from Watkins Glen High School learned sign language and went on to the Rochester Technical Institute for the Deaf to become an interpreter.

The economic challenges confronting the region are visible in the school systems, which lack personnel and resources to seek additional funds to update video and distance learning equipment. Resources obtained with the ARC grant addressed these shortcomings by enabling students from districts of all sizes to participate in the distance learning program. Schools were able to offer specialized language classes, including Spanish, Mandarin, and American Sign Language. One student from Watkins Glen High School learned sign language and went on to the Rochester Technical Institute for the Deaf to become an interpreter. The distance learning program also enabled students to access classes they would need to meet college entrance requirements.

Class-to-class collaboration and collaborative meetings through telecommunications technology allowed students and teachers access to resources at multiple schools, giving the project a regional impact.

Local stakeholders explained that there was a strong sense of community support for the grant given its educational focus and because it addressed a general lack of innovative educational activities in the region. Class-to-class collaboration and collaborative meetings through telecommunications technology allowed students and teachers access to resources at multiple schools, giving the project a regional impact. Staff emphasized that ARC funds were important to the successful implementation and promotion of the project across the region.

Lessons Learned

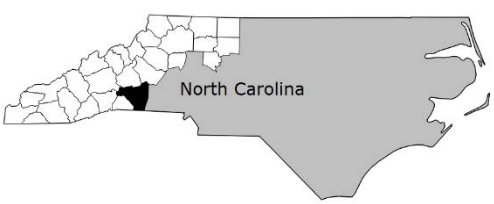
Insights and lessons learned from this grant include the following:

- A regional approach makes broadband Internet deployment more cost-effective: Building on a model of regional cooperation, Greater Southern Tier BOCES was able to leverage resources and achieve sufficient scale to deliver critical virtual services and courses to students and schools that otherwise could not have obtained them. Schools were eager to participate because they were not required to pay for service or the initial equipment. Regional cooperation also helps ensure that assets like data centers have higher utilization rates and less idle time.

- Technology adoption benefits from proactive outreach and promotion: This ARC grant was particularly helpful in creating awareness across the region of specialized virtual courses. For example, video conferencing supports science classes that are not available within the Southern Tier region of New York.
- Schools in low-wealth communities need to be vigilant and proactive to leverage needed assistance: Greater Southern Tier BOCES used multiple funding sources to develop its virtual education network and programs. Armed with more timely and comprehensive information on available assistance, communities can be more competitive for federal resources and able to leverage opportunities.

7.2.9 Rutherford County Broadband Internet Expansion

Community Profile



Rutherford County is located in southwestern North Carolina on the South Carolina border. Rutherford County is economically diverse: scenic Lake Lure and Chimney Rock recreational areas in the west are strong magnets for tourism and retirement communities; agriculture dominates in the northeast; and the central and southeastern parts are more industrialized, although the mix of industry here has experienced changes over the past decade. Manufacturing employment is half of what it was in 2000, declining from 28.6 percent of the workforce to 14 percent today. Layoffs and permanent job losses between 2003 and 2012 totaled 4,200, and now 24 percent of the workforce is employed outside of the county.[106,107]

Slightly older and less diverse, Rutherford deviates from the state profile in terms of economic performance (see **Table 7-12)**. In figures released in June 2015, Rutherford had the ninth highest unemployment rate among North Carolina's 100 counties. This downturn in employment is mirrored in Rutherford County's ARC economic status designation. The county moved from "at risk" at the beginning and end of the broadband Internet expansion project to "distressed" in the most recent assessment.

Table 7-12. Rutherford County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty, %**
Rutherford County	−1.8	19.0	81.6	19,551	8.9	21.5
North Carolina	4.3	14.3	84.9	25,284	6.4	17.5
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Rutherford County is proactively working to make the transition from a manufacturing-dependent economy, traditionally textiles, to an information-enabled economy. According to regional leaders, Rutherford County is working collaboratively with neighboring Polk County through e-Polk, a nonprofit

[106] Center for Regional Competitiveness. 2012. "A Comprehensive Economic Development Strategy for the Isothermal Planning Region." Accessed at http://clevelandcc.edu/uploads/information/planning/CEDS.pdf on August 1, 2015.

[107] Rutherford County Economic Development Strategic Plan. 2013. Accessed at http://rutherfordncedc.com/assets/files/Strategic%20Plan/Econ%20Dev%20Strategic%20Plan%20final%20corrected%206-21-13%20(2).pdf on August 1, 2015.

created to address the lack of adequate broadband Internet services in the area, Rutherford County has made information technology infrastructure a linchpin of its economic development strategy.

Project Synopsis

In 2007, Rutherford County provided $76,680 to match an ARC grant of $178,920 to augment an existing multiphase fiber network project to enhance broadband Internet availability to schools and public safety centers. The Golden LEAF Foundation provided the bulk of the funds for the existing network, while ARC funds successfully piggybacked on the fiber network to establish the wireless redundancy that is required for secure public safety applications. A wireless network of equipment including towers, switches, routers, antennas, and other electronic equipment was deployed, with the primary benefit going to supporting emergency 911 responders, police, and fire fighters. Wireless transmitters connecting through nine new towers provided faster, secure, and redundant first responder communications, including improved connections with state and federal agencies and extension of service to isolated areas. When completed in 2009, this project increased the number of wireless access points to include all 17 fire departments in Rutherford County. This network supports transmission of GIS information for emergency service calls and creates a platform for future builds for traffic monitoring and surveillance of high-crime areas.

Site Visit Findings

The ARC-funded wireless network project was executed on time and under budget; it was fully deployed and active in June 2009. The ARC-funded network successfully piggybacked on existing fiber optic networks to improve communications for public safety. This project was also an important piece of a larger two-county planning and deployment effort to enhance Internet connectivity in the region.

The ARC-funded network successfully piggybacked on existing fiber optic networks to improve communications for public safety. This project was also an important piece of a larger two-county planning and deployment effort to enhance Internet connectivity in the region.

The story behind this network is one of strategic vision, regional collaboration, and transformation. Seeded by planning grants from North Carolina’s Rural Internet Access Authority (subsequently renamed the e-NC Authority), Rutherford and Polk Counties developed strategic e-community action plans that galvanized grassroots efforts to improve broadband Internet access and utilization. Follow-on support from the e-

NC Authority helped both counties implement the plan to create a local nonprofit, e-Polk that was charged with delivering "affordable, reliable connectivity and services for our region" with the goal to … "enhance economic development, improve the quality of life, and create a broad platform of innovation enabling underserved areas."[108] The plan also called for the creation of Foothills Connect Business and Technology Center to "encourage, develop and support entrepreneurship through the provision of broadband technology."[109]

The region's efforts in developing and using broadband Internet platforms evolved in 2007 when Foothills Connect Business and Technology Center secured a $1.44 million grant from Golden LEAF Foundation. With this, Foothills Connect was able to complete an existing fiber network to county schools and fire departments to create and emergency services fiber network. The net effect added 38 miles of fiber to public networks in Rutherford County that connected 17 fire departments and 2 emergency medical services (EMS) stations.

Within this greater context of broadband Internet investment in the region, funding from ARC complemented the EMS fiber buildout by providing resources for a secure wireless EMS network over the county's fiber. Together the grants provide the fiber and wireless capacity needed for secure and redundant communications in the county.

The wireless network funded by ARC was pivotal to optimizing the value of the fiber buildout by providing the redundant wireless infrastructure needed by community anchor institutions, especially for public safety.

All public safety traffic on this network communicates on secure radio frequency channels that are dedicated to emergency services; the system also supports lower frequency channels for communications of other community anchor institutions. The EMS now communicates more efficiently throughout the rural areas of the county, and the 911 center now tracks all emergency response vehicles for both safety and public responsiveness. The EMS network positions the county to be responsive to requirements and opportunities that may arise as the NTIA's FirstNet initiative develops.

The wireless network funded by ARC was pivotal to optimizing the value of the fiber buildout by providing the redundant wireless infrastructure needed by community anchor

[108] PANGAEA. No date. "Mission." Accessed at http://www.e-polk.org/mission/ on August 1, 2015.
[109] Foothills Connect Business and Technology Center. No date. Accessed at http://www.foothillsconnect.com/ on August 1, 2015.

institutions, especially for public safety. It also is vital to creating viable options for last-mile buildout to underserved areas and to supporting business recruitment, workforce training, and educational initiatives that depend on competitive broadband Internet access. As a former county IT Director stated, "Next time you are driving down the road and look up to see all of those wires hanging from pole-to-pole, just remember, those cables are changing the way our county lives and it does mean progress."

"Next time you are driving down the road and look up to see all of those wires hanging from pole-to-pole, just remember, those cables are changing the way our county lives and it does mean progress."

Former Rutherford county IT Director

Lessons Learned

Through forward-focused leadership, Rutherford County is transforming itself into a self-described "place where the world connects." This still-unfolding story offers many insights for communities confronting challenging economic conditions.

- Leveraging and extending existing infrastructure can be an efficient means of providing faster, more reliable communications capabilities to the public sector: Counties that want to be successful in moving the needle on their economic dashboard have to be involved in advancing telecommunications in a way that builds on existing infrastructure. This grant leveraged ARC funding to take an existing fiber optic network to the next level of functionality for public safety purposes.
- Effective collaboration enables the realization of a shared vision: Threats facing the county were politically agnostic, and everyone was affected by the limited economic prospects of the county. Collaborative leaders worked together on planning committees and commissions to solve their connectivity problems and work toward a shared vison.
- Grassroots involvement is essential to enhanced regional broadband Internet connectivity: Rutherford and its partner Polk County could not have bootstrapped the development of their network without active grassroots support. Inclusiveness was a mandate for early e-community planning meetings that sought to raise awareness of the need for broadband Internet and gather citizen input as part of the planning process.

Inclusiveness was a mandate for early e-community planning meetings that sought to raise awareness of the need for broadband Internet and gather citizen input as part of the planning process.

7.2.10 Youngstown Ohio Works and Riverbend Industrial Park Broadband Internet Access

Community Profile

Youngstown is Ohio's ninth largest city with a population of 565,773, down 60 percent since 1960[110] with the collapse of the industrial economy. Serious challenges persist in Youngstown and the wider region where poverty rates are more than double state and national averages and per capita income is just over half of the national average (see **Table 7-13**).

Table 7-13. Mahoning County/City of Youngstown, Ohio, Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Mahoning County	−2.7	15.8	80.4	14,876	7.1	36.4
Ohio	0.3	14.1	88.5	26,046	5.9	15.8
United States	2.5	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Despite the indicators of economic underperformance, Youngstown, Ohio, has come a long way from the devastation caused by the collapse of the steel industry and deindustrialization of the Rust Belt. New highly innovated initiatives, such as the siting of the pilot institute for a national advanced manufacturing initiative in Youngstown, are helping build momentum for revitalizing the economy.[111] The expanding Youngstown Business Incubator, in the heart of downtown, was ranked as the number one university-associated business

[110] U.S. Census. State and County QuickFacts. "Population." Accessed at http://quickfacts.census.gov/qfd/states/39/3988000.html on August 1, 2015.

[111] Johnson, Dave. August 23, 2012. "Ohio 3-D Printing Manufacturing Hub Initiative." Our Future. Accessed at https://ourfuture.org/20120823/ohio-3d-printing-manufacturing-hub-initiative on August 1, 2015.

incubator in the world by the Swedish University Business Incubator Index.[112] The city aims to build on these initiatives to diversify its economy to renew its economic base.

Project Synopsis

In 2010, ARC awarded $91,318 to the City Government of Youngstown Ohio with an equivalent match of local funds to upgrade broadband Internet connections to two industrial parks. Businesses located in these parks complained of insufficient bandwidth for their operations. At the time of the grant request, 32 businesses were located in the two industrial parks. Leaders we spoke with were concerned that without the addition of gigabyte fiber access in the business parks, Youngstown would lose many of the existing 735 jobs located in the park.

Interviewees noted that the project helped retain the 735 jobs that were in the park because gigabit fiber was essential to the operations of these businesses. In addition, interviewees reported that other businesses were interested in coming into the park to operate because of the presence of gigabit fiber and that 105 jobs had been created.

Site Visit Findings

The site visit interview was conducted with the Director of the Department of Community Planning and Economic Development and the Chief Executive Officer of the company that had assisted in the planning and deployment of the fiber network. According to these local leaders, companies that existed within the park had the opportunity to switch to the fiber network being built with grant funds when their current ISP contracts ended. Interviewees noted that the project helped retain the 735 jobs that were in the park because gigabit fiber was essential to the operations of these businesses. In addition, interviewees reported that other businesses were interested in coming into the park to operate because of the presence of gigabit fiber and that 105 jobs had been created.

Lessons Learned

The Riverbend Industrial Park Broadband Access grant was well planned and coordinated. It resulted from the collaborative process that involved all parties involved in the project. Lessons learned from this case include:

- Good planning is essential to successful broadband Internet infrastructure deployment: The site visit made clear that appropriate planning was at the heart of this

[112] First Energy. 2015. "Youngstown Business Incubator Earns Recognition." Accessed at https://www.firstenergycorp.com/content/fecorp/economicdevelopment/resource_room/features/YBI-earns-recognition.html on August 1, 2015.

project's success. The company that managed the project for the city was knowledgeable in discussing the buildout and also had the knowledge of the telecommunications industry needed to plan for deployment and the subsequent start-up connections with businesses.

- Coordination and cooperation are critical to avoiding delays when multiple partners are involved: Many factors can delay fiber deployment, such as city equipment procurement processes and the construction necessary to house the fiber system electronics. The fiber deployment at the Riverbend Industrial Park, however, was facilitated by cooperation between city authorities and an established company during the deployment of fiber. Fiber in Youngstown was mostly aerial, and some fiber had to be run through conduits under the river close to the business park. Because of effective coordination, the city and its contractors worked efficiently to complete each step of the deployment process.

7.2.11 SEDA Council of Governments (COG) Promoting Technology Adoption for Progress (PTAP)

Community Profile

SEDA-COG serves 11 central Pennsylvania counties. Sparsely populated but with great land mass, the region is home to more than 9,000 farms and rich in natural resources including timber, minerals, and energy.[113] The counties that comprise the SEDA region vary widely in their demographic and economic profiles (see **Table 7-14**). The region is also home to Penn State University and a major regional medical complex.

The region's economic landscape is changing. Since the recession began in 2008, manufacturing fell from 23 percent of employment in 2004 to 16.5 percent in 2015. The highest percentage of jobs are in the health sector (20 percent), followed by manufacturing and retail (15 percent) and food and accommodations (11 percent).[114]

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[113] SEDA Council of Governments. 2015. "SEDA-COG At a Glance." Accessed at http://www.seda-cog.org/PDF%20Library/At%20a%20Glance.pdf on August 1, 2015.

[114] SEDA-Council of Governments. June 2015. "Comprehensive Economic Development Strategy Five Year Update." Accessed at http://www.seda-cog.org/SiteCollectionDocuments/5-Year%202015%20CEDS%20FINAL.pdf on August 1, 2015.

Table 7-14. SEDA-COG County Democratic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Centre County	3.1	12.3	92.7	25,545	4.7	20.5
Clinton County	1.3	17	86.2	21,875	7.5	16.1
Columbia County	−0.3	17	88.0	23,681	6.4	16.6
Juniata County	0.6	19.5	82.9	21,268	5.5	11.8
Lycoming County	0.3	17.2	87.6	22,987	6.1	14.2
Mifflin County	−0.3	20.0	81.5	20,794	6.4	15.3
Montour County	2.0	19.4	89.5	29,600	4.9	10.0
North-Cumberland County	−0.6	19.4	85.3	22,478	6.5	14.2
Perry County	−0.7	15.3	86.7	26,046	5.4	9.7
Snyder County	1.6	16.5	82.6	23,088	5.4	11.9
Union County	−0.2	15.8	84.7	22,259	5.4	12.3
Pennsylvania	0.7	16.4	88.7	28,502	5.7	13.3
United States	2.5	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

The region's population is also aging. The population of people over 65 years of age is 11.8 percent higher than the state of Pennsylvania. Broadband Internet technology that is sufficient for living, taking care of personal business, and monitoring health at home via telehealth will be an asset in addressing needs of the aging population in the region.

Project Synopsis

In 2003, Pennsylvania lacked a coordinated strategy for broadband Internet development and adoption, leaving regions to address inadequate access to broadband Internet on their own. As indicated by SEDA staff, this was seen as a major impediment to their economic, educational, and cultural future.

In 2003, Pennsylvania lacked a coordinated strategy for broadband Internet development and adoption, leaving regions to address inadequate access to broadband Internet on their own. As indicated by SEDA staff, this was seen as a major impediment to their economic, educational, and cultural future. SEDA staff also noted that citizens and businesses in their region did not understand the technological requirements needed to support broadband Internet development or the importance of broadband Internet for the area's long-term growth and sustainability.

In 2004, ARC funded SEDA to develop a technical assistance team to help regional businesses and organizations learn about broadband Internet adoption. The ARC grant underwrote travel, equipment acquisition, supplies, contracts, and other services and provided some compensation assistance for project personnel. The grant enabled five additional staff to provide technical assistance to businesses and organizations throughout the region.

Site Visit Findings

Interviewees stated that prior to the grant, an assessment of local businesses showed that small companies in the region were not planning for technology changes such as website development. Programs implemented through this grant provided training that improved the web presence of businesses in the region.

In addition to developing a web presence for businesses and organizations in the region, the grant allowed these counties to begin to interact with citizens, businesses, and other institutions that were now using the Internet.

With support from the ARC grant, technical assistance teams helped regional businesses and organizations learn about broadband Internet and website development. Students from area universities were recruited to work alongside SEDA staff to build websites for businesses and government organizations in the region. Students also assisted SEDA in Internet skills development programs for citizens and businesses in central Pennsylvania. To address the need for cost-effective web hosting, SEDA initiated a web hosting service that is still in operation today.

In addition to developing a web presence for businesses and organizations in the region, the grant allowed these counties to begin to interact with citizens, businesses, and other institutions that were now using the Internet.

SEDA heavily engaged students in this work to thwart concerns resulting from a survey indicating young people planned to leave the region to find employment. SEDA incorporated students in broadband Internet outreach efforts as a means to encourage them to become invested in the local community and aware of potential opportunities.

SEDA obtained two grants from ARC: the first spanned 2004 to 2006 and the second from 2005 to 2007. Matching funds for the program provided by SEDA were split between cash and in-kind contributions. Unfortunately, shortly after the second grant's close, the economy began to worsen and funding for many SEDA programs dwindled, resulting in the reduction of technical assistance staff. Despite these funding challenges, SEDA continues to host the websites initiated by the ARC grant. Interviewees are uncertain if these services can continue into the future. It is notable, however, that the 2015 SEDA Comprehensive Economic Development Report lists broadband Internet as a continuing major goal.[115]

Lessons Learned

These projects have enabled its leaders to gain knowledge and insight into digital deployment, literacy, and adoption and use and its impact on economic issues. The site visit discussions with the SEDA-COG team elicited the following lessons:

- Public–private partnerships are effective in advancing technology adoption: Public–private partnerships can be effective in advancing the adoption and application of broadband Internet in rural areas. This grant demonstrated how a regional council of government working closely with universities, businesses, and other organizations was able to increase the use of broadband Internet in the community through website development.
- Technical assistance elevates the ability to improve broadband Internet access and utilization: Most local regions still do not have the bandwidth that the FCC now determines is sufficient for living, working, running a business, and learning in today's world—25 Mbps down and 3 Mbps up.[116] This grant was a successful example of how targeted broadband Internet technical assistance

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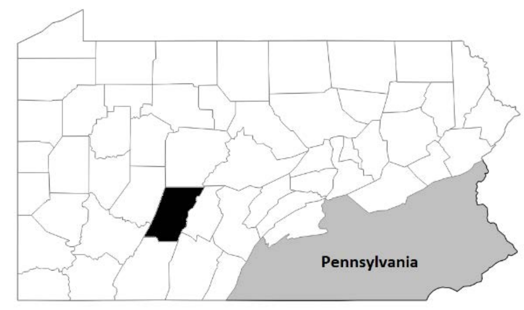
[115] Ibid.

[116] Federal Communications Commission. 2015. "FCC Finds U.S. Broadband Deployment Not Keeping Pace." Accessed at https://apps.fcc.gov/edocs_public/attachmatch/DOC-331760A1.pdf

can be provided through regional institutions to enhance digital literacy based on the specific needs of the community.

- Community needs evolve over time: At the time of the grant, local business and organizations needed help understanding the benefits of broadband Internet and website development. As the socioeconomic characteristics of the region change with time, the region can reassess how to best leverage broadband Internet to meet new needs.

7.2.12 Cambria Connected



Community Profile

Cambria County is part of the six-county Southern Alleghany Region in south central Pennsylvania. Cambria has worked to diversify an economy that remains challenged by out-migration,[117] a growing share of the population over the age of 65, and high unemployment (see **Table 7-15**).

Table 7-15. Cambria County Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Cambria County	−4.1	19.7	88.9	22,659	7.1	14.9
Pennsylvania	4.2	16.4	88.7	28,502	5.8	13.4
United States	2.5	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population > 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

[117] Pennsylvania State Data Center. 2013 "Research Brief." Accessed at https://pasdc.hbg.psu.edu/sdc/pasdc_files/researchbriefs/2012_County_Estimates_RB.pdf on August 1, 2015.

Project Synopsis

In 2008, Cambria County received a grant of $225,000 from ARC with a local match of $267,180 to underwrite the acquisition of WiMAX and Wi-Fi wireless equipment. The wireless project was part of Cambria Connected, a much larger county-wide high-speed broadband Internet infrastructure effort with total costs of $9.5 million and funded by multiple sources. ARC's investment amounted to 2.4 percent of the total cost of the Cambria Connected project. Although ARC provided a small portion of the total funding, a local leader noted that ARC was an important partner in the larger project.

