Rural Anchor Institution Broadband Connectivity: Enablers and Barriers to Adoption

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ABSTRACT
This paper presents findings from two research projects that entail needs assessments, benchmarking, and onsite diagnostics of anchor institutions in support of multi-million dollar broadband middle mile projects funded by the National Telecommunications and Information Administration (NTIA) through the Broadband Technology Opportunities Program (BTOP). The research employs a multi-method approach that includes a web-based survey, focus groups, and onsite diagnostics at selected anchor institutions in rural Florida. Findings indicate that anchor institution broadband adoption is impacted by a host of situational factors, both enablers and barriers, and that understanding the enablers and barriers to broadband adoption in anchor institutions is critical to achieving widespread broadband adoption. The findings also lead to a proposed model of community-based broadband planning through which multiple anchor institutions in a community join together to plan for, develop, implement, and assess broadband deployment and adoption in their community.

Categories and Subject Descriptors
C.2.5 [**Computer Systems Organization**]: Local and Wide-Area Networks

General Terms
Management, Measurement, Economics.

Keywords
Broadband Adoption, ARRA, BTOP, Needs Assessment, Broadband Planning.

1. INTRODUCTION
This paper presents findings from two research projects conducted in rural Florida, each of which entails needs assessments, benchmarking, and onsite diagnostics of rural anchor institutions (community support organizations such as schools, libraries, and hospitals "that provide outreach, access, equipment and support services to facilitate greater use of broadband service by vulnerable populations" [7, p. 33108]). These needs assessment projects are designed to support two multi-million dollar broadband middle mile projects awarded to rural regions of Florida through the National Telecommunications and Information Administration's (NTIA) Broadband Technology Opportunities Program (BTOP).

The research employs a multi-method approach that includes a web-based survey, focus groups, and onsite diagnostics at selected anchor institutions in rural Florida. The research finds that myriad situational factors (both enablers and barriers) affect anchor institution broadband adoption, including administrative support, funding, broadband availability, and knowledge of what broadband is and why it is important. Also, understanding these enablers and barriers is critical to achieving widespread broadband adoption. The findings also lead to a proposed model of community-based broadband planning through which multiple community anchor institutions join together to plan for, develop, implement, and assess broadband deployment and adoption.

2. BACKGROUND

2.1 Broadband in the United States
In 2009, the U.S. was falling behind other countries with regard to home Internet connection speeds [11]. At that time, average speeds were 5.1 megabits per second (Mbps) downstream and 1.1 Mbps upstream, ranking the U.S. 28th in average Internet connection speeds. Of particular concern was the reliance on cable or DSL connections rather than the fiber connections capable of 100 Mbps that were available to 90% of Japanese homes in 2009. This is critical as, "Speed defines what is possible on the Internet" [11, p. 2].

The national eye turned toward broadband with the passage of the American Recovery and Reinvestment Act (ARRA) which included over $7 billion for broadband to be distributed via the NTIA and Rural Utilities Service (RUS). NTIA, RUS, and the Federal Communications Commission (FCC) sought input in developing program guidelines and a national broadband plan. Many stakeholder respondents pressed for federal support of broadband build-out to community anchor institutions, particularly in rural areas [6, 8, 34]. The Benton Foundation noted that "Broadband is vital to our national success" [4, p. 8], impacting job creation and economic growth, public safety, healthcare, and other issues of national concern. Also, AT&T called broadband a "force multiplier" that stimulates the creation of innovative services, drives the economy, and enhances the benefits of investments in other industries [9, p. iii].

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Ultimately, NTIA, RUS, and the FCC operationally defined broadband with two minimum tiers: "first generation data," 200 kilobits per second (kbps) to less than 768 kbps in the faster direction; and "basic broadband tier 1," 768 kbps to less than 1.5 Mbps (1 Mbps equals 1,000 kbps) [15]. NTIA and RUS began funding projects using these definitions, including many projects directly to or for networks that pass anchor institutions.

In early 2010, the FCC published a national broadband plan that stresses the importance of broadband in general, saying that broadband "enables the free and efficient exchange of information" and "removes the barriers of time and space" [16, p. 193]. The plan notes the importance of anchor institutions in national broadband adoption and outlines specific roles for anchor institutions in the broadband adoption process, particularly with regard to digital literacy skill development. Because BTOP will not be enough to close the broadband availability gap for all Americans, it pushes for continued federal financing of broadband deployment and adoption, which is critical as NTIA found in 2010 that many Americans "still rely on slow, narrowband Internet access or do not use the Internet at all" [29, p. 1]. Also in 2010, the FCC increased their definition of broadband to a minimum speed of 4 Mbps [17].