According to local press releases, the Cambria Connected network "would deliver services including land mobile radio with simulcast backhaul, automatic meter reading, business and residential broadband Internet, video surveillance, high speed mobility, SCADA, metro-LAN services and community Wi-Fi. It would support a public safety network with enhanced voice communications and be the first network in Pennsylvania capable of supporting high-speed mobile data applications, including live streaming video and computer-aided dispatch."[118] The network was designed to benefit the economic, cultural, and educational development of the Cambria County community. Data from ARC records indicate that 711 businesses were projected to benefit, as well as more than 5,500 other participants.[119] Inconsistent reports make it difficult to confirm whether the network met its numerical numbers for service to citizens and businesses.

Site Visit Findings

The City of Johnstown and all of Cambria County had decided to develop a $9.5 million network to provide connectivity to the Internet through a county-wide area network to serve residential and commercial customers as well as provide support for police and fire rescue services, E-911, government, and educational institutions and libraries. Applications such as distance learning and telemedicine would be available to network subscribers. Cambria County modeled the network

[118]Business Wire. April 2013. "Cambria Connected Project Overview." Accessed at http://www.businesswire.com/news/home/20070508006454/en/Cambria-Connected-Project-Overview#.VglYwvlVhHw on August 1, 2015.

[119] ARC Grant Database (ARC.net)

after Allconet, a wireless Internet network developed for Alleghany County, Maryland.[120]

Once completed, Cambria Connected won awards in 2009 from the American Public Safety Communications Officers, the Pennsylvania Economic Development Council, and the State of Pennsylvania Governor's Award for Local Government Excellence.[121] According to the Director of the Cambria Emergency Services at the time, the system was constructed under budget. Interviewees claim that broadband Internet service rates were cut by about one-fourth for the local college compared with their previous rates. The network appears to have been directly responsible for expansion of at least one small business start-up, the In the Styx Internet business. In the Styx was able to gain bulk pricing from Cambria Connected, enabling them to cut their cost of business substantially and offer lower prices to their customers. Furthermore, Digital Razor, a business from another state, came in and offered lower rates for data storage.[122]

Interviewees claim that broadband Internet service rates were cut by about one-fourth for the local college compared with their previous rates. The network appears to have been directly responsible for expansion of at least one small business start-up, the In the Styx Internet business.

By most measures, the interviewees considered the project a success.[123] Unfortunately, the project became tangled up in discussions about whether a county government should own its own Internet network and offer services beyond the boundary of municipal and county government. After the 2012 elections, new county commissioners decided to phase out the expanded service of Cambria Connected, leading ultimately to the restriction of the network to just the government sector. Services to citizens and businesses ceased.

After a short period of time to allow residents and businesses to transition to another Internet network, Cambria Connected became a network connecting only fire, emergency services,

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120 Allconet. No date. Homepage. Accessed at www.allconet.org on August 1, 2015.

121 Zoominfo. "Mr. Brian P. Feist." Accessed at www.zoominfo.com/p/Brian-Feist/901771878 on August 1, 2015.

122 Goldman, Alex. June 2008. "Two ISPs on Cambria Connected: In The Stix and Digital Razor." Wi-Fi Planet. Accessed at http://www.wi-fiplanet.com/columns/article.php/3753881/ on August 1, 2015.

123 GovTech.com. 2008. "Cambria County, PA, Multi-Use Wireless Network Goes Live." Accessed at http://www.govtech.com/public-safety/Cambria-County-Pa-Multi-Use.html on August 1, 2015.

police services, first responders, and other typical county government services by 2013.

Interviews with personnel from the Information Technology group of Cambria County government shared that the network for government services is currently operating on the wireless network, known as Cambria Connected, but discussions are underway about the possibility of purchasing fiber-based Internet services that can provide scalability, reliability, and lower cost of operations.

Discussions with project principals and county officials revealed that the project had the following lasting benefits:

- Cambria County citizens, businesses, and governments collaborated to fund, develop, and successfully deploy a county-wide broadband Internet network to serve citizens, businesses, nonprofit organizations, and government operations.
- Six years of operations of a new communications network provided a profound learning experience for government employees and elected officials. They learned how to bill for service, maintain the network, and transpose the network operation from serving the entire community to a reduced footprint that only serves government operations.

Lessons Learned

Cambria Connected was envisioned and successfully implemented as a county-wide network offering service to all public and private members of the community. That the network now operates in a much-restricted government zone does not negate the real benefits the project imparted to Cambria County or the lessons learned from the experience, such as the following:

The Cambria Connected project gave the county the opportunity to learn to operate within an Internet-driven society and began the conversation with their citizens and businesses, as well as their government operations, about what these shifts might mean for them.

- ARC seed funding can initiate critical learning curves. The Cambria Connected project gave the county the opportunity to learn to operate within an Internet-driven society and began the conversation with their citizens and businesses, as well as their government operations, about what these shifts might mean for them.
- County information technology personnel learned to effectively transition the nongovernmental portion of the network off their network: The change to reduce the network’s use required staff to work with all commercial and nonprofit providers and resulted in an unanticipated

lesson learned that gave staff technical and professional skills from the experience of downsizing.

- Local government can be a lead provider for broadband Internet infrastructure: Organizations that provide funding for broadband Internet infrastructure projects can learn much from studying innovative start-ups and public–private partnerships created by local governments to bring the required broadband Internet services to their regions. Cambria Connected's experience provides useful insights to guide planning actions for local governments that wish to deploy their own broadband Internet networks.

7.2.13 Tri-County Telecommunications Master Planning Initiative and Tri-County Technology College Technology Infrastructure: Pendleton Campus

Community Profile

Six counties comprise western SC Appalachian Council of Governments (ACOG)—Anderson, Cherokee, Greenville, Oconee, Pickens, and Spartanburg.[124] United by geography and the dominance of the textile industry in the past, the region has diversified. Greenville and Spartanburg Counties became more urban and their manufacturing profile became more mechanical, with a focus in the automotive, aviation, and plastics sectors. Other counties in the region remain a mix of rural and urban, with tourism a dominant sector in parts of all counties.[125] Strong collaborative regional planning capacity, housed in SC ACOG and other organizations, serves as a foundation for cooperation. A cooperative local culture helps communities better respond to emergent opportunities, a factor cited in an earlier ARC examination of factors contributing to successful economic diversification.[126]

These counties are also well served by Clemson University (CU), located in Anderson County. This region can leverage the

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[124] SC Appalachian Council of Governments. No date. Accessed at http://www.scacog.org/ on August 1, 2015.

[125] SC Appalachian Council of Governments. 2014. "CED Update 2-14: An Outstanding Year for Target Industry and Global Competitiveness." Accessed at http://www.scacog.org/Portals/9/2014%20SCACOG%20CEDS%20UPDATE.pdf on August 1, 2015.

[126] Appalachian Regional Commissions. December 2014. *Economic Diversity in Appalachia: Case Studies in Economic Development*. Accessed at http://www.arc.gov/assets/research_reports/EconomicDiversityinAppalachiaCompilationofAllReports.pdf on July 31, 2015.

presence of CU to better provide education and workforce training using high-speed broadband Internet. For example, in 2011, CU created the Center for Workforce Development to provide virtual and distance learning to create a skilled workforce for the region's burgeoning automotive and aviation industries.[127,128]

Sharing low costs and an advantageous location midway between Atlanta and Charlotte and well served by road, rail, and air transportation, SC ACOG counties have seen economic progress over the past two decades. [129] And, although the three counties (Anderson, Oconee, Pickens) that were served by the evaluated grants still underperform the state and region on key economic and demographic indicators (see **Table 7-16**), the differences are smaller than many of the other case study profiles in this section.

Project Synopsis

This project comprised two grants. The first grant funded a master plan that was followed by a second grant to fund equipment for the Tri-County Technical College to enhance education and training. We describe both.

[127] Clemson University College of Engineering and Science. 2011. "Request to SC Commission on Higher Education for Creation of New Center on Workforce Development." Accessed at http://www.che.sc.gov/che_docs/academicaffairs/acap/acap-01-19-2012/2k.pdf on August 1, 2015.

[128] Clemson University Center for Workforce Development. Accessed at http://www.clemson.edu/centers-institutes/cucwd on August 1, 2015.

[129] Upstate Alliance. Accessed at http://www.upstatealliance.com/about-upstate/upstate-sc-overview on August 1, 2015.

Table 7-16. Anderson, Oconee, and Pickens Counties' Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Anderson County	3.0	16.7	81.7	22,081	6.3	16.8
Oconee County	1.2	21.0	83.1	23,904	6.8	19.1
Pickens County	1.0	14.9	82.2	21,182	6.7	18.9
South Carolina	4.5	15.2	84.5	23,943	6.3	18.1
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Tri-County Telecommunications Master Planning Initiative: At the request of Anderson, Oconee, and Pickens Counties, ACOG in 2007 obtained $65,000 from ARC, with a local match of $66,000, to conduct a strategic telecommunications needs assessment and business plan. ARC funds underwrote the costs of ACOG personnel and consultants. The well-received plan delivered detailed broadband Internet inventories, needs analysis, recommended services, and recommendations for future deployment of more high-speed broadband Internet in the three-county region. This strategic plan laid the groundwork for Oconee County to secure $9.6 million in follow-on funding from NTIA's Broadband Technologies Opportunity Program in 2009. This strategic plan laid the groundwork for Oconee County to secure $9.6 million in follow-on funding from NTIA's Broadband Technologies Opportunity Program in 2009.

This strategic plan laid the groundwork for Oconee County to secure $9.6 million in follow-on funding from NTIA's Broadband Technologies Opportunity Program in 2009.

Faculty, administrators, and more than 1,900 students benefited from improved Internet service. These strengthened connections support continuous access to more than 100 online courses spanning approximately 60 fields of study.

Tri-County Technology College Infrastructure: The planning grant described above, along with concurrent planning efforts for the three-county strategic telecommunications plans, informed the community about equipment upgrades needed to improve connectivity at the Pendleton Campus of Tri-County Technical College, which also services satellite locations in Oconee and Pickens Counties. In 2007, ARC provided $100,401, matched by $191,503 in local funds, for these upgrades. Specific investments included the installation of new wireline services and switching equipment that doubled bandwidth from 10 Mbps to 20 Mbps in 48 classrooms, technical closets, and computer labs across the campus. Faculty, administrators, and more than 1,900 students benefited from improved Internet service. These strengthened connections support continuous access to more than 100 online courses spanning approximately 60 fields of study. Faculty, administrators, and more than 1,900 students benefited from improved Internet service. These strengthened connections support continuous access to more than 100 online courses spanning approximately 60 fields of study.

Site Visit Findings

The region is benefitting from virtual instruction as the community college shifts to an ever-larger share of online classes. High-quality broadband Internet infrastructure facilitates the capacity of a region to respond to and benefit from the transition from classroom to virtual learning.

If a primary metric of successful planning involves the degree to which findings are used and recommendations are implemented to good effect, then the Tri-County Telecommunications Master Planning Initiative experienced impressive results. Interviewees said the plan “convened a steering committee that got the right people on the same page to develop a common vision and establish the framework for action.” In the immediate term, the plan attracted support for the significant local match needed to fund the school’s infrastructure upgrades.

The construction of this 252-mile fiber network, providing broadband Internet speeds of up to 10 Gbps, improves Oconee County's attractiveness to new and existing employers and empowers more efficient operations at up to 140 community anchor institutions, 70 of which were connected as of June 2013. Six ISPs are authorized to provide last-mile services to businesses and homes over this network. Oconee FOCUS increased connectivity at the county's 20 public schools from 10 Mbps to 1 Gbps.

A compelling case arguing for the ongoing value and impact of the planning initiative involves Oconee County, the smallest and most rural of the counties and the strongest advocate of the need for a regional approach for telecommunications planning. The 2007 plan documented broadband Internet service in Oconee as being relatively expensive, unreliable, or unavailable at all in some communities. In 2010, Oconee County leveraged this information with a $9.6 million award from NTIA's Broadband Technologies Opportunity Program to install the broadband Internet infrastructure needed to make it a stronger contributor to regional development.

The project, Oconee FOCUS (Fiber Optics Creating Unified Solutions), is a public–private partnership that has built a fiber-optic network consisting of linked concentric networks providing high-speed service to rural parts of the county and connections to very-high-speed transport networks across the state and country. The construction of this 252-mile fiber network, providing broadband Internet speeds of up to 10 Gbps, improves Oconee County's attractiveness to new and existing employers and empowers more efficient operations at up to 140 community anchor institutions, 70 of which were connected as of June 2013. Six ISPs are authorized to provide last-mile services to businesses and homes over this network. Oconee FOCUS increased connectivity at the county's 20 public schools from 10 Mbps to 1 Gbps.[130]

Lessons Learned

The lessons learned from these two interrelated projects are concise but speak volumes to the fact that well-executed, modest planning grants can have broad and lasting impacts:

- Proactive regional planning agencies, especially in the technology arena, can have substantial impact: The same can be said of good regional planning groups that share information, facilitate collaboration, and leverage investments. In this case, a modest planning grant provided the mortar for enhancements at a community college that will support stronger online instruction throughout the region and support one of the region's

[130] Broadband USA Connecting America's Communities. No date. "County of Oconee." Accessed at http://www2.ntia.doc.gov/grantee/county-of-Oconee. And Oconee FOCUS Factsheet. Accessed at http://www2.ntia.doc.gov/files/grantees/oconee_focus.pdf on August 1, 2015.

most poorly connected counties to build out its broadband Internet infrastructure, becoming part of the rising tide that is lifting all boats in the region.

7.2.14 Regional Economic Development GIS Upgrade

Community Profile

The Southeast Tennessee Development Division (SETDD) is a special purpose unit of government created by executive order and comprising county and municipal governments in southeastern Tennessee and northwestern Georgia.[131] Included are Bledsoe, Bradley, Grundy, Hamilton, McMinn, Marion, Meigs, Polk, Rhea, and Sequatchie Counties in Tennessee and Catoosa, Dade, and Walker Counties in Georgia. Ten additional contiguous counties in Georgia and North Carolina join the SETDD counties in the cross-border Tri-State Workforce Alliance[132] and in the Southeast Industrial Alliance.[133]

Even relatively small-scale investments in capacity, such as this GIS upgrade project, can amplify community impacts.

Beyond shared geography, culture, and economy, this unusual level of shared vision and collaboration evidences the recognition that the best path to progress lies in leveraging resources to address common challenges and opportunities. This project demonstrates that even relatively small-scale investments in capacity, such as this GIS upgrade project, can amplify community impacts. Even relatively small-scale investments in capacity, such as this GIS upgrade project, can amplify community impacts.

With a characterization common to many Appalachian counties, the SETDD region underperforms state and national averages with relatively lower educational attainment, higher unemployment, lower median income, and older median age. However, total minority population in all but Hamilton County is lower than 7 percent, and the population in the region is growing, with only Marion County experiencing net outmigration and half of the counties growing at rates exceeding those of the United States and Tennessee (see **Table 7-17**).

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131 Southeast Tennessee Development District. Accessed at http://www.sedev.org/www on August 1, 2015.
132 Tri-State Regional Workforce Alliance. Accessed at http://nwgrc.org/tristateregionalworkforcealliance/ on August 1, 2015.
133 Southeast Tennessee Development District. Accessed at http://www.sedev.org/www on August 1, 2015.

Table 7-17. SETDD Counties' Economic and Demographic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population ≥ 65 Years**	**Educational Attainment (≥ HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
Bledsoe County	7.1	17.6	75.6	15,747	9.6	22.4
Bradley County	2.9	15.4	82.4	21,649	6.9	19.8
Grundy County	−1.8	20.0	70.5	15,683	10.5	29.7
Hamilton County	3.7	15.6	86.3	27,229	6.8	16.6
Marion County	0.4	17.7	76.1	21,399	8.3	18.2
McMinn County	0.2	18.4	80.2	19,744	8.1	18.3
Meigs County	−0.9	19.0	74.1	19,403	9.0	20.7
Polk County	−1.0	18.6	77.4	20,274	8.2	17.3
Rhea County	2.2	17.1	76.9	18,952	9.2	22.6
Sequatchie County	3.6	18.4	80.5	20,899	7.9	17.4
Tennessee	2.4	14.7	84.4	24,409	7.1	17.6
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

At the time of this award (2009), six SETDD counties were designated "transitional," three "at risk," and only one "distressed." Despite concerted efforts in individual counties and across the region, the situation appears to have deteriorated: none of the counties' statuses have advanced: four are now "transitional," three are "at risk" and three are considered "distressed." And, although success in attracting retirees and tourists to the region contributes to the economy, maintaining sustainable high-wage manufacturing jobs remains the economic development gold standard.[134] SETDD has a

[134] Tennessee Department of Economic and Community Development. No date. "Regional Strategic Plan." Accessed at http://issuu.com/setdd/docs/jobs4tn_report?e=4030331/6344696 on August 1, 2015.

strong manufacturing base to build on and has been focused on growing its auto manufacturing and energy clusters to expand on the major appliance and textile sectors that have dominated. Strong information technology infrastructure in parts of SETDD is seen as a magnet that can boost the region's innovation and entrepreneurial capacity, although parts of Polk County and other more rural counties in the region remain underserved.[135]

Project Synopsis

In 2009, SETDD matched an award of $11,055 from ARC to purchase modern GIS software and GPS hardware for use in developing geospatial data compliant with the Federal Geographic Data Committee standards. SETDD assists a 10-county region with regional planning, transportation, and infrastructure development. Equipment purchased included a handheld GPS receiver, ARCView 9.3 GIS software, and two additional software modules to allow the determination of least-cost routes and to perform drive-time analysis, two critical functions for industries employing just-in-time delivery processes that are important to auto suppliers, energy suppliers, and other high-wage industries targeted for regional industrial recruitment.

Site Visit Findings

The GIS equipment purchased with ARC assistance in 2009 was used for site analysis and route planning to optimize locational decisions for companies being recruited or relocating to the region. SETDD worked with the Tennessee Valley Authority and economic developers to develop weighted models for potential industrial sites. Today, Meigs County is home to an industrial park.

The GIS equipment also helped utility districts in the region inventory and map the location of their holdings. One illustrative experience involved a damaged major water tank that drained and caused major disruptions in service. Once the GPS equipment was in hand, pressure zone maps were

[135] Southeast Tennessee Development District. 2015. "Draft Comprehensive Economic Development Strategy." Accessed at http://www.sedev.org/downloads/SETDD2015DraftCEDSUpdate.pdf on August 1, 2015.

developed for the water system, enabling the utility to identify the source of the problem and respond more quickly.

The real story here is not limited to the impact of a modest investment in one piece of equipment for use in one setting. Rather, it is the evolution of the adoption and utilization of GPS and related innovative technologies, the increasing scope and span of its applications for economic and community development, and the value of collaborative partnerships in using the technology to effect positive change.

The real story here is not limited to the impact of a modest investment in one piece of equipment for use in one setting. Rather, it is the evolution of the adoption and utilization of GPS and related innovative technologies, the increasing scope and span of its applications for economic and community development, and the value of collaborative partnerships in using the technology to effect positive change. This story is evidenced in a number of ways. SETDD has been an early adopter of smart geospatial technologies for planning and development since the late 1990s, starting with a pilot project in Bradley County. Today, SETDD has a full-time GIS technician, nine fully licensed GIS employees, and five full software suites that work to integrate GIS into the full range of SETDD data, research, and services. According to economic and community development officials, SETDD uses a DGI Phantom drone to provide livestream feeds used in presentations of industrial sites to prospective clients and collection and presentation of other reconnaissance data.

SETDD is partnering with the University of Tennessee and the Tennessee Emergency Management Association to reduce costs and increase services. For example, by marrying the mapping applications to other functions available on smartphones, governments in SETDD are able to expedite economic recovery from disasters.

SETDD is partnering with the University of Tennessee and the Tennessee Emergency Management Association to reduce costs and increase services. For example, by marrying the mapping applications to other functions available on smartphones, governments in SETDD are able to expedite economic recovery from disasters. Following recent floods, governments worked with the Tennessee Emergency Management Association to email damage assessment forms in Google Docs to planners over Federal Emergency Management Agency smartphones and map damaged areas, completing disaster relief applications within 1 week and finalizing all paperwork within the month, thereby reducing total response times two- to threefold, according to interviewees.

As next steps, SETDD will be working to create map layers related to tourism and cultural heritage to support mobile applications that can be produced for one-third the cost of print copies and to put select elements of the GIS layers online for public access. Local leaders envision an expanded use of drones to establish mesh networks for emergency response situations, to map for energy leaks, and to test the integrity of rock faces near roads and highways.

SETDD views ARC as an important partner in its efforts to improve the economic prospects across its region. They see themselves as a change agent, not only in their region but as a model for other regions in their state, citing interest other regions have expressed in adopting some of their technology practices. Being a change agent presupposes an interest in experimentation that may have put SETDD ahead of the comfort zone of some local and state leaders, so continued financial support from ARC would be well received in southeastern Tennessee. Looking forward, regional leaders have identified three priorities for future ARC support: broadband Internet deployment, rural health, and bridges across the Tennessee River.