2.2 Florida Rural Middle Mile Broadband Projects

The Information Use Management and Policy Institute (Information Institute) at the Florida State University has been conducting two concurrent needs assessments of anchor institutions' broadband connectivity in rural Florida. These projects support the North Florida Broadband Authority (NFBA) $30 million Ubiquitous Middle Mile Project and the Florida Rural Broadband Alliance, LLC (FRBA) $23 million Rural Middle Mile Networks Project, both of which are funded through the BTOP and are bringing middle mile broadband infrastructure to Florida's three Rural Areas of Critical Economic Concern (RACEC) (Figure 1), which are comprised of rural, economically depressed counties [14]. The projects include needs assessment, benchmarking, and onsite diagnostics at selected anchor institutions in the NFBA and FRBA service areas.

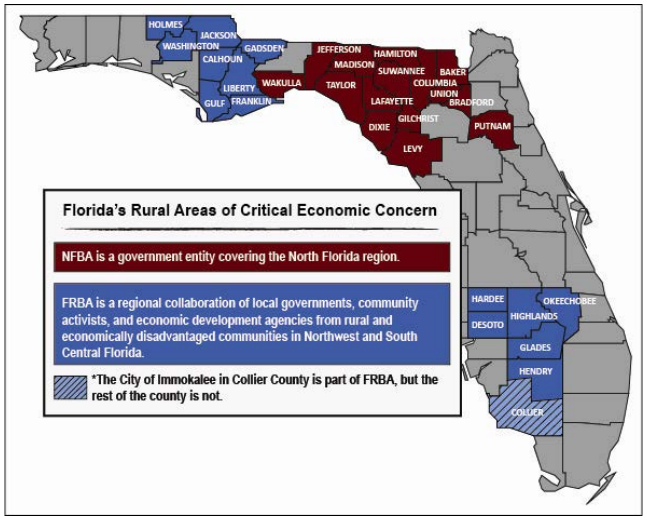

Figure 1. Florida's RACECs © Information Institute.

3. LITERATURE REVIEW

3.1 Broadband Adoption

3.1.1 Technology Adoption: A Historical Viewpoint

Before discussing broadband adoption, it is useful to consider another technology that was not adopted readily, and for which the federal government needed to get involved to finance and support infrastructure build-out: electricity. Supporting this viewpoint, Field notes the parallels between the Depression Era push for electric consumption and the current push for broadband deployment and use during a recession [19].

Bringing electricity to rural America was not an easy undertaking as rural Americans needed to be convinced of the value of electricity to their daily lives, especially since electricity was intangible and therefore mysterious and frightening [1]. This was accomplished less via exhortations about the value of electricity in general or as a public good and more via spectacle and entertainment [1], as well as practical applications in the home [10]. The 1893 World's Columbian Exposition broadened the reach of electricity because it presented electricity as novel and entertaining, rather than mysterious and frightening [1].

People also needed to understand the practical applications of electricity in their homes, which required development of electrical appliances that would drive electricity consumption [10]. Broadband adoption studies show that users who view the Internet positively tend to be more active in the online environment [25], and one way to improve people's views of the Internet is to make it relevant and necessary to them. Simply having access to broadband does not guarantee people will adopt and use it; people need training and support to understand the importance of broadband to their daily lives [24, 29]. The FCC also notes this concept of using a tangible application of a technology to encourage adoption: "Broadband networks only create value to consumers and businesses when they are used in conjunction with broadband-capable devices to deliver useful applications and content" [16, p. xi]. Developing and promoting such applications is critical since broadband is *the* "greatest infrastructure challenge of the early 21st century" [16, p. 3].

3.1.2 Broadband Adoption Today

Broadband adoption is a critical issue facing the U.S. (adoption is different from availability—adoption refers to subscription and use). Even with ARRA funding, the development of the national broadband plan, and an increase in broadband awareness at a federal level, the U.S. remains far from full broadband adoption. This is an issue for both home and institutional adoption, particularly for anchor institutions. Just because a broadband network becomes available in an area does not mean that people are guaranteed to subscribe to and use that broadband.

The FCC notes that there are three key factors in determining broadband adoption: cost, knowledge, and relevance. Several studies find that lack of interest or need is the primary reason cited as a barrier to home adoption [12, 13, 30]. Another study finds that acceptance and use of broadband increase as minorities realize broadband's value to their work and personal lives [21]. These studies further support the argument that people need tangible evidence of what broadband can do for them before they will adopt broadband technology.

The FCC sees its role as fostering broadband deployment and the role of anchor institutions as fostering broadband adoption and use [16]; for this to occur, anchor institutions themselves must adopt broadband. However, issues of why some anchor institutions adopt broadband and others do not largely are absent from the literature. One FCC report includes data from national broadband mapping efforts on broadband connectivity at K-12 schools: over 21% of schools for which download and upload speeds were reported (about 19,000) have speeds less than 3 Mbps downstream and 768 kbps upstream [18]. The FCC notes the 3 Mbps downstream and 786 kbps upstream threshold was set for households but likely is not sufficient for a school that must serve multiple users on one network simultaneously.