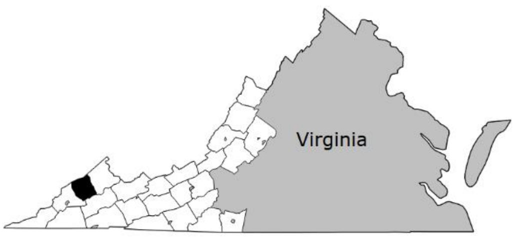
Lessons Learned

SETDD is a best practice example of the evolutionary development of comprehensive GIS capacity to support economic development, regional planning, and a spectrum of government services. As a result, a large multicounty region spanning portions of three states is well resourced with high-value GIS databases to support emerging opportunities in public safety, health care planning and provision, disaster response, and economic development. Key points taken from this study include the following:

As a result, a large multicounty region spanning portions of three states is well resourced with high-value GIS databases to support emerging opportunities in public safety, health care planning and provision, disaster response, and economic development.

- GIS is an important tool that validates and supports comprehensive cross-boundary planning and development efforts.
- SETDD is distinguished among GIS centers examined for this evaluation in the depth of expertise and longevity of its professional staff. Unlike many similar organizations, SETDD would not be incapacitated by the loss of any one staff person. That fact underpins the confidence its member governments have in the timeliness and quality of assistance that SETDD GIS can provide.
- Government can be entrepreneurial and innovative; with its early uptake and experimental application of drone technology, SETDD is an active agent for technology diffusion. Particularly impressive were the benefits imparted in rapid and precise documentation of flood damage that expedited recovery processes.

7.2.15 Dickenson Center for Education and Research Equipment



Community Profile

Dickinson County, Virginia, is located in far southwestern Virginia on the Kentucky border. Rich natural resources, including coal, natural gas, timber, and minerals, have long dominated the employment opportunities in the region. Despite proactive efforts by the Dickinson County Board of Supervisors' Industrial Development Board (DCIDB) and other local government leaders to transition to a more diverse and knowledge-based economy, almost 28 percent of the local labor market still works for energy extraction firms,[136] and more than 77 percent of the workforce commutes to jobs outside of the county.[137] Declining population, low high school graduation rates, and lack of economic diversity are challenges that cannot be overcome easily or quickly, but leaders in Dickenson County are looking for innovative ways to change the region's prospects. As noted in **Table 7-18**, Dickenson County faces population decline, a higher share of elderly residents, higher unemployment, lower educational attainment, and much lower per capita income as compared with state and national averages.

In 2003, broadband Internet availability was limited and unaffordable for many businesses and households in Dickenson County. DCIDB responded proactively by implementing a plan to bring wireless service to the county, starting with connectivity to support local government services, laptops in police vehicles, and 911 emergency services. Subsequent phases orchestrated through a separate agency established by DCIDB extended last-mile service to businesses and households, making Dickinson County the first in the Commonwealth to offer countywide wireless services. According to interviewees, call centers were identified as an attractive economic development target, so ARC investments in technology and telecommunications aligned with the county's strategy.

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136 Cumberland Plateau Planning District Commission. 2013. "Economic Development Strategy." Accessed at http://www.cppdc.com/Reports/2013%20Comprehensive%20Economic%20Development%20Strategy.pdf on August 1, 2015.

137 Virginal Employment Commission Labor Market Information. 2015. "Dickenson County Community Profile." Accessed at http://virginialmi.com/report_center/community_profiles/5104000051.pdf on August 1, 2015.

Table 7-18. Dickenson County Demographic and Economic Profile

Geography	Percent, %				Percent, %	
	Population Growth (2010–2013)	Population > 65 Years	Educational Attainment (> HS Graduates)	Per Capita Income, $	Unemployment (June 2014)	Poverty
Dickinson County	−3.7	18.1	72.4	18,215	9.8	9.8
Virginia	4.1	13.4	87.5	33,493	5.4	11.3
United States	3.3	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

ARC granted $4 million in 2008 to the Industrial Development Authority of Dickenson County for the Virginia Coalfield Economic Development Authority to conduct the first of a three-phase project to convert a large shell building into a technology-enabled classroom. Additional partners (Federal Directed Grant, Virginia's Tobacco Trust, U.S. Department of Agriculture, and Columbia Phipps Foundation) provided $490,095 for the effort.

The Dickenson Center for Education and Research (DCER) was reconfigured into classroom space to address the traditional academic curriculum, the IT and technical trades, health careers, and the specific training needs of the mining and natural gas industries.

Located in Dickenson County Technology Park, The Dickenson Center for Education and Research (DCER) was reconfigured into classroom space to address the traditional academic curriculum, the IT and technical trades, health careers, and the specific training needs of the mining and natural gas industries. DCER was to serve as an educational and workforce training facility that provides workforce development for new careers, access to higher education for graduating high school students, retraining opportunities for existing industries, and GED programs for adults. ARC funded the equipment for the facility $100,000 (79.9 percent) that was matched by $25,162 (20.1 percent) with local resources. The equipment included servers, computers, workstations, audio/visual equipment, and projectors. Although first-year use statistics more than met expectations, subsequent years saw ever-declining success in achieving the original goals for education, training, and research. The operation of DCER is expected to be turned over to the county government, which already uses much of the space as spillover for judicial and other functions.

Site Visit Findings

A shell building that had been vacant for more than a decade was the focus of a major campaign to support a growing technology sector. Low business costs and progressive broadband Internet infrastructure were the key features to attract related business and industry.

DCER was envisioned as a one-stop education and training center that would over time also become an energy industry research center for mining and natural gas companies located in the region. Facilities developed at the center included four general purpose classrooms, a biology/chemistry lab, computer lab, a distance learning and videoconference classroom, a nursing classroom, two industrial training classrooms, a multipurpose training hall, and two conference rooms. DCER's educational partners, Mountain Empire Community College and Southwestern Virginia Community College, would offer general education academic courses and focused industry training classes developed in response to the needs of clients. A promising beginning had 379 students enrolled in 303 workforce training activities and 67 college academic classes, but a fairly rapid succession of events effectively scuttled DCER's prospects for success.

A promising beginning had 379 students enrolled in 303 workforce training activities and 67 college academic classes, but a fairly rapid succession of events effectively scuttled DCER's prospects for success.

Interviewees explained that Travelocity, which had a call center in the area, closed operations, relocating the call center to India. A total of three call center operations moved in and out of the location over the next 4 years, and EQT, a local natural gas company that was expected to become a research partner was acquired by a company in Texas. Failure to retain students made it difficult for educational partners to sustain funding for course offerings. Further, equipment and software purchased in 2008 are aging, and resources for replacements to meet online training needs are scarce.

Failure to retain students made it difficult for educational partners to sustain funding for course offerings. Further, equipment and software purchased in 2008 are aging, and resources for replacements to meet online training needs are scarce.

The current situation is a far cry from the energizing vision that launched DCER. Interviewees stated that some classes continue to be offered, but the majority of the building serves as a temporary location for district court services while a new courthouse is being built. A small call center that services the

Federal Retirement Thrift Investment Board operates in some of the space. DCER has been managing the full facility, but with the recent loss of its director, the building is expected to be turned over to the county for its general use. The local hospital will use the nursing classroom to teach second-year licensed practical nursing students.

Lessons Learned

- A realistic and holistic needs assessment should be done before investments are made and plans implemented: The best intentions and adequate financial resources to implement an integrated plan that builds on technology infrastructure could not overcome the challenges presented by the region's demographics and its remote location.
- Rightsizing investments using publicly available data about potential participants could prevent overscaled investments: This project is a good example of scale handicapping an endeavor from the start. The facility that was renovated is large, and given the demographics of the area, it would have been difficult to generate enough volume of students to sustain operations. For instance, the high school only has 385 students, of whom a small fraction would be seniors whose schedules and educational aspirations would align with the DCER premise. The DCER facility is extremely overscaled in relation to the area's potential demand.
- Expecting too much of wireless technology: Too much reliance on wireless technology to deliver broadband Internet was a risky strategy.

7.2.16 West Virginia State Museum Education

Community Profile

West Virginia's history has been profoundly shaped by its mountainous geography and the natural resources they contain, with mining and logging long dominating the economy. As a leading producer of energy, West Virginia is closely associated with extraction operations producing coal and natural gas, but the state is actively working to secure a place as a leader in wind and other green clusters. [138] Travel and tourism draw visitors across seasons to enjoy the many

[138] West Virginia Department of Commerce. 2015. "Energy Opportunities." Accessed at http://www.wvcommerce.org/(S(2l44d0rotmq4rg453yacklfy))/energy/energyopportunities/default.aspx on August 1, 2015.

recreational activities supported by West Virginia's many rivers, forests, caves, and mountains. [139]

West Virginia is a state of many small and medium-sized cities, all of which are designated within the Appalachian Region. Although the state has persistently lagged national averages on key economic and demographic indications (see **Table 7-19**), there has been economic progress in recent years, as evidenced in ARC's economic status designation. In 2008, at the time of the ARC grant, 13 West Virginia counties were considered "distressed" compared with 9 in 2016; the number of "at-risk" counties declined from 17 to 4, and "transitional" counties increased from 15 to 22 over that period.

Table 7-19. West Virginia Demographic and Economic Profile

	Percent, %				Percent, %	
Geography	**Population Growth (2010–2013)**	**Population > 65 Years**	**Educational Attainment (> HS Graduates)**	**Per Capita Income, $**	**Unemployment (June 2014)**	**Poverty**
West Virginia	−0.1	17.3	83.9	22,966	6.5	17.9
United States	2.5	14.1	86.0	28,155	6.1	15.4

Source: U.S. Census Bureau, Quick Facts sourced for the following data categories: population growth, population ≥ 65 years; education attainment, per capita income, and poverty (the most recent year available). Bureau of Labor Statistics, Local Area Unemployment Statistics Map sourced for the following data category: unemployment (June 2014).

Project Synopsis

The statewide mission of the West Virginia State Museum, encompassing outreach to all 55 counties of West Virginia, was enhanced in 2009 with the opening of its new and technologically improved facility at the Cultural Center in the state capitol, Charleston. ARC funded the West Virginia Division of History and Culture to improve the museum's educational programs with high-technology equipment in 2008: $200,000

[139] West Virginia Division of Tourism. 2013. "Economic Impact of Travel on West Virginia 2000-2012 Detailed State and County Estimates." Accessed at http://www.wvcommerce.org/App_Media/assets/doc/travelandrec/industry/marketing/2012_Economic_Impact.pdf on August 1, 2015.

matched $235,000 in state funds.[140] The primary objective was to develop the museum's capacity to deliver highly impactful virtual museum experiences to classrooms across the state. State-of-the-art technology classrooms were equipped at the museum to support on-site instruction and virtual learning programs. The West Virginia Division of Culture and History worked with teams of lead teachers and curriculum specialists to develop teacher kits, curriculum guides, and educational rooms. Classroom teachers were trained to incorporate these activities into their lesson plans. Plans to train 75 teachers with a goal of having 50 actually implement the programs in their instruction plans and classrooms were exceeded with 109 teachers actually trained. Widespread adoption and an increase in personal data devices are spurring continued innovation in the virtual delivery of museum programs to students and teachers. Through this project, creative use of technology in cultural resources fosters among students a shared virtual experience of what it means to be a West Virginian and provides continued professional development for educators in the use of emerging technology for experiential instruction.

Through this project, creative use of technology in cultural resources fosters among students a shared virtual experience of what it means to be a West Virginian and provides continued professional development for educators in the use of emerging technology for experiential instruction.

Site Visit Findings

The West Virginia State Museum Education Initiative demonstrates a very successful model for using virtual tools to provide rich educational experiences that have been endorsed by the West Virginia Department of Education (WVDOE).

Sixteen lead teachers recruited from across the state were paid to assist in developing teacher kits and instructional materials to augment the virtual classroom activities. The project director noted that the lead teachers' participation not only ensured the relevance and quality of the teacher kits that were developed but also embedded the idea of the museum as an active partner in their classrooms. Museum staff work closely with WVDOE to develop materials that align with subject and grade-level standards. Workshops conducted in approximately 40 counties in summer 2013 delivered training and teacher kits to more than 1,800 teachers. Kits on various topics contain topical information binders, instructions on accessing relevant websites, lesson plans, and activity packs for students.

[140] West Virginia Division of History and Culture is a nonprofit without 501(c)(3) IRS status.

To date, up to 9,000 students have been involved in virtual museum sessions.

To date, up to 9,000 students have been involved in virtual museum sessions with involvement having more than one form. Students visiting the museum can now have their experience enriched with sessions in the museum's technology-enhanced classroom. Students use tablet computers to develop materials that can be taken back to their schools for later use by downloading to their phones or flash drives. Students who lack home computers are encouraged to use alternative display options that are often more available, such as play stations or televisions. Museum staff conduct regular programmatic reviews to ensure effectiveness of the students' experiences at the museum. Alternatively, students' visits to the museum may be entirely virtual, foregoing the expense of actual field trips but securing the experiential learning opportunity.

The main impediment seems to be the absence of sufficient bandwidth or appropriate equipment on the receiving end.

Although the West Virginia State Museum Education Initiative successfully implemented web-based virtual applications, the audiovisual equipment that was envisioned as supporting real-time interactive statewide classes has been underused. The main impediment seems to be the absence of sufficient bandwidth or appropriate equipment on the receiving end. The museum staff and education partners struggle to develop "best practice" materials and presentations without access to a network of field partners and wider opportunities to collaborate. Finally, the effectiveness of their outreach efforts is limited by the lack of broadband Internet access in all West Virginia communities. The lack of access to high-speed Internet within many of the schools creates a major barrier to the museum's primary outreach goals.

Lessons Learned

In many ways, the West Virginia State Museum was ahead of its time in the marriage of technology, education, and cultural resources, particularly in the span of its ambitions to serve a largely rural state.

In many ways, the West Virginia State Museum was ahead of its time in the marriage of technology, education, and cultural resources, particularly in the span of its ambitions to serve a largely rural state. Because this project was ahead of its time, it was appropriate that the project used a pilot test approach to project monitoring and evaluation. A few key observations may have resonance with a broader audience that is interested in adapting technology to engage people with history and cultural resources:

- The museum is practicing technology diffusion in a novel way, involving "push" and "pull" models simultaneously: Lead teachers brought in to develop engaging lesson plans become, in effect, sophisticated technology missionaries who push the benefits of the virtual field trips and teacher kits on their colleagues. The colleagues are simultaneously being pulled toward using the technology, unique content, and virtual experience it delivers to their students, whose familiarity and interest in all things digital makes the museum's approach all the more compelling.

- Communication is a two-way process that can only be as effective as the least well-provisioned element: Equipping the museum with state-of-the art audiovisual equipment is, in some ways, a stranded investment when the majority of classrooms that are the target for the live virtual programming lack the equipment or broadband Internet access of the speed and quality needed.

7.3 SUMMARY FINDINGS

Case studies conducted for this evaluation provide a deep and more intimate look at a select mix of ARC-funded telecommunications and technology projects, with the express purpose of developing recommendations for best-practice strategies for expanding broadband Internet access, adoption, and use in the Appalachian Region. The mix of 18 projects visited included many identified as promising exemplars of success, as well as a smaller set of projects for which the case study was, in effect, a forensic postmortem on projects that did not succeed, despite laudable efforts. Examination of cross-cutting themes, commonalities, and ubiquities among these 18 projects illuminates the nature of success in this arena and provides information that can be used to the advantage of projects funded by ARC in the future.

7.3.1 Generalizability of Case Study Findings

The case study collective mirrors the full project portfolio in many dimensions including geographic distribution, year of investment, duration of project, scale of ARC investment, and leveraged funds. This diversity strengthens the relevance of findings from these case studies to the spectrum of ARC telecommunications and technology projects.

Although the 18 projects visited represent only slightly more than 5 percent of the total FY 2004 through FY 2010 technology awards, they include at least one example of every project function and every beneficiary category.

Previous analysis in **Section 5** looked at the overall performance of the portfolio, as measured by the percentage of projects that met or exceeded their respective project goals: slightly more than half (55 percent) had met at least 85 percent of their goals. We sought to augment this understanding of performance in the case studies and considered stated project goals in combination with evidence gathered during the site visits.

All projects have officially closed, and if related activities are ongoing, they are being sustained with local or other funds that build on ARC's original investment. In general, we observed that more long-term success was achieved through a phased evolution over 12 years that incorporated some combination of: increased awareness, growth in demand, partnership building, and work across political and geographic boundaries to boot strap infrastructure projects.

In contrast, a project that could not achieve its goals and is now effectively defunct, the Dickenson Research and Education Center (DREC) in Clintwood, Virginia, was thwarted from success by an overreliance on wireless solutions that could not provide service on a level that was needed to support strategic visions. The DREC was created in large part to train workers for technology jobs that failed to materialize as the call centers that were recruited moved on to areas with better, fiber-based access.

Stranded Investments

The successful ones highlighted in these cases embed flexibility into their project design and equipment investments to optimize their ability to respond to the hyperdynamic technology arena.

Directly related to the issue of rapidly evolving technology is the risk of stranded investments. The dynamic nature of advances in multiple aspects of broadband Internet and web-based applications, software-designed networking, cloud technology, open-source software, and rapidly advancing feature-rich personal access devices contribute to a situation where the optimal solution can seem like an ever-moving target. This should be of particular concern because the bulk of ARC's telecommunications and technology resources are expended on equipment purchases. While all projects confront this situation, the successful ones highlighted in these cases embed flexibility into their project design and equipment investments to optimize their ability to respond to the hyperdynamic technology arena. One example of this is the decision by Three Rivers Planning District to move away from a proprietary vendor-defined and controlled electronic filing system for its multicounty governments to open-source software developed and maintained by its university partner.

A different perspective on the concept of stranded can be taken from the West Virginia Museum project where state-of-the-art video conferencing equipment that potentially permits real-time educational programming to complement virtual field trips is underutilized and risks becoming obsolete because the technology in the schools that are targeted to receive the programming is inadequate. ARC is in a position to guide applicants to embed flexibility into project design and equipment selections to enable longevity for returns on investment. ARC itself is repeatedly lauded for the relative flexibility they afford applicants to remodel projects as needed, so this idea builds on an attitude/practice ARC already embraces.

Planning

Three projects are considered “defunct,” having effectively ceased operations related to the project; one planning project successfully completed its limited-term objectives and is no longer active; two projects are operating, albeit in a limited capacity, having accomplished their primary goals and then having to retrench for reasons explained in the individual case studies; four projects are operating for the original purpose at levels similar to the grant period; and seven projects (half of the 14 nondefunct projects) have expanded operations beyond the scale or scope originally funded by ARC.

In summary, the cases are representative of the collective portfolio on many measures and are exemplary in myriad ways. The organizations managing these projects continue to work towards improving the economic conditions and quality of life in communities they serve, despite a general worsening of the economic situation in many parts of the Appalachian Region overall and especially in the distressed and at-risk counties that were included in the case studies. And, while three projects included in this study did not meet their longer-term goals and are now defunct, they are still contributing to technology deployment in the Region by allowing their experiences to be mined for lessons that might help prepare others for the challenges they will confront as they work to transform their communities.

7.3.2 Cross-Cutting Issues

Common key questions provided the platform from which unique aspects of each project as well as cross-cutting issues could be extracted for use in development of best practice recommendations. Through discussion, interviewees elaborated on the criticality of ARC in confronting previous and ongoing challenges and suggested the types of assistance ARC could provide going forward that would have the greatest impact on their efforts. A discrete set of cross-cutting factors emerged that shed light on the success or limitations of the broader set of cases studied. These "big" factors are discussed below.

Infrastructure Evolution

A major theme that cut across project types was that a community's default position has to be that fiber connectivity is the goal and wireless should be seen as an adjunct or transitional means, not an end point.

Fiber is the gold standard, and Appalachian communities want it. The telecommunications landscape changed significantly over the examined period as a result of the hyper-stimulating effect of $4 billion injected into the market from the BTOP and Broadband Investment Program (BIP components of the American Recovery and Reinvestment Act of 2009) that primarily funded research and middle mile infrastructure and adoption efforts that targeted underserved rural communities, such as the communities ARC serves.[141,142] Today, ARC stakeholders have more precise information about broadband Internet coverage gaps and, as a result of adoption efforts, have a more sophisticated and receptive understanding of broadband. The last mile piece of the connectivity puzzle is still missing, and repeatedly in these interviews participants shared that ARC stakeholders think that their communities' futures are limited as long as last mile service is inadequate or unavailable entirely. Interviewees made it clear that they would welcome any and all assistance that ARC could offer to address this pressing problem, including having last mile be an express focus for future grants, perhaps even changing ARC's charter to allow it to make awards to incent private providers to bring services to regions where the market case does not presently support fiber deployment. A major theme that cut across

[141] Broadband Technology Opportunities Program. Homepage. Accessed at http://www2.ntia.doc.gov/ on August 1, 2015.

[142] U.S. Department of Agriculture, Rural Utilities Service. January 2011. *Advancing Broadband: A Foundation for Strong Rural Communities*. Broadband Initiatives Program Awards Report. Accessed at http://www.rd.usda.gov/files/reports/RBBreportV5ForWeb.pdf on August 1, 2015.

project types was that a community's default position has to be that fiber connectivity is the goal and wireless should be seen as an adjunct or transitional means, not an end point.

Lead regional planning organizations combine strong planning skills, deep contextual knowledge, external contacts and experience in collaboration and oversight with the perspective to see projects as part of a broader, holistic multi-partner, multi-phased response to challenges or emerging opportunities.

Another theme that cuts across the projects, successful and not, involves the role that planning has in shaping successful outcomes. There are multiple aspects to this issue. Lead regional planning organizations combine strong planning skills, deep contextual knowledge, external contacts, and experience in collaboration and oversight with the perspective to see projects as part of a broader, holistic, multipartner, multiphased response to challenges or emerging opportunities. Not surprising, many of the more successful projects were led by professional planners. Even though all projects do not have this depth of planning experience, all can benefit by borrowing best practices from a different sector. With encouragement, organizations planning telecommunications projects can become better prepared to respond to major threats and adapt to changing circumstances. Planning cannot prevent disasters from happening, as in the devastating tornado that destroyed fiber being deployed for the Marion County School System, but perhaps proactive consideration of worst-case scenarios in a tornado prone locale might have positioned the situation to be something other than a total loss.

Scale

Regional efforts often benefit from deliberate processes to develop shared visions and have outreach and communication to stakeholders as an explicit and ongoing component of strategy.

Aggregation of demand is a proven strategy for effecting broadband Internet deployment in rural and remote communities.[143] Similarly, aggregation of interests proves to also be powerful in delivering other types of successful technology-based development projects in Appalachia. Many of the more successful and sustained efforts supported by ARC between 2004 and 2010 were centered at regional commissions or planning districts that had as their target multiple contiguous Appalachian counties. Economies of scale and the opportunity to phase development over the region in accordance with member counties' relative receptivity and capacity to undertake new projects, investments, or technology adoption efforts seem to promote more successful outcomes in our case studies. Southeast Tennessee Development District provides a best

[143] Battista, Daniela. 2002. "Demand aggregation to encourage infrastructure rollout to under-served regions." Organisation for Co-operation and Economic Development (Paris, France). Accessed at http://www.oecd.org/sti/ieconomy/2491219.pdf on August 1, 2015.

practice example of this finding in its participation with neighboring states in formal cross-border development efforts (see **Section 7.3.16**).

This is not to say that regional projects should take precedence over appropriately sized smaller, one-county projects. The emphasis needs to be on defining "appropriate" in the context of particular undertakings. Specifically, some of the least successful grants suffered from undertaking projects of a scale that could not be supported by the local capacity, however defined. In some cases, the market was insufficient, and in others, the population was too small. Demographics are a powerful force that needs to be considered to right-size a development effort.

Measuring Leadership

Project leaders shared many thoughts about making evaluations more relevant by ensuring that the rights things are being measured at the appropriate milestones during and after the project.

Good leadership enables good results, and it is true many of these projects were characterized by exemplary leaders who were informed, committed, and respected. One additional trait that was also observed was the attention leaders gave to project metrics and outcome evaluation. In this instance, project leaders take good measures and keep good records. Even in one of the projects that was confronted with challenges that could not be overcome, the attention to data collection and recordkeeping attests to the leaders' commitment to internalizing lessons that could be used to better guide future efforts. Project leaders shared many thoughts about making evaluations more relevant by ensuring that the right things are being measured at the appropriate milestones during and after the project. This focus on metrics was echoed by survey results from the broader evaluation that showed significant longer-term benefits that can only be captured over longer time periods as projects mature.

Partnerships

Survey results show that 80 percent of ARC telecommunications project stakeholders felt that they were better able to facilitate new relationships with other stakeholders as a result of projects. This finding is reinforced by the case studies.

Survey results show that 80 percent of ARC telecommunications project stakeholders felt that they were better able to facilitate new relationships with other stakeholders as a result of the projects. This finding is reinforced by the case studies. Beyond infrastructure, "network" in the context of community and economic development has to be actively manifested in strong and diverse outreach and engagement efforts to build relationships. Proactive and inclusive engagement of stakeholders from across the extended community of interest characterizes all of the most successful efforts across project types. For example, Whatley Health Services in Alabama works to overcome a severe shortage of doctors and dentists who are willing to practice in its service area by actively building relationships and developing innovative cross-training opportunities with the state's medical and dental schools and advocating for the need its efforts represent.

When this convergence of interests is paired with an operating model of coordination rather than control, the outcomes can be impressive, as with the Regional High Growth Training Center in Somerset, Kentucky.

Projects that arise from shared needs can contribute to development of shared vision and shared responsibility that underpin sustainability. In this area, local utility companies, government, a community college, and a workforce development board came together to create a focused-industry training center that is meeting the industry's needs for a skilled technology workforce today and is evolving to meet emerging needs for the industry's transition as it prepares to be involved in broadband Internet deployment. The Center was the result of a strong partnership that is making the community more competitive in multiple ways.

ARC: A Nexus of Information and Action

One of the hallmark values of the Internet is its ability to transform knowledge and high-value information into a digital format to make evermore complex and comprehensive data ubiquitously available. One of the rate-limiting factors impeding full realization of this valuable capacity is the fact that laws, rules, and practices that govern the full adoption of many high-value applications have not developed apace of the technology. (We discuss this further in **Section 8**.) This is particularly true in the areas of telehealth, legal services, and education, where a mosaic of unharmonized local, state, and federal rules complicate adoption of truly critical broadband Internet applications. Impediments arising from the need to rationalize rules, laws, and licensing practices across political borders were cited by interviewees as limiting the ability of individuals and organizations to bring web-based benefits to remote and rural communities. For example, in telehealth the lack of reimbursement parity for telehealth services and restrictions that prevent doctors from providing services across state borders limit widespread utilization applications that are critical to rural Appalachian communities going forward.

In general, stakeholders recognize that developments in this arena move very fast, and many are concerned about their capacity to keep up with changes in technology and its use. The issues of how best to stay apprised of developments, how to move along the technology learning curve, and how to ensure that they are aware of opportunities for assistance emerged as common concerns. Opportunities to share information and be part of a broader learning community of practitioners who share an interest in bringing the power of the Internet to bear on local problems and opportunities would be welcomed by leaders and managers.

7.3.3 The Difference Made

The resounding conclusion from these case studies is that through ARC-supported efforts 18 disadvantaged and underserved communities acquired telecommunications infrastructure and technology that resulted in improved access to education, health care, government and community services, business development, job training, and improved employability.

"Community" in this context encompasses 105 counties, 44 (41 percent) of which are considered by ARC as "distressed" or "at risk." These projects enabled public and nonprofit organizations to dramatically change the way they interact with clients and increase the number and quality of services delivered. The projects expanded the universe of technology-assisted teachers in the Appalachian Region and reached learners of all ages through innovative educational strategies. After the ARC grants ended, most projects sustained local support to continue operations or expand their operations. That community support attests to the fact that value of their efforts was realized. As best-practice models, these projects offer amplified insights into the factors that differentiate levels of success, providing guidance to ARC as it looks forward to helping other communities shape and build a more competitive, technology-enabled future for their community or region.

8 Policy Issues

In this section, we turn from assessing the performance of ARC's telecommunications and technology grants from 2004 through 2010 to examining key policy issues that will likely influence ARC's ability to support broadband Internet access in the Appalachian Region. Many issues are at play in the telecommunications realm, but here we survey 23 of the most salient for ARC to consider. As discussed in the literature review (Section 4), understanding the policy environment is important because there are many cross-cutting and significant implications for businesses, workers, households, and community-based institutions like libraries and schools as they seek to flourish and maintain relevance in the future.

To best decipher the policy issues, we divide them into categories: direct broadband, indirect broadband, broadband applications, broadband availability, broadband adoption and utilization, and cross-cutting policy issues. These policy issues are distinct but should be approached holistically because each issue is interrelated.

The following policy discussion demonstrates the dynamic policy environment in which ARC is operating, which shows little indication of slowing. As ARC forges into a new period of telecommunications and technology grantmaking, it will be critical for staff and advisors to remain acutely aware of the policy environment so that ARC can best carve out a role for its investments to have the most long-term impacts.

8.1 INTRODUCTION AND METHODS

Evaluation for the sake of assessing the success of what has already been done is of marginal value unless evaluators extract lessons that can guide future actions. For ARC, it will also be important to merge the contemporary realities of the policy changes that support broadband Internet access, adoption, and affordability with the findings from this evaluation. The forces shaping the telecommunications ecosystem today are very different from those that defined it through much of the 2004 through 2010 evaluation period. This rapidly evolving ecosystem is diverse, complicated, and dynamic, bordering on turbulent. Consider the following:

- Networks—a shift to cloud computing is redefining the nature, scale, and frequency of telecommunications infrastructure investment at every level.
- Devices—explosive adoption of personal access devices and the Internet of Things is fundamentally shifting the paradigm of how individuals and organizations access and use digital information.
- Applications—mobility is the growth medium that has moved web-based services from essentially $0 to almost $50 billion in 2010 to a projected $143 billion in 2016.

We delve into 23 of the key policy issues that the RTI team identified as most pertinent to ARC as it considers charting its path forward. These issues are organized by the functional framework we describe in **Section 5**: direct broadband, indirect broadband/supported by broadband, applications of broadband, and availability of broadband. We added two additional categories. The fifth briefly discusses broadband adoption and utilization. Finally, a sixth category is cross-functional to capture policy issues that affect all of the functions described. **Table 8-1** summarizes these functional categories that we use to describe the policy topics most pressing for rural broadband Internet access and adoption.

The RTI team relied heavily on the expertise of Jim Baller, Mark Johnson, Jane Smith Patterson, Ashley Stelfox, and Deborah Watts for guidance and direction in identifying the most pressing policy issues for ARC to consider. The guidance from this expert group was supported by current research on these topic areas.

Table 8-1. Function Dimension of the Evaluation Framework

Function	Description
Direct broadband	"Outside the building" projects that expand broadband Internet access or improve Internet connectivity for local businesses, schools, or the community more broadly.
Indirect broadband/ supported by broadband	"Inside the building" projects that invest in networking equipment and other telecommunications tools that are supported by or depend on broadband Internet access.
Applications of broadband	Projects that convey information or provide services via broadband Internet.
Availability of broadband	Programs that support greater broadband Internet availability, generally by providing additional funding opportunities.
Adoption and utilization of broadband	Projects focused on improving adoption and utilization of broadband Internet-enabled services, including developing the digital literacy of participants through training, professional development, or education to spur adoption of broadband Internet and telecommunications technologies.
Cross-cutting broadband	Projects that address multiple aspects of the broadband Internet spectrum from direct broadband, indirect broadband/supported by broadband, and applications of broadband to adoption of broadband.

Note: This table is a revised version of Table 5-2.
Source: RTI, ARC

8.2 KEY POLICY ISSUES

These issues are important because policies will affect the ability of hospitals, businesses, governments, schools, and colleges to provide goods, services, and amenities that will help make the Appalachian Region viable and competitive.

We identified 23 policy issues that are most salient for ARC and its grantmaking over the next 3 to 5 years. Policy issues are organized by broadband Internet function and listed in **Table 8-2**. These issues are important because policies will affect the ability of hospitals, businesses, governments, schools, and colleges to provide goods, services, and amenities that will help make the Appalachian Region viable and competitive.

Now we describe each set of policies by function area by briefly defining the policy, indicating its importance, and summarizing why it is important to ARC.

Table 8-2. Key Policy Issues in Broadband Internet

Function	Key Policy Issues
Direct broadband	• Copper-to-fiber transition/"IP Transition" • Mobile vs. fiber • Gigabit cities • Last-mile connectivity • Electric co-ops, municipal electric utilities, and other entrants into the marketplace • Public–private partnerships
Indirect broadband/ supported by broadband	• Mobile device penetration • Connected devices to the Internet or the "Internet of Things" • Cloud computing • Medical insurance for telehealth projects
Applications of broadband	• Legal barriers to telemedicine • e911 needs coordination with FirstNet • Schools are shifting to digital curricula and e-textbooks • Certification issues surrounding distance learning for teachers
Availability of broadband	• E-rate program • Federal and state government funding for broadband Internet
Across all functions	• Net neutrality • "Dig and wire once"/coinvestment • Local choice • Cybersecurity/privacy of data • Tax policy • Broadband Opportunities Council

Source: RTI, Various.

8.2.1 Direct Broadband Policy Issues

Direct broadband refers to investments "outside of the building" that expand broadband Internet access or improve connectivity (see **Table 8-3**). Examples include laying fiber optics or enabling community-wide Wi-Fi. We offer seven examples of policies affecting the ability for rural communities to access and afford broadband Internet. Rural communities and ARC must wrestle with issues of upgrading broadband Internet infrastructure, shifting markets and options for acquiring broadband Internet, trends that hold potential to exacerbate the digital divide, and difficulties obtaining last-mile access. Each of these issues is ever-changing, making it very complex for communities to navigate and determine their best option for acquiring direct broadband Internet.

Table 8-3. Key Policy Issues for Direct Broadband Deployment

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
		Infrastructure	
Copper-to-fiber transition/"IP transition"	Physical networks that transmit communications services are changing from copper networks originally intended only for transmitting phone calls to modern communications networks (such as DSL and fiber networks) built for a variety of purposes, one of which is phone service.[a]	Modernizing networks requires upgrading equipment and software that are used to transmit signals.[b] Significant investment is required during this transition process.	Low-income and rural communities tend to be less profitable for telephone providers, leaving these communities particularly vulnerable to inadequate basic telephone services during this transition. Telephone services affect the ability to use 911, home alarms, and ATM machines.[c]
Mobile vs. fiber	Given the high economic barriers to deploying fiber networks in low population-density areas, many rural communities have assumed that mobile broadband Internet networks will be their only viable option to fiber networks for the foreseeable future. This has been a cause for concern, as today's mobile broadband Internet networks (e.g., Long-Term Evolution and Wi-Fi networks) are not able to match wired networks, particularly fiber-to-the-premises networks, in terms of reliability, scalability, speed, and the many other factors that would make rural communities competitive with more advantaged communities.	Given the weaknesses of the current generation of mobile broadband Internet compared with fiber broadband Internet networks, rural communities see mobile broadband Internet as a short-term stop-gap/stepping stone to fiber networks. There are, however, wireless technologies under development that, when combined with fiber driven to deep into neighborhood nodes, will enable data speeds of hundreds of megabits per second and possibly even exceed a gigabit per second. These technologies, which are sometimes referred to as fiber-wireless (FiWi) or hybrid fiber-wireless (HFW) technologies, may create important new options for rural communities.	ARC can continue to monitor technology developments and help educate communities on the various network options that may be available to them, including fiber, FiWi/HFW, etc. ARC can hold virtual briefings (podcasts or webcasts) to review different technologies and how they best fit for different communities. When FiWi/HFW technologies become viable for rural communities, ARC should also consider taking an active role in policy discussions surrounding federal and state incentives for the deployment of such networks.
		Trends	
Gigabit cities	Localities with broadband Internet networks that provide ultra-fast speeds. One gigabit per second is roughly 100 times faster than the average fixed high-speed Internet connection.[d]	Spurred by efforts in Chattanooga, TN, and the Google Fiber rollout, communities across the United States are seeking to acquire gigabit networks by working with willing incumbents, exploring public–private partnerships, or developing their own networks.[e]	Appalachian communities will struggle to keep up with the rapidly improving Internet speeds of communities with greater access to robust networks. This makes the Appalachian Region less attractive for ICT and tech-based companies, and it makes it difficult for ARC residents to access the next generation of innovative services offered via the Internet.

(continued)

Table 8-3. Key Policy Issues for Direct Broadband Deployment (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Last-mile connectivity (sometimes referred to as "first mile")	The final wireline segment of a broadband Internet network that reaches the premises of end users. This is a frequent bottleneck and can be expensive to resolve.[f]	Internet access providers may not serve some areas at all or may provide inadequate last-mile connections that cannot support rapidly evolving needs for high-capacity broadband Internet. Public-sector investments in "middle-mile" broadband Internet networks can reduce the costs to private companies of operating in and entering the last-mile marketplace.[g]	Where there is insufficient investment by the private market, ARC should consider how to best spur last-mile connectivity for Appalachian communities possibly by investing in middle-mile networks, supporting community investments in their own networks, or facilitating public–private partnerships for the last mile.[h]
Market Options			
Electric cooperatives, municipal electric utilities, and new entrants into the marketplace	Electric cooperatives are well positioned to deploy broadband Internet networks in rural areas. Ten to 15% of electric cooperatives may ultimately carry out some form of broadband Internet deployment to markets that are underserved by incumbent Internet service providers.[u] Similar to electric cooperatives, municipal electric utilities are well positioned to deploy broadband Internet networks in their service areas. In fact, municipal electric utilities have been pioneers in the broadband Internet space, both because they have the infrastructure in place that eases deployment and a high internal demand for communications services.	Given that they are owned by their customers, cooperatives and municipal electric utilities can be more attuned to community needs. Electric cooperatives and municipal electric utilities may be able to leverage funding from other federal sources (e.g., FCC, USDA Rural Utilities Service), and they have significant knowledge and expertise from years of providing electricity service that will carry over well to broadband Internet deployment.	ARC should determine the markets where electric cooperatives and municipal electric utilities currently operate in the Appalachian Region and which of those markets lack adequate service from incumbents. In those cases, ARC can explore partnerships with electric cooperatives. ARC can also support removal of barriers to entry by electric co-ops and municipal networks.
Public–private partnerships	Models for public–private partnerships for broadband Internet deployment include: • Private sector led • Nonprofit led consortium • Government led and private supported • Joint ownership A common model is for a municipality to build and own the broadband Internet network and then lease it to private Internet service providers.[j]	The private sector alone may not deploy adequate broadband Internet networks in rural areas because of low population density and more difficult topology. Public–private partnerships can help overcome these issues by leveraging public funds, community assets, local leadership, and private-sector expertise and capital.[k]	ARC cannot make grants directly to private companies. However, as examples show, public–private partnerships can be an effective model for deploying broadband Internet in rural areas. ARC could collect and disseminate information about public–private partnerships and encourage grantees to consider public–private partnership options for deployment, improvement, and expansion of local broadband Internet networks.

(continued)

Table 8-3. Key Policy Issues for Direct Broadband Deployment (continued)

[a] Federal Communications Commission. May 20, 2014. "IP Transition." Accessed at https://www.fcc.gov/guides/ip-transition on August 1, 2015.

[b] Ibid.

[c] Public Knowledge. May 11, 2015. "The Impact of Technology Transitions on Rural Communities." Accessed at https://www.publicknowledge.org/news-blog/blogs/the-impact-of-technology-transitions-on-rural-communities.

[d] Federal Communications Commission. January 18, 2013. "FCC'S Broadband Acceleration Initiative to Foster Gigabit Goal." Accessed at https://apps.fcc.gov/edocs_public/attachmatch/DOC-318489A1.pdf on August 1, 2015.

[e] Barkis, Will. March 17, 2015. "The Gigabit Age is Upon Us." TechCrunch. Accessed at http://techcrunch.com/2015/03/17/the-gigabit-age-is-upon-us/#.giykhl:b4rU on August 1, 2015.

[f] Community Broadband Networks. "Glossary Terms." Accessed at http://muninetworks.org/glossary/1#term17.

[g] The Executive Office of the President. January 2015. "Community-based Broadband Solutions." Accessed at https://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf on August 1, 2015.

[h] For example, see case 7.3.10, ARC's grant in Youngstown, Ohio.

[i] Craig Settles. July 2014. "Electric Co-ops Build Rural Broadband Networks." *Broadband Communities Magazine*. Accessed at http://www.bbcmag.com/2014mags/July/BBC_Jul14_ElectricCoops.pdf on August 1, 2015.

[j] National Telecommunications & Information Administration. January 2015. "BroadbandUSA: An introduction to effective public–private partnerships for broadband investment." Accessed at http://www2.ntia.doc.gov/files/ntia_ppp_010515.pdf on August 1, 2015.

[k] Ibid.

Policy issues and trends for installing direct broadband continue to reveal a myriad of complexities for ARC to navigate in its operations and grantmaking. Issues of deploying last-mile access to households and capacity for broadband Internet to be equipped with the necessary speed to handle next-generation services will continue to plague rural regions. Also, the marketplace of providers best positioned to provide broadband Internet to rural communities is ever-changing. ARC is well positioned to provide the Appalachian Region with access to information about how to decipher the best broadband Internet provider for each community. Lastly, the needed infrastructure to position rural communities to best take advantage of future broadband Internet access is evolving rapidly. It will be important for ARC to review grants to ensure that communities are requesting an infrastructure to best position the community to readily evolve with the technology.

8.2.2 Indirect Broadband Policy Issues

Indirect broadband refers to projects "inside the building" and includes networking equipment and other telecommunications tools that depend on broadband Internet access (see **Table 8-4**). Key trends that are presently affecting the ability of rural communities to participate in a connected society and economy are the increased integration of devices with the Internet and Internet-based data storage and computing. These

Table 8-4. Key Policy Issues for Indirect Broadband

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Devices			
Mobile device penetration	Increased use of devices such as smartphones and other mobile devices connecting to the Internet is shifting demand to a need for more mobile broadband Internet networks. As of 2014, there were 3.6 billion unique mobile subscribers globally and a projected 4.6 billion in 2020.[a]	Additional spectrum will be needed to allow growth of broadband Internet mobile devices. The International Telecommunications Union met in Geneva (2015) to determine how collaboration can harmonize spectrum to enable growth. If there are inadequate mobile broadband Internet networks, the increasing number of people using mobile devices to access information will be either unconnected or connected with slower speeds.	Decisions on how to harmonize the spectrum and the FCC's involvement in spectrum assignment will be important for Appalachian communities. ARC may consider investing with other entities to fund research on how the available spectrum will affect the Appalachian Region. Ensuring access to mobile broadband Internet networks and affordable devices and services will be important for people living in Appalachia to fully participate in the information age.
Connected devices to the Internet or the Internet of Things	A disruptive way of working and living whereby machines are able to communicate with each other through cloud computing, and applications and data sensors enable a complex set of technologies, industries, and applications to interact in new and "smart" ways.[b]	Growth of connected devices is expected to be explosive with wide-ranging impacts for households and businesses. Gartner, Inc. estimates a 30% increase in connected devices from 2014 to 2015 with 4.9 billion connected things in 2015. This number is forecasted at 25 billion by 2020.[c] Measurements from connected devices and sensors will be sent to "the cloud"" for analysis. Control information will be sent back. The amount of data passed by each sensor will be small, but the amount of traffic in aggregate will be huge.	If the Appalachian Region does not have access to ample networks to support the growth and use of connected devices, residents and businesses will be precluded from the efficiencies, increased productivity, and lower costs that connected devices offer. Thus, this Region will experience an additional negative impact on its ability to access educational, social, and economic opportunities.
Internet Data Storage and Computing			
Cloud computing	Cloud computing refers to a variety of Internet-based computing services. Data storage and computing is occurring over the Internet or "in the cloud" instead of on a user's hard drive.[d]	Cloud computing offers a number of benefits: costs of operation are reduced; cheaper computers can now use sophisticated computers at the data center; need for in-house IT personnel to service computers and technical equipment is reduced; ability to work off site at any time is enhanced; platforms are stronger to more effectively enable collaboration across different software platforms.	As cloud computing continues its penetration of the U.S. IT market, ARC may need to counsel grant applicants to consider purchasing services from a cloud computing service rather than purchasing expensive hardware/software equipment. It will preclude expensive in-house IT staff as well. Broadband Internet access by Appalachian Region citizens in the educational, business, religious, and nonprofit fields or homes will still need the last-mile access to take advantage of this new cost-effective trend.

(continued)

Table 8-4. Key Policy Issues for Indirect Broadband (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Telehealth			
Medical insurance for telehealth projects	A lack of speed and stability in Internet broadband Internet reduces the ability of doctors to provide care via telehealth projects. Insurers will not insure telehealth that is unreliable. The effectiveness of programs such as the Rural Health Care Program of the USF, including the Healthcare Connect Fund, is diminished because they cannot be used in regions without quality broadband Internet.	Residents in the Appalachian Region are typically in poorer health, are older, and experience higher rates of poverty. Lack of affordable quality care exacerbates these conditions. Telehealth helps expand health care access and provide training to allied health professionals.	ARC may want to monitor communities at risk of losing access to rural health care programs that increase access to residents at reduced costs. ARC efforts can be better coordinated with states, federal programs, and nonprofits to ensure broadband Internet quality is stable and reliable to support telehealth equipment.

[a] GSMA. "The Mobile Economy 2015." Accessed at http://www.gsmamobileeconomy.com/GSMA_Global_Mobile_Economy_Report_2015.pdf on August 1, 2015.

[b] Burrus, Daniel. No date. "The Internet of Things is Far Bigger than Anyone Realizes." *Wired*. Accessed at http://www.wired.com/insights/2014/11/the-internet-of-things-bigger/ on August 1, 2015.

[c] Gartner. November 11, 2014. "Gartner Says 4.9 Billion Connected 'Things' Will Be in Use in 2015." Accessed at http://www.gartner.com/newsroom/id/2905717 on August 1, 2015.

[d] Griffith, Eric. April 17, 2015. "What is Cloud Computing?" *PC Mag*. Accessed at http://www.pcmag.com/article2/0,2817,2372163,00.asp on August 1, 2015.

trends will continue to grow in significance into the future. A policy area of importance for rural communities in indirect broadband Internet is federal government programs that enable access to health care via broadband Internet.

The policy dynamics affecting the ability of people and community organizations to use equipment and networks supported by broadband Internet underscore the risk that the Appalachian Region faces in ensuring quality access. Without this access, the Region's ability to be competitive in terms of a place to both do business and participate in the socioeconomic benefits of a digital age will likely diminish. To further compound these issues, the ability of doctors to provide cutting-edge telemedicine to rural areas will deteriorate, making it more difficult for residents of rural Appalachia to access health care. ARC should monitor policy developments in spectrum allocation and guide grantmaking that best positions the Appalachian Region to evolve with the speed requirements and demands of devices reliant on broadband Internet to perform consistently and accurately.

8.2.3 Applications of Broadband Policy Issues

Applications of broadband refer to projects, programs, and services that provide information using broadband Internet, such as distance learning, e-payment systems, and EMRs, that will enable such new doctor–patient initiatives as personalized medicine and precision medicine.[144] The key policy issues for applications of broadband Internet touch on some of ARC's program areas such as health, education, training, and public safety (see **Table 8-5**).

As noted above, policy implications of issues related to broadband Internet applications are significant. Depending on how issues are resolved and Appalachian communities respond to policy developments, the health, public safety, and basic access to education stand to deteriorate and thus further compound issues for the Appalachian Region's socioeconomic health. ARC can help prepare communities for addressing these issues by serving as an information liaison and convener between the federal government, states, and Appalachian communities. Low-cost efforts to understand state laws for telehealth and distance learning, for example, can begin to bridge a stronger understanding for all organizations involved on ways to advance policy to facilitate greater use of telehealth, distance learning, and access to digital class curricula.

[144] Tailoring of medical care, including prevention, diagnosis, and treatment, to individual characteristics and preferences.

Table 8-5. Key Policy Issues for Applications of Broadband

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Legal Issues			
Legal barriers to telemedicine	A variety of legal barriers constrain (or facilitate) the use of telemedicine including, but not limited to: • Cross-state barriers to telemedicine: Some states have decided to team up with each other to allow cross-border telemedicine. Ten state medical boards have issued specialized certificates or licenses for physicians to practice medicine across state borders through telehealth technology.[a] • State parity laws for private insurance coverage: Telemedicine parity laws that are being implemented by states require private insurers to cover telemedicine-provided services comparable to that of in-person services. Twenty four states have enacted some form of telemedicine parity laws.[b] • Medicaid policies: In December 2013 the Center for Medicare & Medicaid Services proposed rule changes for physician fees to expand coverage for telehealth services. As of 2015, 48 state Medicaid offices provide reimbursements for at least some telehealth services.[c] • State employee health plans: Roughly half of state employee health plans include some level of coverage for telemedicine services. Given that most states self-insure, this is an area for improvement.[d]	Telemedicine can improve the quality of patient care, afford patients time savings and travel savings, decrease system- wide costs, and be used to more effectively monitor chronic illnesses. Until laws are rationalized at state, regional, and federal levels, the full benefits of telemedicine could be constrained. Alabama and Tennessee are the only two ARC states that have issued specialized certificates for physicians to perform cross-state telehealth services.	Rural communities have the most to gain from continued growth in telemedicine services (or stand the most to lose from barriers that artificially limit telemedicine). ARC could help pave the way for greater telemedicine practice by creating a working group on ways states can normalize telemedicine laws. Bringing together medical societies, hospital associations, medical schools, state health directors, and a representative of the federal government may help advance telehealth in the Appalachian Region.
Service Delivery			
e911 needs coordination with FirstNet	Police officers, firefighters, paramedics, and other public safety entities need a dedicated nationwide wireless broadband Internet network. After 9/11, a law was passed to enable this. NTIA is administering FirstNet.[e] Today's 9-1-1 systems support voice-centric communications only and are not designed to transfer and receive text messages, videos, or photos. The next generation 9-1-1 rules, adopted January 15, 2015, by the FCC, seek to remedy this.	Without greater coordination between next-generation 9-1-1 and FirstNet, first responders and other public safety entities will be ill-prepared to respond to emergencies in rural regions.	While multiple paths of development can be useful in early stages of developing next-generation technologies, this exposes ARC's investments in public safety telecommunications systems to more risk. To mitigate risk of making the wrong bet and minimize stranded investment, ARC could assign a staff person to monitor these two areas (in Washington meetings)

(continued)

Table 8-5. Key Policy Issues for Applications of Broadband (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
			and provide a blog on these activities to Appalachian regional public officials who have a "need to know" about the health and safety sectors.
Schools are shifting to digital curricula and e-textbooks	Schools at all levels are shifting more to digital delivery of content and e-textbooks. This includes online homework assignments that presume students have access to the Internet and online access to community colleges-dual enrollment classes.[f]	Those without access to the Internet at home will also lose access to books and coursework that is becoming standard in schools. Thus, these students will lack access to resources that advance learning. Some Internet providers, such as Comcast, have initiatives that offer lower-priced Internet services to families based on income levels. These programs are offered only in certain providers' markets.	It is becoming more important to ensure that students and families have access to the Internet either at home or at the very least at accessible community anchor institutions. A yearly survey of schools in the Appalachian Region might provide some action items for potential Requests for Proposals (RFPs) related to school technology issues and access to networks during afterschool hours.
Certification issues surrounding distance learning for teachers	Certification issues for online distance learning are not harmonized across states, sometimes causing difficulties for teachers who teach via satellite, which limits student access to courses.	Distance learning offers the opportunity to gain new certifications for skills that allow people to work with future technologies, yet to be discovered. With digital communications becoming worldwide and educational institutions assuming a worldwide catchment area, this problem could be exacerbated. Further, a shrinking number of teachers in rural areas that may limit class options for rural students could be expanded through distance learning.	ARC could work with the leaders of the education communities in their Region to assess teacher shortage issues and potential solutions with distance learning. A survey of ARC states' education laws could help ARC review salient issues related to distance learning and inform ARC's grantmaking accordingly.

[a] Gruessner, Vera. May 6, 2015. "Laws Affect Adoption of Telemedicine Across State Borders." mHealth Intelligence. Accessed at http://mhealthintelligence.com/news/laws-affect-adoption-of-telemedicine-across-state-borders on August 1, 2015.

[b] Thomas, Latoya and Capistrant, Gary. May 2015. "State Telemedicine Gaps Analysis." American Telemedicine Association. Accessed at http://www.americantelemed.org/docs/default-source/policy/50-state-telemedicine-gaps-analysis---coverage-and-reimbursement.pdf on August 1, 2015.

[c] Ibid.

[d] Ibid.

[e] FirstNet. Homepage. Accessed at http://firstnet.gov/ on August 1, 2015.

[f] Many new organizations are springing up to look at the issue of digital learning. DigiLearn, a nonprofit with bipartisan board members and foundation support, defines its vision for education. "All learners fully prepared by an innovative culture of life-long learning to flourish as contributing citizens in an increasingly technology-driven world. Digital Learning Institute. Homepage. Accessed at http://www.digitallearninginstitute.org/ on August 1, 2015.

Source: RTI, Various.

8.2.4 Broadband Availability Policy Issues

Many programs are aimed at increasing the availability of broadband Internet at the national, state, and local levels. Of particular importance are the programs that offer funding to increase broadband Internet availability. These programs may be essential to broadband Internet availability (as is the case with the FCC's E-rate program and CAF), and they shape how broadband Internet is offered through the program's requirements.

For example, the FCC recently offered funding to major Internet service providers to build out networks in remote areas across the county through the CAF program, but providers are only required to build out networks capable of reaching speeds of 10 downstream/1 upstream Mbps. Going forward, ARC can monitor funding programs and advocate for program requirements that would enhance the availability of truly robust broadband Internet networks.

In general, greater use and awareness about federal and state government funding opportunities may strengthen Appalachian communities' access to outside resources. ARC can monitor the E-rate program to ascertain which of the Appalachian communities are using E-rate and offer grants to strategically complement E-rate resources. If funding for E-rate fluctuates, ARC can adjust its funding strategies to continue to maximize the FCC's program to enhance opportunities for rural Appalachian communities to improve broadband Internet adoption for schools and libraries. Similarly, ARC can raise awareness through its telecommunications and technology portfolio about access to federal government funds to support broadband Internet. As these programs adjust in their resource allocation and guidelines, ARC can adjust its grantmaking to best complement existing resources (see **Table 8-6**).

Table 8-6. Policy Issues for Adoption of Broadband

Policy Issue	Summary	Why Important	Implications for ARC
E-rate Program	An FCC program that helps schools and libraries obtain affordable broadband Internet. Discounts for support depend on poverty level and urban and rural location. Modernization of the fund took place in 2015, which expanded connectivity and reach. It also allowed for more wireless services in classrooms.[a]	The degree to which the FCC adjusts the spending cap and requirements for E-rate will affect the ability of schools and libraries in low-income regions to access these resources for direct and indirect broadband Internet.	ARC and the E-rate program have similar goals. ARC can monitor how E-rate is operating so that ARC can best complement E-rate's activities with coinvestments in connectivity. ARC can also provide guidance to interested communities, schools, and libraries in the Appalachian Region.
Awareness about federal and state funding for broadband Internet	When programs are being designed or modified, the FCC asks for specific input to shape the program. For example, the FCC is currently soliciting comments on whether and how to expand its "Lifeline" program, which could have a major impact on families in low-income rural areas. When programs are underway, there is often a lack of understanding and information about funding opportunities for broadband Internet that exist across federal and state government.[b]	Groups seeking funding may not realize the extent of current U.S. government funding for broadband Internet and thus do not take advantage of opportunities to increase access. Additionally, the FCC uses comments submitted during the designated comment period to make rules and procedures for various funding programs.	ARC staff can track the comment periods for major funding programs and submit comments when appropriate. ARC can also compile and disseminate information about funding opportunities to interested parties within the Appalachian Region.[b] Further, ARC can work with these funding agencies through semiannual meetings or other modes of communication to strengthen awareness about the needs of ARC and other rural communities.

[a] FCC. June 30, 2014. "Answers to Common Questions about the E-Rate Modernization Proposal to Get Wi-Fi in ALL Schools and Libraries." FCC Blog. Accessed at https://www.fcc.gov/blog/answers-common-questions-about-e-rate-modernization-proposal-get-wi-fi-all-schools-and-librarie on August 1, 2015.

[b] As an example, Senator Kirsten Gillibrand compiles a list of U.S. government funding agencies and associated opportunities. Gillibrand, Kirsten E. 2015. "A Guide to Broadband Funding Opportunities: How to Navigate the Funding Process." Accessed at http://www.gillibrand.senate.gov/imo/media/doc/Gillibrand%20Broadband%20Funding%20Guidebook%202015.pdf on August 1, 2015. NTIA is also developing a comprehensive list of funding sources within the federal government.

Source: RTI, Various.

8.2.5 Broadband Adoption and Utilization Policy Issues

Adoption and utilization policy issues affect the ability of communities to encourage greater use of broadband Internet in ways that maximize the benefits of that use. Adoption efforts may include digital literacy programs designed to encourage community members to take advantage of online education and training programs. Utilization efforts tend to focus on how individual users can take optimal advantage of the advanced communications technologies, depending on the user's particular circumstances. For example, if the user is a business, utilization efforts may help the company use broadband Internet more effectively, by taking advantage of teleworking, eCommerce, online content delivery, and other means appropriate to that business.[145] ARC could play a significant role in identifying ways for Appalachian communities to make the most of their existing connections.

8.2.6 Cross-Cutting Broadband Internet Policy Issues

Policies in this section are relevant to all functions of improving access to broadband Internet and the ability of communities to participate in the digital age. We summarize the role of public–private partnerships, dig and wire once policies, net neutrality, legal harmonization, cyber security, and tax policies (see **Table 8-7**). These policy issues are deeply complex with many layers, intricacies, and invested stakeholders. We summarize them to highlight how each issue is at play for the Appalachian Region and why it is important for ARC to be mindful of these issues as it awards grants in the telecommunications and technology program. Greater understanding about the landscape of cross-cutting policy issues will leave ARC in a better position to target and adapt its investments for impact.

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[145] Curri, Michael and Adams, Doug. No date. "Change Is Hard…So Is Utilization." Strategic Network Group. Accessed at http://sngroup.com/tag/meaningful-broadband-use/ on August 1, 2015.

Table 8-7. Cross-Cutting Policy Issues

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Net neutrality	The concept that Internet service providers should not be able to block, slow, or otherwise manipulate open access to lawful content and devices. For example, several content companies, most notably Netflix, complained that Internet access providers were intentionally slowing or blocking their content because it was data intensive—or alternatively were charging more for an Internet "fast line." Net neutrality advocates argued this violated the spirit of an "open Internet" where content is delivered on a neutral basis. Some advocates of "network neutrality" refer to the concept as "open access" and claim that it also requires Internet service providers to make their networks available to other providers on a wholesale basis. The federal broadband Internet stimulus programs (BTOP and Broadband Initiatives Program) had such a requirement, but the FCC's current Open Internet rules do not.	For years, the FCC and the courts have gone back and forth on how to enact open Internet rules. Most recently, the FCC elected to reclassify certain types of broadband Internet under Title II of the Communications Act of 1934. Doing so gave the FCC more power to regulate broadband Internet services in order to impose open Internet rules, which require broadband Internet service providers to refrain from slowing and blocking content, etc. Although in the recent Open Internet Order the FCC declined to regulate most areas involving broadband Internet services, there is concern that the Order could ultimately lead to federal regulation of Internet prices and access and require broadband Internet service providers to allow wholesale access to its networks. The relationship between net neutrality and completion is also controversial. Advocates claim that requiring Internet service providers to make their networks available to others will enhance competition. Opponents claim that forced access discourages investment ultimately reduces competition or produces competition only low-quality services.	ARC can continue to support the core values and protections the Open Internet Rules currently provide but should continue to follow both sides of the debate. ARC is in a position to provide useful clarifications about the Open Internet rules to consumers, communities, and potential service providers.

(continued)

Table 8-7. Cross-Cutting Policy Issues (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Dig and wire once/Co-investment	Practices that minimize the number and scale of excavations when installing telecommunications infrastructure in highway rights-of-way and other public and private development such as water/sewer systems, electric lines, new buildings, and towers.[a] Some municipalities are enacting "dig once" policies as a way to encourage more cost-effective deployment of broadband Internet. Policies can include legally requiring developers to install open access conduits, partnering with contractors on installing open access conduits when other underground utilities are installed, and incorporating open access conduits when repairing or replacing underground utilities underneath roads and sidewalks. Additionally, some communities have gone a step further and laid fiber any time there was an underground infrastructure project.[b]	The largest cost for deploying broadband Internet is the construction phase—digging and burying fiber optic cables underground. Careful planning, mapping of conduits, and communication with telecommunications providers about conduit locations is essential. Proponents believe "dig once" is one of the more simple solutions to decreasing the costs of deploying broadband Internet. It can also can cut the costs of all utility deployments, not just broadband Internet deployments.[c] Communities that have laid fiber during other infrastructure constructions have also been attractive to private-sector investors.[d]	There are opportunities for ARC to meet with county/state/municipal officials in the Appalachian Region and begin a dialogue on the "dig once" policy. In addition, educational materials and draft legislation from other municipalities and county governments could be shared as models. In the mountainous regions of Appalachia, "dig once" also has a positive effect on the environment. Duplicate digging through rock and stony soils and across mountain streams for utilities placement has the potential for increased environmental damage.

(continued)

Table 8-7. Cross-Cutting Policy Issues (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Local choice community networks	Legal barriers, often at the state level, make it difficult for communities in some ARC states to play a meaningful role in broadband Internet deployment. Local choice is the principle that local communities should have the authority to make choices about the best broadband Internet infrastructure for their communities, including working with willing incumbents, owning networks, or working with a private partner.[e]	Recently, there has been much debate and legal activity regarding this issue, yet the ability of communities to exercise local choice remains uncertain. Approximately 20 states have legal measures that limit the ability of municipalities to invest in or expand high-speed broadband Internet networks because of concerns about the public sector competing with the private sector and limiting public exposure if a network is unsuccessful. Local choice advocates believe that the private sector has failed to make adequate investments in many rural communities and that the communities themselves can play a significant role in rectifying such market failures.[f]	Appalachian communities need more specific education on the options available to underserved communities, including attracting private partners, planning, funding, and managing community. ARC can provide educational opportunities for these communities through regional sessions where these issues are discussed and debated. A good example of a textbook on these issues is a handbook like the *New Mexico Community Broadband Guidebook*.[g] Community network planning must be representative of potential large users, technologists, funding specialists, local government both county and municipal planners, influential leaders, and organizations (e.g., realtors).
Cybersecurity/ privacy of data	Practices, policies, and technologies that protect computers, networks, programs, and data from unintended or unauthorized access, change, or destruction.[h]	As the world becomes more interconnected in general, data security and privacy will be a growing concern for all users of the Internet—households, businesses, community anchor institutions, and governments. If Internet users think data privacy is compromised, the types of Internet applications that people are willing to use could be limited.	As ARC makes investments in the telecommunications and technology portfolio, it will need to consider how conducive infrastructure, equipment, operating software, and applications will be for the evolving needs for greater cyber-security and data privacy. Educational sessions on cybersecurity practices and data privacy laws and their implementation and practice will be important in a region such as Appalachia.

(continued)

Table 8-7. Cross-Cutting Policy Issues (continued)

Policy Issue	What Is It?	Why Is It Important?	What Are the Implications for ARC?
Tax policy	Tax policy at the federal, state, and local levels is not optimized to fully support broadband Internet deployment and uptake.	Tax policy can have significant impacts on the behavior of markets; thus making it easier or more difficult to provide, access, and benefit from the Internet.	ARC can survey the ARC states and see if there are incentives and disincentives built into their tax policies. A review of the ARC states could also note the investment from state budgets for the past few years. A document of effective tax policies across ARC states could spur the 'copycat principle' whereby states with less effective tax policies adopt more effective tax policies from other ARC states.
Broadband Opportunities Council	A White House initiative bringing together over 25 federal departments and agencies to devise ways to support communities seeking broadband Internet investment and deployment.	The Broadband Opportunities Council recently published an initial report listing the ways the federal government can encourage investment in community broadband Internet, coordinate to encourage broadband Internet deployment, or reduce federal barriers that make broadband Internet deployment more difficult.	ARC can develop a relationship with the Broadband Opportunities Council to provide the Council with its perspective on broadband Internet deployment and adoption.

[a] Federal Highway Administration, Office of Transportation Policy Studies. October 2013. "Minimizing Excavation Through Coordination." Accessed at https://www.fhwa.dot.gov/policy/otps/policy_brief_dig_once.pdf on August 1, 2015.

[b] Dale, Bradley. Aug. 24, 2015. "Google Fiber and AT&T Like Cities That Lay Fiber, Public IT Veteran Says; Gail Roper Did Work in Kansas City, Austin, and Raleigh that Made Each City More Attractive to Google Fiber." The Observer. Accessed at http://observer.com/2015/08/google-fiber-and-att-like-cities-that-lay-fiber-public-it-veteran-says/ on August 1, 2015.

[c] Center for Innovative Technology. No date. "Broadband Policy Assessment." Accessed at http://www.wired.virginia.gov/wp-content/uploads/Broadband/Virginia-Resources/Policy-Assessment-Tool-Guide.pdf on August 1, 2015.

[d] Dale, Bradley. Aug. 24, 2015. "Google Fiber and AT&T Like Cities That Lay Fiber, Public IT Veteran Says; Gail Roper Did Work in Kansas City, Austin, and Raleigh that Made Each City More Attractive to Google Fiber." The Observer. Accessed at http://observer.com/2015/08/google-fiber-and-att-like-cities-that-lay-fiber-public-it-veteran-says/ on August 1, 2015.

[e] Coalition for Local Internet Choice. Homepage. Accessed at http://www.localnetchoice.org/on August 1, 2015;

The Executive Office of the President. January 2015. "Community-based Broadband Solutions." Accessed at https://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf on August 1, 2015.

[f] Wyatt, Edward. November 9, 2014. "Communities Fight State Laws That Can Divide Broadband Access." *New York Times.* Accessed at http://www.nytimes.com/2014/11/10/technology/in-rural-america-challenging-a-roadblock-to-high-speed-internet.html?_r=0 on August 1, 2015.

[g] New Mexico Department of Information Technology. March 2013. "Community Broadband Master Plan Guidebook." Accessed at http://www.ctcnet.us/NewMexicoCommunityGuidebook.pdf on August 1, 2015.[h] University of Maryland University College. No date. "Cyber Security Primer." Accessed at http://www.umuc.edu/cybersecurity/about/cybersecurity-basics.cfm on August 1, 2015.

Source: RTI, Various.

Even a brief summary of cross-cutting issues facing broadband Internet access, provision, and deployment underscores the hyperdynamic policy environment for the organizations, agencies, and individuals involved. The stakes are high, with significant potential for winners and losers to emerge. Certain policy directions could make it much easier or much more difficult for rural communities to access and use broadband Internet. Some of the cross-cutting issues such as dig and wire once policies and public–private partnerships will be driven at the local and state levels, while other issues, such as net neutrality, will be dealt with at the federal level. ARC can stay abreast of these issues at all levels and monitor how the Region will be affected by rules and regulations as they unfold. ARC can navigate this volatile policy climate and adjust its course for investment in broadband Internet and its applications and adoption accordingly.

8.3 SUMMARY

In many ways, the contexts in which ARC grants will be made in the future will be fundamentally different and more complex than the contexts in the past, creating the need for ARC to take a more proactive role in providing stakeholder communities with the information and tools they will need to successfully adapt the power of broadband Internet to improve their prospects. Given some of the uncertainty in the policy environment, ARC will need to mitigate risk and adjust course as it monitors policy developments at the local, state, and federal levels. Recommendations on this and other topics are more fully developed in **Section 9**.

9 Findings and Recommendations

The Internet pervades every aspect of our lives and is changing every field of work. As businesses, workers, and households become dependent on information technology and being connected to the Internet, the more important it becomes to address and eliminate digital divide issues. As discussed in Section 2, these issues are more severe in the rural and economically disadvantaged communities served by ARC. It is critical to provide high-capacity, advanced broadband Internet and develop the capacity of individuals and organizations to effectively use the Internet so that all aspects of community economic development—health, education, training, business development, governance, and civic capacity—can be enhanced.

ARC's 2004 through 2010 telecommunications and technology program that funded over 300 projects was designed to help ARC address these precise issues and challenges. In this last section of the report, we synthesize the findings and conclusions from this evaluation and offer recommendations for ARC and other interested organizations to continue to positively affect rural regions through both broadband Internet deployment and supportive activities into the future.

In this section, we relay the themes, findings, and conclusions that emerged from the evaluation. We build on the literature review (**Section 4**) about the role of broadband Internet for community economic development and how it is evolving, the detailed analysis of the ARC grant portfolio (**Section 5**), survey findings (**Section 6**), case studies (**Section 7**), and the review of the policy landscape (**Section 8**) to offer overall findings and recommendations. The themes that surfaced fall within three main categories. We organized our findings and recommendations within these categories and discuss them further in subsections below so that policy makers and rural community economic development advocates can more readily connect their work to broader issues. The three overarching categories are as follows:

(1) Present and Future of Broadband Internet
   - Deployment
   - Adoption and utilization

(2) Pressing Needs for the Appalachian Region
   - Telehealth
   - Education and workforce
   - Job creation

(3) The Role of ARC Moving Forward
   - A nexus for information
   - A streamlined grant operator

We recognize that under current funding levels, ARC is not positioned to act on all of these recommendations. Instead, our intent in this section is to lay out the spectrum of actionable items and important issues that rural telecom and telecommunications organizations and rural community and economic development advocates, including entities like ARC, can focus ideas for investing resources in ways that have the most potential for long-lasting impacts.

The findings and recommendations are meant to be guidance rather than prescriptions. Ultimately, ARC has limited resources and its member states are faced with difficult decisions about how to best prioritize ARC investments across all ARC program areas (e.g., education, health, energy) and within the telecommunications and technology program to address competing needs of ARC-designated counties. This evaluation acknowledges that ARC and other entities operating in the Region are faced with difficult decisions about trade-offs for investment in areas with great demands yet finite resources to meet those needs. We recognize that under current funding levels, ARC is not positioned to act on all of these recommendations. Instead, our intent in this section is to lay out the spectrum of actionable items and important issues that rural telecom and telecommunications organizations and rural community and economic development advocates, including entities like ARC, can focus ideas for investing resources in ways that have the most potential for long-lasting impacts.

We discuss each of these three thematic areas and underscore specific findings and recommendations within these overarching topics.

9.1 PRESENT AND FUTURE OF BROADBAND INTERNET

The first theme that captures findings and recommendations from the evaluation relates to examining the present and future of deployment and use of broadband Internet. This theme is important because how broadband Internet is deployed is complex and changing rapidly. We describe the related issues and ideas for action first for broadband Internet deployment and then broadband Internet adoption.

9.1.1 Deployment

Broadband Internet deployment surfaced as a significant issue throughout this evaluation. The research shows that broadband Internet availability has increased significantly since 2004 when ARC began its grantmaking for the associated portfolio under evaluation. Yet, as we demonstrate in the literature review (**Section 4**), the needs and uses of broadband Internet are surging and outpace availability. Identifying ways to deploy broadband Internet more efficiently, at competitive prices to rural users, and of a standard and speed that ensure performance will be critical for ARC and others to focus on.

Three dimensions within broadband Internet deployment relay the types of challenges and opportunities for increasing broadband Internet availability:

- competitive markets
- last mile or extending broadband Internet to households
- network infrastructure technologies

We discuss the findings and recommendations for each of these points below.

Competitive Markets

Finding #1: Broadband Internet access has increased in the Appalachian Region, but it has not kept pace with demands. The private sector alone cannot deploy broadband Internet at price points that rural markets can pay. New business models are needed to provide broadband Internet.

Recommendation #1: Although ARC cannot award grants to private companies to make deployments in rural areas more attractive, ARC and others can help rural

communities develop innovative approaches to obtaining the advanced communications capabilities they need. ARC can help educate communities about the various models that are emerging across the United States today—including working with willing incumbents, establishing public–private partnerships, working with a municipal or cooperative electric utility, working with telephone cooperatives, and many more. ARC and others can educate communities by gathering and disseminating relevant information; conducting seminars, webinars, and workshops; and connecting interested communities to other communities that have launched successful initiatives and to knowledgeable public and other organizations.

"Local choice" is the principle that communities should have the right to play a major role in selecting the broadband Internet model that best meets their community's needs. Hundreds of communities across the United States have successfully embraced some form of local choice.[146] In particular, communities are increasingly turning to public–private partnerships as a model for broadband Internet deployment. Public–private partnerships between a combination of local government, the private sector, and nonprofit organizations can offer innovative approaches to increasing broadband Internet access when the private sector alone is not meeting demand. Despite the fact that ARC cannot award grants to a private company, ARC can encourage grantees to learn about these innovative models as potential solutions for communities to expand their networks.

Communities may also find it useful to work with Electric Cooperative Associations and municipal electric utilities to deploy broadband Internet. Municipal electric utilities were deploying fiber to entire communities years before the private sector did, and they often have the technical expertise, infrastructure, and ethic of universal service necessary to make a broadband Internet network a good investment. One way for ARC and others to contribute to this potential is to review

[146] See the Community Broadband Networks Community Network Map. Accessed at http://muninetworks.org/communitymap on August 26, 2015.

communities, using the National Broadband Map,[147] within their Region that do not have networks that support the minimum speeds that the FCC classifies as "broadband"—currently at least 25 megabits per second down and 3 megabits per second up. Then ARC member states can work with relevant co-ops or municipal electric utilities to assess their willingness to offer broadband Internet services.

ARC is also well positioned to hold informal or formal learning sessions to explore this potential model. With a collection of information about how other communities have created successful co-op models, interested stakeholders including the electric co-op could explore potential options for greater deployment. If there is an indication of feasibility, ARC member states can follow up with a more detailed planning session such as a charrette[148] to craft a model that best suits the community and all parties involved.

Finding #2: Competitive markets ensure rural communities have a choice in broadband Internet providers, thus leveraging market forces to increase options, improve affordability, and drive down costs for consumers.

Policies and practices that further limit the availability of multiple service providers in rural areas will make it more challenging for rural communities to access affordable quality broadband Internet.

As a result of low population density and difficult topography, the Appalachian Region faces challenges in attracting service providers to deploy broadband Internet. Policies and practices that further limit the availability of multiple service providers in rural areas will make it more challenging for rural communities to access affordable quality broadband Internet.

Recommendation #2: ARC can continue to monitor the policy environment and local community practices to better ensure market competition in rural Appalachian communities.

At the state level, legal barriers can constrain community initiatives to accelerate broadband Internet deployment and promote competition. These laws can have significant adverse implications for the Appalachian Region's ability to deploy broadband Internet more effectively. On the positive side, local

[147] National Broadband Map. Accessed at http://www.broadbandmap.gov/about on August 26, 2015.

[148] The Town Paper. No date. "What is a Charrette?" Accessed at http://www.tndtownpaper.com/what_is_charrette.htm on August 26, 2015.

dig and wire once policies are beginning to take hold around the country, making it easier for broadband Internet service providers to consider investment in communities they might have previously considered too costly. With the significantly lowered costs of not having to pay to dig to lay the fiber, service providers find the lowered costs "market friendly" and thus more inviting for investment. This is spurring potential broadband Internet service providers to enter communities with sparser populations with difficult topographies that are now considered "fiber-ready."

ARC, its member states, local communities, and other rural advocates will be better prepared to position their Region for broadband Internet deployment if they stay aware of the status of policies that either limit or encourage greater service provision in rural regions.

ARC, its member states, local communities, and other rural advocates will be better prepared to position their Region for broadband Internet deployment if they stay aware of the status of policies that either limit or encourage greater service provision in rural regions.

Last Mile

Last mile connectivity is a second issue important to broadband Internet deployment that surfaced in our research. Last mile deployment refers to reaching a network to homes, businesses, and other end users. Last mile connectivity can be particularly difficult in in rural areas because of the difficult terrain and low population density.

Finding #3: Deploying broadband Internet to households is difficult and expensive, yet the need for this infrastructure is significant with similarly significant implications for the economic competitiveness and well-being of rural Appalachian residents.

Deploying broadband Internet to households is often expensive and can be difficult to achieve, especially in rural areas with sparse populations and difficult topographies. According to the survey respondents, extending broadband Internet infrastructure to households is an important need—68 percent of respondents who responded to a question about infrastructure needs cited last mile as one of their top concerns.

Recommendation #3: ARC should make last mile connectivity a priority in its education efforts to member states and relevant communities and, if possible, prioritize last mile in its grantmaking.

ARC and other stakeholders can conduct a low-effort assessment of its member states and the regions within those states about status of last mile connectivity using FCC's data so that regions without access can be prioritized for ARC grants.

Network Infrastructure Technologies

This infrastructure evolution is occurring against the backdrop of broader trends such as the exponential growth in the number of connected devices, reliance on cloud computing, and proliferation of mobile device penetration.

Broadband Internet networks are evolving with transitions like shifting from copper to fiber and robust wireless networks. This infrastructure evolution is occurring against the backdrop of broader trends such as the exponential growth in the number of connected devices, reliance on cloud computing, and proliferation of mobile device penetration (see **Section 4.3** and **Section 8.2**). These kinds of factors will be important when communities consider the kinds of last mile investments that will be most beneficial for them in the long term.

Finding #4: The technologies for broadband Internet networks are evolving rapidly as are demands on the broadband Internet infrastructure.

In the RTI survey, respondents cited that their biggest future need for broadband Internet infrastructure is technology upgrades. Seventy percent of respondents to this question said that infrastructure investment to support faster broadband Internet speeds and service was a top priority for their community.

Recommendation #4: ARC must monitor the technology evolution to avoid investing in short-term solutions or legacy technologies.

In this ever-changing technology evolution for broadband Internet, it is difficult to keep pace with the most appropriate technology investments for long-term impacts. For example, some existing wireless and copper cable systems are ill equipped and unable to meet future demands. Despite higher start-up costs, high-capacity fiber, fiber to the premises, and last mile technologies are proven to have a greater effect and longer lifespan than alternative transmission technologies, such as copper. ARC, member states, and communities can be savvy investors in broadband Internet with technical advisement on the most appropriate technologies for long-lasting deployment. ARC can serve as a clearinghouse of information for its communities, including providing information about the strengths and weaknesses of current and emerging technologies.

9.1.2 Adoption and Utilization

Once broadband Internet is available in an area, the major factors important for greater adoption that are most relevant to this evaluation are affordability, quality, and digital literacy.

Adoption and utilization are the next components of deployment that emerged in our research. Availability, or deployment, is a prerequisite for adoption, as discussed above in **Section 9.2.1**. Once broadband Internet is available in an area, the major factors important for greater adoption that are most relevant to this evaluation are affordability, quality, and digital literacy.

Affordability and Quality

Affordability issues (the price that end consumers pay) associated with broadband Internet service are closely tied to deployment issues. Affordability and quality are relevant for rural and urban areas alike, but these issues are often more pronounced in rural areas for a variety of reasons. Sometimes, prices for broadband Internet services in rural areas are similar to prices in urban areas but are at a lower level of quality (speed, reliability, bandwidth).

Finding #5: Affordability of quality broadband Internet services continues to be a barrier for the Appalachian Region.

Survey respondents ranked "lower monthly broadband Internet fees for consumers" as the top need their community faces related to better broadband Internet adoption (69 percent of respondents answered this question, or 69 out of 100). The limitations of the private sector's ability to provide affordable quality broadband Internet coupled with a hyperdynamic policy environment present a complex setting for organizations like ARC to best invest in rural broadband Internet. However, this fluctuating time also offers options for creative partnering and policy changes that can strengthen the availability of affordable and quality broadband Internet in rural communities.

Recommendation #5: ARC can encourage practices such as "dig once," policies such as local choice, and public–private deployments to help promote lower costs and greater competition for affordable, quality broadband Internet.

As ARC and member states review infrastructure plans in the Region, they can encourage such plans to incorporate a communications infrastructure installation when groundbreaking occurs for other utility work. This is one way to help lower the costs of broadband Internet installation.

As ARC and member states review infrastructure plans in the Region, they can encourage such plans to incorporate a communications infrastructure installation when groundbreaking occurs for other utility work. This is one way to help lower the costs of broadband Internet installation. ARC can also encourage practices and policies that ensure open and competitive markets in rural communities.

Digital Literacy

Digital literacy, also referred to as digital readiness, is one of the key indicators of whether an individual will adopt broadband Internet and be able to use it to its full potential.

Finding #6: There is a digital literacy gap between urban and rural areas.

Digital literacy was the second most highly ranked need for the Appalachian Region in terms of adoption (56 percent of respondents). Without digital literacy it is difficult to get libraries, schools, hospitals, businesses, and households to take full advantage of the information age.

Recommendation #6: ARC should continue to invest in digital literacy programs.

To maximize uptake of broadband Internet service, ARC can continue to complement investments in infrastructure with efforts to increase the digital literacy of ARC residents. In the 2004 through 2010 portfolio of grants, most investments in digital literacy focused on school-age children and job training. These are highly valuable areas to focus on. In addition, it would be useful to consider investing in the digital literacy of older populations since the population in the Appalachian Region tends to be older on average. One way to accomplish this would be to train librarians so that they could then share that knowledge with older residents in the community through training sessions and classes, for instance.

As these adoption strategies continue to be established, there are ways to enhance utilization of a network—for businesses, governments, individual users, and more. ARC and others can continue to play a role in identifying ways to improve utilization for various end users and work with its member communities to implement these utilization programs.

9.2 PRESSING NEEDS FOR THE REGION

Three pressing needs for community economic development emerged from our evaluation that are deeply rooted in the infrastructure and enabling capabilities of broadband Internet. They are the need for telehealth, education and workforce training, and job creation.

9.2.1 Telehealth

Three pressing needs for community economic development emerged from our evaluation that are deeply rooted in the infrastructure and enabling capabilities of broadband Internet. They are the need for telehealth, education and workforce training, and job creation.

Residents in the Appalachian Region are typically in poorer health, are older, and experience higher rates of poverty than more urban areas. Lack of affordable quality health care exacerbates these conditions. Therefore, Appalachian communities have the most to gain from telehealth services, which help expand health care access, improve the quality of patient care, afford patients time savings and travel savings, reduce costs for health systems, and provide training to allied health professionals.

Finding #7: A suite of legal barriers limits the benefits that telemedicine could have on the Region.

The myriad of laws at the state, regional, and federal levels make it more challenging for physicians to practice telemedicine, thus limiting its potential to reach rural patients.

The myriad of laws at the state, regional, and federal levels make it more challenging for physicians to practice telemedicine, thus limiting its potential to reach rural patients. Some examples of the legal barriers to telehealth include issues for cross-state telehealth networks, state laws that do not require private insurance providers to cover telehealth services, complex Medicaid policies, and state employee health plans that lack telehealth coverage.

Recommendation #7: ARC can continue and enhance information sharing with rural broadband Internet stakeholders about best practices for harmonizing laws, policies, and regulations.

Some communities are making headway in harmonizing laws and policies to facilitate rural telemedicine practice. ARC could help advance telehealth in the Appalachian Region by creating a working group to study ways states can normalize telemedicine laws by convening groups of key individuals from medical societies, hospital associations, medical schools, state health directors, and the federal government.

9.2.2 Education and Workforce

Broadband Internet is an extraordinary enabler that reduces the degree to which these obstacles of distance and access negatively affect students and workers eager to learn.

Ensuring quality education and workforce training is highly valued among most communities and regions because education and training are fundamental building blocks for healthy and vibrant societies. These needs are even greater in rural regions because of the lower levels of wealth, more sparsely population regions, and fewer job (and training) opportunities. Broadband Internet is an extraordinary enabler that reduces the degree to which these obstacles of distance and access negatively affect students and workers eager to learn.

Finding #8: Education and workforce training remain essential concerns for the Appalachian Region. At the same time, broader trends across the country indicate a greater reliance on broadband Internet for delivering educational content.

Residents in Appalachia are less educated than average,[149] while educational content is increasingly being delivered via the Internet across the country. Modern classrooms use the Internet reliant to access digital content such as online videos, digital textbooks, and web-based assessments. Distance learning programs enhance students' education by providing opportunities to access teachers and subjects outside of their school walls. Expanding broadband Internet access has significant implications for rural schools that are often constrained in the number of teachers and courses they can offer.

Additionally, e-learning will play a vital role in supporting lifelong learning outside of formal educational settings. The growth of free and low-cost courses offered on the web by universities and private companies like Coursera has opened up a world of opportunities for people around the globe. Massive open online courses are a potentially disruptive online learning model that challenges the status quo in higher education.

[149] According to 2009 through 2013 ARC data, the percentages of U.S. adults completing their high school diploma and bachelor's degree were 86.0% and 28.8%, respectively. The percentages of adults in the Appalachian Region were 84.6% and 21.7%, respectively. Refer to http://www.arc.gov/reports/custom_report.asp?REPORT_ID=61 for more granular statistics by state and county.

Recommendation #8: Continued support of education and workforce development through broadband Internet investments is critical. Also, ARC can play a coordinating role in educating communities about other federal programs that support education and workforce development like the FCC's E-rate program.

A sustained focus on education and workforce training that encourages digital literacy across communities will complement efforts focused on the deployment end of the spectrum.

ARC focused much of the 2004 through 2010 grant portfolio on projects that directly affected K–12 schools, teachers, community colleges, universities, and job training facilities using investments that spanned the broadband Internet technology spectrum such as Internet access, networking equipment, computers and devices for schools, curriculum development, teacher training, and worker training. A sustained focus on education and workforce training that encourages digital literacy across communities will complement efforts focused on the deployment end of the spectrum. ARC can also help communities even without granting them money by organizing and disseminating information about other programs, resources, and funding opportunities. For example, the FCC's E-rate program is an important resource that schools should be aware of, and as Finding #12 discusses, ARC can play a role as an information broker for E-rate and other programs. Specifically with E-rate, ARC can focus on helping communities obtain E-rate monies they need to deploy fiber broadband Internet access to schools and to retrofit classrooms with wireless equipment.

9.2.3 Job Creation

Finding #9: Communities in the Appalachian Region are less satisfied with job opportunities than other aspects of life. Broadband Internet access and speeds have a proven connection to increased economic development, and ICT jobs are a driver for the U.S. economy.

Job satisfaction in the Region was ranked lowest among other dimensions of everyday life satisfaction measures, according to our survey results

Broadband Internet can help alleviate some of these economic challenges by enabling business growth through new markets and education and training opportunities for new kinds of jobs.

Job satisfaction in the Region was ranked lowest among other dimensions of everyday life satisfaction measures, according to our survey results (see **Figure 6-12**). Our survey finding is consistent with unemployment and wage data. Unemployment rates in the Region tend to be slightly higher than the rest of the country,[150] and average pay tends to be considerably lower.

Broadband Internet can help alleviate some of these economic challenges by enabling business growth through new markets and education and training opportunities for new kinds of jobs. Businesses have found that the Internet is a meaningful platform for communicating with customers, delivering services, and managing business processes. Furthermore, ICT jobs are in demand and pay more than the national average.

Recommendation #9: ARC, communities, and states can collaborate to develop clear and stronger messages about broadband Internet's connection to building a more competitive economy.

ARC can help link the importance of broadband Internet to job creation by developing clear messages about this connection and seeding this information with its member states and regions. ARC can also require stronger communication elements within their grants that will help grantees build community buy-in (see Recommendation #13) and simultaneously build greater community awareness about the importance of broadband Internet to community vitality, including job creation.

9.3 THE ROLE OF ARC MOVING FORWARD

Looking to the future, ARC will continue to work in a dynamic time for the telecommunications industry, in which these types of investments will no longer be considered a novelty or luxury, but fundamental infrastructure necessary for development and well-being of the Region's residents.

Between 2004 and 2010, many of ARC's investments in telecommunications and technology were forward thinking in what was then an also rapidly evolving industry. We commend ARC for embracing this endeavor and investing in pilot projects that were unproven at the time. Looking to the future, ARC will continue to work in a dynamic time for the telecommunications industry, in which these types of investments will no longer be considered a novelty or luxury, but fundamental infrastructure necessary for development and well-being of the Region's

[150] According to 2013 ARC data, the U.S. unemployment rate was 7.4% compared with the Appalachian Region unemployment rate of 7.6%. Refer to http://www.arc.gov/reports/custom_report.asp?REPORT_ID=61 for more granular statistics by state and county.

residents. ARC can continue to be an effective contributor in this space through its grantmaking. ARC also has the potential to augment its role in rural broadband Internet deployment by adopting two practices: (1) playing a greater role as an information broker among Appalachian communities and interested parties and (2) streamlining and standardizing grant operations. These two recommendations are explained below in more detail. We offer these ideas as realistic, actionable items for ARC to consider. We also understand that these efforts may require additional resources for the telecommunications and technology program, which may not be feasible. Regardless, it is important to specify ideas for action so that progress can be made to the extent that resources allow.

9.3.1 ARC as an Information Nexus

ARC is well positioned to continue to be a real-time information nexus for communities in the Appalachian Region. ARC can engage in fact finding, monitor policies, and coordinate across agencies and other organizations for the benefit of communities that desire to improve their broadband Internet infrastructure.

Finding #10: Information that is current, comprehensive, and inclusive of the spectrum of possibilities and that accounts for current policies and regulations is valuable to project leaders in the field.

Our case studies revealed that there is continued interest among Appalachian communities in (1) having access to information such as best practice models, sources of financial and technical assistance, and other federal programming that helps communities better deploy and adopt broadband Internet

Our case studies revealed that there is continued interest among Appalachian communities in (1) having access to information such as best practice models, sources of financial and technical assistance, and other federal programming that helps communities better deploy and adopt broadband Internet and (2) gaining a better understanding of changes to the legal and regulatory framework and how those changes will affect their use of broadband Internet for economic and community development. Although ARC currently provides these services, with additional resources or partners, ARC can augment its function as an information nexus to increase its reach to relevant communities, the types of issues covered, and the frequency of information sharing.

If ARC is a more proactive information broker, ARC member states and communities can become better positioned to make more beneficial decisions about broadband Internet-related investments.

Recommendation #10: With more resources, ARC can augment its efforts to discover information, monitor policy developments, and share that information with its stakeholders.

ARC already functions as an information nexus. Priorities and concerns are shared among ARC-designated local development districts, state representatives, and the Commission, and grants and other information resources are transferred back to communities. ARC can elevate its role as an information nexus by increasing the following efforts:

- **Information discovery:** ARC can build on its partnerships with federal agencies, regional universities, and research centers to collect and relay the most up-to-date data on
  - broadband Internet access and adoption in Appalachian counties,
  - other existing funding programs in place, such as E-rate,
  - state and local policies that help or hinder telehealth and e-learning, and
  - resources such as relevant toolkits, such as the NTIA primer on public–private partnerships.[151]
- **Monitoring policy and program developments:** ARC can liaise more frequently with federal agencies, such as FCC, NTIA, U.S. Department of Labor, U.S. Department of Education, HUD, and USDA's Rural Utilities Service, and providers to continue to stay abreast of developments in ongoing and future programming for broadband Internet and the variety of policies influencing broadband Internet deployment and adoption. When formal announcements are made, ARC can continue to serve as an information clearinghouse by making updates available to communities in its service area.

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[151] National Telecommunications & Information Administration. January 2015. BroadbandUSA: An Introduction to Effective Public-Private Partnerships for Broadband Investments. Accessed at http://www.ntia.doc.gov/files/ntia/publications/ntia_ppp_010515.pdf on August 26, 2015 and on adoption best practices: National Telecommunications & Information Administration. May 2013. NTIA Broadband Adoption Toolkit. Accessed at http://www2.ntia.doc.gov/files/toolkit_042913.pdf on August 26, 2015.

- **A model for learning and information diffusion:** ARC and its member states and communities can build on efforts for virtual and in-person working groups as a real-time way to collect and disseminate information on priority areas such as health care, education and workforce training, and web-based tools for government services to identify issues, best practices, and opportunities for partnering. ARC and its member states and communities can also partner with the research community to hold policy briefings on deploying broadband Internet infrastructure, the various technology options to deploy (for example, whether aerial or buried), and key items to include in planning for broadband Internet deployment. Examples of best practices can be shared with municipal, county, and state officials in the Appalachian Region. Finally, mobile broadband Internet's strengths and weaknesses can be discussed in similar real-time forums and turned into podcasts.

Finding #11: Lack of resources (not enough time, funding, or staff capacity) were the biggest obstacles to grantees.

A lack of resources—such as time, funding, and staff capacity—consistently emerged from the surveys and case studies as one of the primary obstacles to achieving beneficial outcomes. We are not suggesting that ARC simply allocate more funding to grantees, but there are perhaps low- to no-cost ways to ensure resource capacity is enough to better support grantees to maximize benefits.

Recommendation #11: Build local capacity for planning and administering ARC grants.

As ARC potentially enhances its role as an information nexus, it can leverage this function by making ARC grantees aware of ongoing related programs, such as the Connect America Fund, E-rate, and others, to enhance the ability of projects to improve staff capacity, increase available funding, and adopt best practices during project implementation. ARC could also consider how to more effectively partner with and leverage funding from the private sector when feasible.

If requested by grantees and with more resources, greater access to ARC staff during the grant period could be done via videoconferencing and other web-based communication platforms to stay in closer communication with grantees.

9.3.2 ARC as a Grant Operator

Over the course of the research process, RTI observed a wide diversity of project types, beneficiaries, funding structures, and reporting quality. Although this diversity is indicative of the diversity of grants and needs in this space, it also reflected room to incorporate more strategic investments in ARC's portfolio. The grants database indicates that data collection during the 2004 through 2010 time frame was sporadic and inconsistent across projects. Improvements to ARC's grant operations will improve the quality of projects selected and effectiveness of grants. Findings and recommendations in this section address two elements of grants: (1) the RFP and proposal process and (2) the data collection and reporting process.

RFP and Proposal Process

Finding #12: The telecommunications and technology grantmaking was loosely structured, allowing for maximum flexibility for states to self-select the most desired projects for ARC investment.

Projects spanned the entire spectrum of infrastructure, adoption, and applications of telecommunications technology. As a result, the outputs and impacts from ARC investments range widely. The wide range of projects is indicative of a mix of federal, state, and local initiatives, some of which are not directly linked to telecommunications or technology.

Recommendation #12: Adopt the RTI functional and beneficiary frameworks for structuring ARC's telecommunications and technology portfolio. ARC member states can determine the desired portfolio mix for maximum impact and invest in grants accordingly.

ARC member states can also create an RFP with clear guidelines and parameters about priorities in broadband Internet for community economic development

To more effectively and strategically invest in telecommunications and technology, ARC and its member states should develop overarching principles to help states guide their project design so that projects are set up for longer-term impacts and are less likely to become "stranded" investments as a result of technology changes. ARC member states can also create an RFP with clear guidelines and parameters about priorities in broadband Internet for community economic development and encourage grantees to pursue "lessons learned" from this evaluation, such as mechanisms for stronger communication in the community and incorporating stronger elements of planning (see Finding #13 and Recommendation #14).

Finding #13: Impacts are accelerated when communities as a whole are aware of and engaged in the telecommunications and technology investment.

In the survey and case studies, grantees reported that projects not engaged with the community about their efforts faced barriers. However, grantees also indicated the grants had broader secondary effects on communities and community partners that were not originally anticipated in the application.

Recommendation #13: ARC should encourage the inclusion of communities in the grant planning process to help avoid stranded investments and maximize community use of investments.

Engaging the community ahead of time and planning for collaborative activities ensure that grantees more carefully consider community needs.

As part of the grant proposal and evaluation, ARC should strongly encourage applicants to include community aspects in their program or project design. The application should include a section to identify community partners and other stakeholders and encourage grantees to engage multiple civic organizations and businesses. Engaging the community ahead of time and planning for collaborative activities ensure that grantees more carefully consider community needs.

Additionally, community involvement should help with avoiding stranded investments—programs or projects that are abandoned or underused because they only serve a single group or purpose. Grant applications should address how investments will allow for multiple uses and users in the community so equipment is not underused. Furthermore, ARC member states can encourage grants that incorporate multiple dimensions of the broadband Internet functional framework (direct, indirect, applications, adoption) for the highest level of effectiveness.

Finding #14: Stronger, more thoroughly developed proposals have a greater likelihood of overcoming unexpected challenges and delivering successful outcomes.

Some of the more successful projects benefitted from the participation of partners with professional planning skills and from a proactive focus on adaptive changes as the project progressed.

Our case studies revealed that some of the more successful projects benefitted from the participation of partners with professional planning skills and from a proactive focus on adaptive changes as the project progressed. Contingency planning and scenario building encourage applicants to consider the options for responding to challenges that can easily span funding shifts, retirement or loss of key personnel, technology obsolescence, or even natural disasters. Preapplication planning offers a venue for engaging potential stakeholders in the effort and building community support.

Recommendation #14: ARC member states can use its RFP process to ask applicants to identify factors critical to the success of their grant and relay alternative approaches for mitigating potential challenges to those critical success factors. ARC can reinforce planning as an element important for grantees to embrace by requiring more fully developed project plans as a milestone that triggers release of funds to implement the full project.

With encouragement, organizations planning telecommunications and technology projects can become better prepared to respond to major threats and adapt to changing circumstances. Information required on a more structured application form could incent more forethought and active planning on the part of applicants. ARC can provide potential applicants access to best practice resources and planning toolkits on its website.

Data Collection and Reporting

Finding #15: The performance data in ARC.net are inconsistent in quality, making it difficult to assess performance "success" based on project indicators.

Reported data from ARC grantees lacked consistency and rigor and made it difficult to assess project outcomes. Projects with missing data represented approximately one-sixth of the portfolio, making it difficult to define the impacts as truly representative of the program.

Additionally, grantees used inconsistent methods to report paired outputs and outcomes. While some used a very strict standard for explaining "served" as opposed to "improved," others appeared to insert the same numbers in both columns. These inconsistencies indicate a lack of understanding of reporting standards and made it impossible to conclude which projects resulted in positive results for participants.

Recommendation #15: Simplify data collection for ARC grantees by eliminating paired metrics and systemizing data collection with online tools.

By trimming down the number of performance measures, grantees will be able to more easily distinguish the metrics they are collecting and report them accurately. An online tool to simplify data collection will also enable better data consistency and quality across all projects.

Data collection efforts using self-reported data in paper format are outdated. By systemizing data collection with online tools based on a quality database infrastructure, ARC can track performance on a year-to-year basis and streamline the process of updating and archiving data. (RTI's successful use of an online survey for this evaluation proves that most grantees have online access. For those grantees without access, ARC can follow up this data collection by phone).

Finding #16: Observation of at-close performance measures often fails to capture the full effects of a grant and its wider impacts on the community.

From RTI's survey, respondents explained both quantitative and qualitative long-term impacts of the grants. The responses paint an impressive picture of a high return on investment for ARC-funded projects, which was difficult to observe from the at-close data alone. The majority of projects continued after the grant period and secured secondary funding, continuing their work in the communities.

The responses paint an impressive picture of a high return on investment for ARC-funded projects, which was difficult to observe from the at-close data alone. The majority of projects continued after the grant period and secured secondary funding, continuing their work in the communities.

Additionally, projects had unexpected secondary results that included leveraging more funding, forming better community relationships and business environments, and empowering students and health workers to find innovative solutions. These survey findings, together with the strong after-close performance measures, indicated a long-term effect that was not captured in the original at-close data.

Recommendation #16: Capture medium- to long-term impacts of grants through periodic surveys 1, 2, and 5 years after the end of the grant period

ARC would benefit greatly from investing in a low-cost online survey protocol and understanding the long-term impacts of the grants, as well as capturing some of the public-sector benefits, including cost savings, average speed increases, and impacts on secondary beneficiaries.

Modern online survey methods are cost-effective and quick to deploy to capture information. ARC would benefit greatly from investing in a low-cost online survey protocol and understanding the long-term impacts of the grants, as well as capturing some of the public-sector benefits, including cost savings, average speed increases, and impacts on secondary beneficiaries.

By conducting periodic surveys after the end of the grant period, ARC can also achieve a higher response rate by maintaining contact with relevant stakeholders and project managers with institutional memory and more proactively evaluate its strategy and adapt to new needs.

9.4 CONCLUSION

Given that we offer 16 distinct recommendations derived from our multimethod evaluation of the portfolio, review of the literature, and investigation of the key policy issues, it is worthwhile to consider how these recommendations coalesce into broader areas of focus. Essentially, these recommendations suggest that ARC pursue three concurrent actions:

(1) Proactively scan the status of broadband Internet programs and policies.

(2) Adopt a more strategic approach to grantmaking.

(3) Serve as an information broker by convening, coordinating, and educating stakeholders of the rural broadband Internet ecosystem and Appalachian Region.

These actions are not steps in a linear process, but rather each action can be used to inform the others, serving as a feedback loop to ARC to reinforce beneficial grant investments.

9.4.1 Proactively Scan the Status of Broadband Internet Programs and Policies

ARC and its member states can better inform ARC's decisions by conducting regular, proactive scans of the Appalachian Region to identify community needs for broadband Internet and developments in the policy environment. Needs identified in this study do not require exhaustive effort or research. Instead, a staff member to serve in this role may be a half-time position that monitors last mile connections, cost, quality, competition among providers, and digital literacy programs in the

Appalachian Region. Some of these data points are readily available, while others could require some effort to collect.

Additionally, as the hyperdynamic policy environment continues to evolve, ARC staff can monitor policies on

- net neutrality,
- local choice,
- dig and wire once policies,
- E-rate and other USAC programs, and
- policy issues related to telehealth.

Better understanding of these policies will inform a more strategic grantmaking process and provide better information for grantees and others in the Appalachian Region on ways to best leverage existing resources to advance broadband Internet deployment and adoption.

9.4.2 Adopt a More Strategic Approach to Grantmaking

ARC can more strategically invest in communities and areas where gaps exist, continuing with a focus on the pressing needs of telehealth, education, and workforce development while broadly supporting job creation.

A set of RFPs to better disseminate ARC or Region-specific data-driven strategic priorities will help state representatives and potential grantees navigate their planning and proposal development. Greater access to ARC staff during the grant period is a learning opportunity for grantees and ARC alike. It will allow for a better exchange of coordinated strategies, expectations, best practices, and accurate data to allow for effective grant management and implementation. With more regular engagement of grantees during the grant period, ARC can learn more quickly and fold this ongoing feedback into future grantmaking decisions.

Finally, a systematic online data collection effort using simple surveys can better track project impacts and challenges during and after the grant period. Using a systematic online data collection method will create a virtuous positive feedback loop for ARC and grantees. ARC will be able to more effectively adapt to the rapidly changing technology and policy environment. By incorporating efficient two-way communication and data reporting, ARC will be able to make strategic decisions more quickly and proactively in order to continue advancing telecommunications and technology in the Region.

9.4.3 Convene, Coordinate, and Educate Stakeholders of the Broadband Internet Ecosystem

Finally, ARC can increase the effectiveness of its grants by convening key individuals and groups to help gather (virtually or in person) and disseminate best practices. With its experience and knowledge of the Region, ARC is well positioned to share information among local grant applicants, state program managers, and other federal agencies involved in broadband Internet and technology investment in rural areas. ARC can play a valuable coordinating role in determining how various partners, programs, sources of expertise, and other resources can unite to achieve maximum impact on the Appalachian Region.

Appendix A: Database Modifications

In its database management process, RTI narrowed the database to more concisely and accurately analyze the effects of the telecommunications and technology portfolio. **Section A.1** outlines the projects RTI consolidated or eliminated from the database, and **Section A.2** outlines the projects with incomplete data and their reasons for exclusion from the comparative performance statistics in the database summary (Section 5).

A.1 CONSOLIDATION AND ELIMINATION OF PROJECTS FROM DATABASE

In December 2014, RTI and ARC agreed to remove seven projects from the evaluation because they were outside of the scope of the study. Five of the projects were revisions to projects with initial approval dates prior to 2004, one project was a revision to a consulting agreement, and the remaining project was an award related to the ARC grants performance measurement system.

Additionally, RTI combined eight projects into four to consolidate multiple grants to the same recipient. These projects represent pairs of projects that are the revisions and initial awards.

Finally, ARC recommended removing two projects because they were outside the scope of the evaluation.

The elimination of these 12 projects narrowed the database from 322 to 310 projects. They are listed in **Table A-1.**

Table A-1. Projects Eliminated or Consolidated from the Project Portfolio for Evaluation

Project Number	Title	Action
NY-14631-I-R1	Southern Tier East Telecommunications Facility Inventory & Computer Mapping, Revision	Remove: outside study window
NY-14632-I-R1	Southern Tier West Wireless Technology Study, Revision	Remove: outside study window
NY-15051-I-R1	Southwestern NY Entrepreneurship Development, Revision	Remove: outside study window
WV-14477-I-R1	EdVenture Group Technology Opportunity Center TOC, Revision	Remove: outside study window
WV-14477-I-R2	Ed Venture Group Technology Opportunity Centers TOC, Revision	Remove: outside study window
CO-13958-I-A-R3	Michael Hernon Telecommunication Consultant, Revision	Remove: outside study window
CO-12882-I-J	Web-Based Resources for Grant Development/Performance Measurement & Assessment of Opportunities to Improve Business Processes	Remove: outside scope of evaluation
CO-14135-C4	Southern Growth Policies Board Annual Conference	Remove: outside scope of evaluation
MD-16516-I-R1	Washington County GIS Site Mapping	Consolidate with MD-16516-I
NY-15778-R1	Schuyler-Chemung-Tioga BOCES Educational Opportunities Network	Consolidate with NY-15778
CO-14157-C3-R1	Oak Ridge National Laboratory (ORNL) 2005 Summer Institute	Consolidate with CO-14157-C3
CO-14157-C6-R1	Oak Ridge Associated Universities (ORNL) 2008 Summer Math/ Science/Technology Institute	Consolidate with CO-14157-C6

Source: ARC.net, RTI Memo, December 5, 2014

A.2 PROJECTS WITH INCOMPLETE DATA

RTI identified 79 grants that were missing at-close numbers or projected numbers.[152] ARC and RTI were able to review and update data for 25 grants by searching through paper files that were not captured in ARC.net, leaving 54 (17 percent of the grant portfolio) without at-close data. The 54 grants without at-close data fell into three categories:

[152] RTI did not make any modifications to the validated data. Of the 310 projects, 65 had a validation visit from ARC. This report does not analyze validation data.

- 23 had no performance data available at the close of the grant because the programs were just getting started or were in the early stages of implementation.
- 10 were managed by another agency, and ARC does not get closeout numbers from them. Examples of other agencies include HUD and TVA.
- ARC and RTI were unable to locate the paper files for 21 grants. These were primarily for grants between FY 2004 and FY 2007.

Descriptive statistics for the portfolio found in Section 5 refer to the 310 projects. However, any summaries of performance measures rely on the subset of 256 projects with complete data. **Table A-2** lists the 54 projects with incomplete or missing data.

Table A-2. Projects with Incomplete or Missing Data

Project Code	Title	Reason for Missing Data
AL-14894-I	Franklin County Telecommunications	Data unavailable at close
PA-16187-I	Pike County Emergency Training Facility Apparatus	Data unavailable at close
PA-16642-I	Regional Technology Incubator Equipment	Data unavailable at close
NA-16676-I	Yancey/Mitchell School-Based Telehealth Network	Data unavailable at close
AL-16181-I	Networking to Educate Today’s Students (NETS)	Data unavailable at close
AL-15844-I	Ft Payne Innovative & New Vision for Educating Students Today (INVEST)	Data unavailable at close
OH-14789-I	Marietta Memorial Hospital South Pavillion Operating Center	Data unavailable at close
OH-15602-I	Hocking College Energy Institute	Data unavailable at close
MD-16261-I	Workforce Development Through Smart Classroom Technology	Data unavailable at close
AL-15845-I	Calhoun Community College Robotics Manufacturing Integration & Simulation	Data unavailable at close
AL-14988-I	Calhoun Community College Nursing Skills Laboratory Equipment	Data unavailable at close
NY-15334-I	Research Foundation of SUNY Heavy Equipment/Truck Advanced Diesel Laboratory	Data unavailable at close

(continued)

Table A-2. Projects with Incomplete or Missing Data (continued)

Project Code	Title	Reason for Missing Data
MD-16359-I	Non-Linear Video Editing Lab Upgrade	Data unavailable at close
MD-15854-I	Frostburg State University Nanotechnology Laboratory	Data unavailable at close
MD-16837-I	Garrett College Networking Program	Data unavailable at close
MS-16532-I	Calhoun County Career & Technical Center Equipment	Data unavailable at close
MS-16692-I	Blue Mountain College Math & Science Technology Infrastructure Improvements	Data unavailable at close
NY-14797-C1	Cattaraugus County Asset Mapping	Data unavailable at close
NY-14797-I	Cattaraugus County Asset Mapping	Data unavailable at close
GA-16420-I	Bartow County Civic Center AV Equipment	Data unavailable at close
NA-15557-I	Northwest NC Advanced Materials Cluster	Data unavailable at close
KY-15529-I	Empowering the People of Rural Appalachian KY	Data unavailable at close
AL-16557-I	Muscle Shoals National Heritage Website Development	Data unavailable at close
PA-15070-I	East Stroudsburg Incubator Expansion	Basic agency project; we do not get closeout numbers for these
KY-15734-I	Lake Cumberland Career & Training Center Renovation	Basic agency project; we do not get closeout numbers for these
NY-14630-I	Odessa-Montour Telecommunications	Basic agency project; we do not get closeout numbers for these
TN-14914-I	Rhea County Hospital Equipment	Basic agency project; we do not get closeout numbers for these
KY-16417-I	Kentucky School of Bluegrass & Traditional Music Program Building Renovation	Basic agency project; we do not get closeout numbers for these
MS-15662-I	Connecting West Point to the World	Basic agency project; we do not get closeout numbers for these
OH-15884-I	Monroe County 911 Equipment & Location Based Response System	Basic agency project; we do not get closeout numbers for these
PA-15432-I	Erie Technology Incubator at Gannon University	Basic agency project; we do not get closeout numbers for these
KY-16440-I	From Coal to Broadband: Making the Transition & Connection	Basic agency project; we do not get closeout numbers for these
MD-14759-I	Allconet2 Broadband to Business Electronic Infrastructure Equipment, Phase II	Basic agency project; we do not get closeout numbers for these
CO-15086-I	Mission WV Scholarships	Data files unavailable or destroyed

(continued)

Table A-2. Projects with Incomplete or Missing Data (continued)

Project Code	Title	Reason for Missing Data
CO-15627-I	HRDC New Facility Wi-Fi, MD	Data files unavailable or destroyed
CO-15228-I	CTCNet Basic Computer Skills Curriculum	Data files unavailable or destroyed
CO-14871-I	OH University WEB IT	Data files unavailable or destroyed
CO-15227-I	OH Appalachian Community Technology	Data files unavailable or destroyed
CO-14849-I	Pulaski County Community Broadband, VA	Data files unavailable or destroyed
MD-16489-I	Allegany County Public School Smart Board	Data files unavailable or destroyed
CO-14870-I	Epworth Broadband Initiative	Data files unavailable or destroyed
PA-14747-I	Tourism Web Mapping Enhancements for the Valleys of Susquehanna	Data files unavailable or destroyed
AL-14699-I	Northeast AL Community College Learning Logic Math Computer Lab	Data files unavailable or destroyed
MD-16524-I	Allegany Community College Workforce Training Computer & Technology Upgrade	Data files unavailable or destroyed
CO-15821-I	Blacksburg Municipal Annex	Data files unavailable or destroyed
CO-15820-I	St. Francis University Geothermal Heating & Cooling System	Data files unavailable or destroyed
AL-14717-I	Marshall County E-911 Telecommunications Upgrade	Data files unavailable or destroyed
KY-16013-I	Edmonson County Technology/Training Center Equipment	Data files unavailable or destroyed
AL-7805-C25	Consolidated Technical Assistance Grant	Data files unavailable or destroyed
AL-14731-I	Franklin County Employability thru Technology & Basic Skills Training	Data files unavailable or destroyed
TN-16042-I	Rhea Medical Center Electronic Medical Records Project	Data files unavailable or destroyed
KY-15424-I	Owsley County Dropout Prevention Program	Data files unavailable or destroyed
KY-15584-I	Regional High Growth Training Center	Data files unavailable or destroyed
WV-15663-I	Forward Southern WV Public Higher Education Mall	Data files unavailable or destroyed

Source: ARC.net, RTI

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Appendix C: Survey of Projects Funded by the Appalachian Regional Commission on Information Technology and Broadband Internet

We have a series of questions about the [insert name of project; ARC project number] grant you received from ARC to implement from [insert time frame of project].

1) How would you describe the economic conditions in the town or region that the grant targeted <u>at the time</u> [insert the project name] was awarded?
   a. Excellent
   b. Good
   c. Fair
   d. Poor
   e. Don't know

2) How would you describe the economic conditions in the town or region that the grant targeted <u>today</u>?
   a. Excellent
   b. Good
   c. Fair
   d. Poor
   e. Don't know

3) In thinking about the town or region the ARC-funded project served, do you think that residents are, for the most part, satisfied with each of the following aspects of their lives today?

   Rank each item below on a scale of 1 to 10 with 1 being extremely unsatisfied, 5 being satisfied and 10 being extremely satisfied.
   a. The number of people with good, well-paying jobs that you have regular contact with
   b. The safety of your neighborhood especially around the schools that your children attend
   c. The quality of libraries, hospitals, and transportation amenities in your neighborhood
   d. Your ability to move to a different neighborhood if you wanted to move

4) What was your role in the ARC-funded project? Check the most appropriate response.
   a. Project manager
   b. Project staff
   c. Grant application/grant manager
   d. Staff with partner organization
   e. Community member involved in or aware of the project
   f. Local government employee involved in or aware of the project
   g. Other, please describe. [insert text box]

5) Did your organization <u>contract</u> with an outside entity with a specialization in grant-writing to help your organization <u>develop the grant proposal</u>?

CATEGORIES

1 Yes
2 No
3 Don't know

6) Did your organization contract with an outside entity to help implement, manage, or evaluate the funded project?

CATEGORIES

1 Yes
2 No
3 Don't know

7) In your own words, as you reflect on the [insert name of project and project #], has the town or region changed as a result? In other words, if this grant had not happened, would the town or region be different than it is today? Please explain.

8) Over the life of the project, what were the challenges your organization faced in carrying out the project? Please check all that apply. [Randomize options except Other and None]

    a. Third-party or additional resources expected to facilitate project did not come through
    b. Staff members were unable to devote sufficient time to the project
    c. Staff members lacked enough expertise to carry out the project
    d. Our organization encountered unexpected problems that made it difficult to devote attention to the ARC project.
    e. Staff turnover created difficulties in carrying out the project
    f. Lack of support from organizational leadership
    g. Other? Please describe
    h. There were no challenges in carrying out the project

    Please expand if you like:

9) Did you have a community advisory group for your project?
    a. Yes
    b. No
    c. Don't know

10) Rank the top three factors that you think would have helped the project have a greater impact than it did with 1 being the most significant factor that would have helped the project, 2 being the second most significant, and 3 being the third most significant. [Randomize with "other" last]
    a. More funding
    b. More flexibility in grant requirements
    c. More time
    d. Better trained staff
    e. Better technical assistance
    f. Greater community buy-in and/or support
    g. More awareness about the project
    h. Greater support from organizational leadership
    i. Other___please specify.

Please expand if you like: [insert text box]

11) Since the project's conclusion, has your organization documented measures of the project's impacts?
    a. Yes
    b. No
    c. Don't know
12) Has your organization conducted an end-of-project evaluation?
    a. Yes
    b. No
    c. Don't know

If yes to #11, go to #13; if no or don't know to #11, go to #14 (every respondent should get #9).

13) Different projects have impacts that can fall into different categories. From the list of possible impacts below, please check whether a listed impact applies to your project.

Businesses and Jobs
Households
Leveraged Private Investment
Linear Feet and Telecom Sites
Programs and Plans
Patients
Students
Workers/Trainees
Participants
Other

13 a–k. You have listed [insert first-level categories checked] as an impact of your ARC project.

a. Please specify how many businesses and jobs were impacted. Check all metrics that apply and list the number beside the checked metric.

Businesses Created [insert field for #]
Businesses Served [insert field for #]
Jobs Created [insert field for #]
Jobs Retained [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

b. Please specify how many households were impacted. Check all metrics that apply and list the number beside the checked metric.

Households improved [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

c. Please specify how much private investment is leveraged. Check all metrics that apply and list the number beside the checked metric.

Funding leveraged [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

d. Please specify how much linear feet of fiber was constructed and/or how many telecom sites were established. Check all metrics that apply and list the number beside the checked metric

Linear feet of broadband established (linear feet of fiber constructed) [insert field for #]
Telecom Sites established [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

e. Please specify how many programs and plans were created and/or implemented. Check all metrics that apply and list the number beside the checked metric

Programs implemented [insert field for #]
Please briefly describe programs implemented [insert text box]
Plans or reports created [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

f. Please specify how many patients were impacted. Check all metrics that apply and list the number beside the checked metric.

Patients improved [insert field for #]
Patients served [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

g. Please specify how many students were impacted. Check all metrics that apply and list the number beside the checked metric.

Students improved [insert field for #]
Students served [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

h. Please specify how many workers/trainees were impacted. Check all metrics that apply and list the number beside the checked metric.

Workers/trainees improved [insert field for #]
Workers/trainees served [insert field for #]
Don't know/We do not collect impact metrics
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

i. Please specify how many participants were impacted. Check all metrics that apply and list the number beside the checked metric.

Participants improved [insert field for #]
Participants served [insert field for #]
Don't know/We do not collect impact metrics

Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

a. Please specify other kinds of impacts that you have noted.

[second-level categories]
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]
Other [insert field for name] [insert field for #]

14) We would now like to ask you about how the ARC project might have had broad impacts in your community. Please check all the categories that apply for the kinds of impact the ARC project [insert project name and #] may have had. Check all that apply, though many choices may not be relevant to your ARC-funded project.

Communications Infrastructure

a) Better broadband Internet service for households in the region
b) Better service delivery to your organization's clients or customers
c) Better broadband Internet service for schools or other organizations
d) Better broadband Internet for hospitals or other health care facilities
e) Better broadband Internet service for libraries
f) Better broadband Internet for other community organizations
g) None of the above/not relevant

Job & Business Climate

a) Better broadband Internet service for businesses
b) Better climate for entrepreneurship
c) Better business climate for companies
d) More jobs for a town or region
e) More home-based businesses
f) None of the above/not relevant

Education/Skill Building

a) Improved the level of job skills for people in a town or region
b) Improved the educational level of people in a town or region
c) Students better prepared for post-secondary education
d) Students or workers better prepared for the workforce
e) Improved computer, broadband Internet and/or social medial skills
f) None of the above/not relevant

Public Purposes

h) Improved planning capacity of a town or region to help facilitate community or economic growth
i) Improved communication between local governments and their citizens
j) Better GIS applications that yield improved information about local or regional infrastructure
k) More online services provided by government, such as paying water bills or taxes, obtaining permits making reservations, etc.
l) None of the above/not relevant

Health/Safety

m) Improved health care for clients
n) Improved public safety for residents
o) None of the above/not relevant

15) Overall, do you think this project met ARC's expectations? Check one.
  a. Exceeded expectations
  b. Met expectations
  c. Somewhat met expectations
  d. Did not meet expectations

16) Please describe any factors that led to the ability of the project to meet expectations.

17) It is possible that your ARC-funded project had <u>broader</u> impacts on the region or organization at which the project funding was aimed. Please identify the broader impacts from the following list; you may check more than one if it applies.
  a. Participants in the project are better at cooperating with others in the community to address issues
  b. Participants in the project are more likely to have a leadership role in addressing community issue
  c. Participants feel more connected to the community than they did before
  d. Other [insert text box]
  e. None

18) How much, if at all, has the ARC-funded project helped facilitate new relationships in your region across organizations that might not otherwise have strong ties?

CATEGORIES
1. A lot (5 or more)
2. Somewhat (3–4)
3. Not very much (1–2)
4. Not at all (0)

    Please expand if you like:

19) Since the conclusion of the project, how often have individuals who participated in the project held meetings to discuss issues the project was aimed at addressing?
    a. Very often (every 1–3 months)
    b. Somewhat often (every 4–9 months)
    c. Not too often (once a year)
    d. Never

20) Was the project intended to be ongoing after the grant period?
    a. Yes
    b. No
    c. Don’t know

21) Did the ARC-funded grant [insert name of grant and grant #] receive any funding to support its activities <u>after</u> the ARC funds expired?
    a. Yes
    b. No
    If yes, #22 &#23 if no #24.

22) Where did the funds come from after the ARC project closed? Check all that apply.
    a) State government
    b) County government
    c) Private sector
    d) A grant from a nonprofit or foundation
    e) Some other source of federal funds
    f) Don’t Know
    g) Other (insert blank space to list)

23) If you know how much additional funding was attracted after the ARC grant, [insert name of grant and grant #], was completed please fill in.

24) What are your **community's** biggest needs in broadband telecommunications and related technology infrastructure in the years ahead? (*check all that apply)*

a. Infrastructure investments to reach households currently unserved by broadband Internet networks
b. Infrastructure investment to support faster broadband Internet speeds service
c. More technical support personnel in the community or organization to maintain equipment
d. Replacing out-of-date computers or technologies in schools, hospitals, libraries, and local government.
e. Investing in retrofitting facilities, such as internal wiring, so they can better support wireless broadband Internet access
f. Other [insert text box]
g. Don't know

25) What are your **community's** biggest needs in order to increase adoption of broadband telecommunications and related technology in the years ahead? *(check all that apply)*

a. Lower monthly broadband Internet fees for consumers
b. Improving digital literacy for citizens
c. More competition among broadband Internet providers
d. Other [insert text box]
e. Don't know

26) What are your **community's** biggest needs in improving education for broadband Internet and related technology in the years ahead? *(check all that apply)*

a. More training for people working in libraries, health care facilities, or other community organizations to help them better use computers and broadband Internet to carry out their missions
b. More training for teachers so they can better use computers and broadband Internet in the classroom to improve educational outcomes
c. More education on the issues of privacy, intellectual property, and archiving information
d. Other [insert text box]
e. Don't know

Please expand if you like:

Appendix D: Abbreviations List

ACOG	Appalachian Council of Governments
ARC	Appalachian Regional Commission
ATC	Appalachian Technical College
AV	audiovisual
BIP	Broadband Investment Program
BOCES	Board of Cooperative Educational Services
BOE	Board of Education
BSCC	Bevill State Community College
BTOP	Broadband Technology Opportunities Program
CAF	Connect America Fund
CBDG	Community Development Block Grant
CLIC	Coalition for Local Internet Choice
COG	Council of Governments
CREC	Center for Regional Economic Competitiveness
CU	Clemson University
DCER	Dickenson Center for Education and Research
DCIDB	Dickinson County Board of Supervisors' Industrial Development Board
DREC	Dickenson Research and Education Center
EMR	electronic medical record
EMS	emergency medical services
FCC	Federal Communications Commission
FCDA	Fannin County Development Authority
FiWi	fiber-wireless
FY	fiscal year
GDP	gross domestic product
GED	General Educational Development
GIS	geographic information system
GPS	global positioning system
HCHC	Hale County Health Center
HFW	hybrid fiber-wireless
HRSA	Health Research Service Administration
HUD	Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
ICT	information and communication technology
INVEST	Innovative & New Vision for Educating Students Today
IoT	Internet of Things
ISP	Internet service provider
IT	information technology

ITU	International Telecommunications Union
LAN	local area network
LCADD	Lake Cumberland Area Development District
LED	light-emitting diode
NARDEP	National Agricultural and Rural Development Policy Center
NETS	Networking to Educate Today's Students
NGO	nongovernmental organization
NTIA	National Telecommunications & Information Administration
NYSER NET	New York State Education Research Network
ORNL	Oak Ridge National Laboratory
PTAP	Promoting Technology Adoption for Progress
PTAP	Promoting Technology Adoption for Progress
RFP	Request for Proposal
SBI	State Broadband Initiatives
SCADA	supervisory control and data acquisition
SCC	Somerset Community College
SEDA-COG	SEDA-Council of Governments
SETDD	Southeast Tennessee Development Division
SKRECC	South Kentucky Rural Electric Cooperative Corporation
SNG	Strategic Networks Group
SPCDF	Somerset Pulaski County Development Foundation
STEM	Science, technology, engineering, math
STEPUP	Striving for Technological Empowerment while Providing Unlimited Potential
SUNY	State University of New York
TRPDD	Three Rivers Planning and Development District
TVA	Tennessee Valley Authority
UAB	University of Alabama at Birmingham
USAC	Universal Service Administrative Company
USDA	U.S. Department of Agriculture
USF	Universal Service Fund
WARC	West Alabama Regional Commission
WHSI	Whatley Health Services Inc.
WVDOE	West Virginia Department of Education

Appendix E:
Case Studies

E.1 CASE STUDY INVITATION LETTER TO GRANTEES

To: Case Study Project Interviewee (Insert name):

I am writing to request your assistance with an important evaluation of grants made by the Appalachian Regional Commission (ARC) for technology-based economic and community development projects made during the period 2004–2010. My colleague (Deborah Watts/Jane Patterson) and I are teaming with the Research Triangle Institute to conduct an in-depth evaluation that involves an intensive review of documentation, a comprehensive survey of all 322 grantees regarding the outcomes and impacts of the funded projects, and site visits and interviews in at least one project selected to represent each of the 13 states that comprise the Appalachian Region. The (insert project name) was selected as the case study for (insert state) in this evaluation.

Projects selected for the case study site visits are those that offer the best examples of particular project types or that are thought to have potential to offer lessons that can guide the ARC in working with similar projects in the future. We wish to gather the perspectives of key individuals who were involved directly in these projects, who benefitted from them, or who are generally situated to have valuable insights into the role of such efforts to contribute to local economic or community development. **This means that we are hoping to speak with project managers, relevant project liaisons from partner organizations, beneficiaries of the projects, and local economic/community developers.**
These conversations could take place on an individual basis or, perhaps more conveniently, in a group setting—if that can be arranged. This input will be extremely valuable to the ARC as it considers how its efforts may need to evolve to better assist the counties that constitute its service area.

We will be traveling next week (insert dates) to project sites to conduct these case studies. We hope to be in (insert town name) between (insert dates). We will be calling you on (insert day) to confer on the feasibility of a site visit during the suggested period or, if necessary, to explore alternative dates that would be mutually convenient. We also hope to discuss with you the names of other individuals who are familiar with this grant and its impacts and who might be willing to provide insights that could be useful to us as we work to assist the Appalachian Regional Commission looking forward. Please feel free to share this email with others that you think should be made aware of this request.

Should you wish to contact me before we are able to reach you directly, I can be reached at the numbers below and also the email listed below. We look forward to talking with you and thank you in advance for any assistance you are able to provide to this evaluation.

Jane Smith Patterson and Deborah T. Watts

(Insert work phone)

(Insert mobile phone)

(Insert email)

E.2 CASE STUDY PROTOCOL

The case study team used a common set of questions to guide the case study interviews. These questions included but were not limited to the following:

1. Please briefly describe the project (insert project title) that was funded by ARC in (insert year).
2. What situation or conditions led to the need for this effort? How was the project planned and who was involved in the planning? What, if anything, was the role of external advisors?
3. What were the goals for the project and did the project meet these goals within the timeline for the project?
4. Was sustainability included in the project plans?
5. If goals were met subsequent to the end of the project, please discuss the reasons for the delay.
6. If goals were not met, please discuss the reasons for this outcome.
7. Please describe any outcomes attributed to this project that were in addition to those defined in the original proposal to ARC. Has the project leveraged other benefits to the community/grantee?
8. Were the goals/efforts supported by this project sustained beyond the endpoint of ARC support? How was this achieved/supported?

9. What is the role of this sort of effort in community and/or economic development?
10. How important was it to have ARC support?
11. What other organizations, if any, were partners in this effort? What were their roles? How important was the participation of these partners to project outcomes and/or sustainability?
12. What do you think is the role of performance measures applied to projects such as this one? How often should they be applied to optimize their usefulness?
13. What sort of additional resources are needed by communities such as yours to become more competitive?
14. Are you aware of opportunities to share experiences and learn from similar efforts in other communities? Would there be interest in such opportunities?
15. What are the largest challenges facing your community today?
16. Are there federal and/or state policies that need to change or be enacted to assist your development efforts?
17. How important is it to have an advocate for policy that assists counties in the Appalachian region?