3.2 Broadband and Anchor Institutions

Microsoft notes that for anchor institutions, basic broadband is 100 Mbps symmetrical [16]; the FCC goes further, saying all U.S. communities should have access to affordable broadband to anchor institutions at a minimum speed of 1 Gbps [16], a goal that the U.S. is far from meeting. AT&T, EDUCAUSE, and Comcast Corporation, among others also note the value of connecting anchor institutions to big broadband since anchor institutions can be the fastest way to bring broadband to the largest user population in an area [8, 28, 34]. AT&T says "broadband connectivity at a local library or community center might be transformative for a community that is new to broadband, or where economic challenges make penetration to the home unrealistic" [9, p. 7]. A BTOP-funded study conducted in Michigan supports this assertion, finding that that household density (the number of households per square mile) is one of the key drivers of broadband build-out [12].

Libraries, in particular, are trustworthy sources of free public Internet access in the U.S. [16], yet many suffer slow connection speeds, hampering their ability to provide quality Internet to everyone [22]. A 2009 report indicates that 20% of U.S. libraries report connection speeds below 1.5 Mbps, and 33% of rural libraries report such slow connection speeds [3]. Meanwhile, those speeds are at the front door, but actual speeds available to users at public access workstations are likely slower since speeds tend to degrade between the front door and workstation, particularly at high-traffic times in the library [5].

4. METHOD

This research began with six research questions that guided each of the two needs assessments:

RQ1. Which types of broadband networks currently are deployed in the anchor institutions in the NFBA and FRBA service areas, and which situational factors and issues impact how anchor institutions deploy their broadband networks?

RQ2. How can the middle mile network designers deploy and configure the networks such that they best meet the current and future needs of anchor institutions?

RQ3. Which factors affect the likelihood that anchor institutions in the NFBA and FRBA service areas will adopt high-speed broadband?

RQ4. What are the existing and future broadband uses and applications of the anchor institutions in the NFBA and FRBA service areas?

RQ5. In which ways can the anchor institutions in the NFBA and FRBA service areas improve their network deployments to increase connection speeds at the workstation?

RQ6. What type of training do staffs at anchor institutions in the NFBA and FRBA service areas need in order for those organizations to assist underemployed and unemployed members of the general population to gain critical broadband-related skills?

Each project used a multi-method approach that included a survey, focus groups, and onsite diagnostics, with data collection for the NFBA project occurring first. Lessons learned regarding data collection instruments, such as survey and interview questions, were incorporated into the FRBA project, so that the FRBA data collection included some additional questions and topics that were identified as critical but missing from the NFBA data collection instruments. Data analyses varied by method, with the research team employing descriptive statistics and GIS mapping for survey data, thematic content analysis for focus group data, and qualitative analysis for onsite diagnostics data.

4.1 Anchor Institution Broadband Survey

4.1.1 Survey Sampling Strategy

For both projects, data collection began by first identifying the population of anchor institutions in the service area, 320 in NFBA and 323 in FRBA. Because of the relatively small sizes of the populations, the research team opted to survey the entire population, rather than a sample (in both cases, additional anchors were identified while the survey was in the field and these institutions also received the survey: 48 in NFBA and 23 in FRBA). Due to the use of a population rather than a sample, these data are not necessarily generalizable throughout the U.S. or elsewhere, but they still provide useful indicators of rural anchor institutions' broadband connectivity and may inform broadband adoption efforts outside of rural Florida.

4.1.2 Survey Data Collection

Surveys were created in both paper and electronic formats (using Survey Monkey), and anchors were invited to participate via a mass mailing that included an introductory letter explaining the project and why their participation was needed for data collection, a copy of the survey, and the URL for the electronic version. The research team sent reminder notices via email every 2-3 weeks that each survey was in the field, as well as making reminder phone calls. Ultimately, 190 anchors returned the survey in total, a 26.6% response rate (n=113 for NFBA, response rate 30.7%; n=82 for FRBA, response rate 23.7%).

4.1.3 Survey Data Analysis

Survey data were analyzed using descriptive statistics via SPSS and Microsoft Excel and GIS mapping using ArcGIS. Codebook variables were derived from the survey questions, and codes were assigned to all possible answers for each variable. The dataset was coded, answers from paper surveys were added, and records that represented duplicate or bad data were deleted. In addition, several variables were converted from continuous to categorical formats for the analysis (Internet adoption year, cost information, and workstation speeds). The categories for Internet adoption year were derived from Rogers' diffusion of innovation curve [31] and data from the Pew Internet & American Life Project

[33]. Several new categories for staff computer training plans were derived from the Other response.

4.2 Focus Groups

The study team determined that the best way to leverage available resources was to conduct 10 focus groups (five each for NFBA and FRBA), each covering a three-county area; a sixth focus group was added in NFBA for members of a Rural Health Partnership. Counties were combined into the area groupings based on geographic proximity in order to minimize travelling distances for participants; ultimately, this resulted in eight focus groups servings three counties each, one focus group serving two counties, and one focus group serving three counties plus a near-by city considered to be part of the RACEC.

4.2.1 Focus Group Sampling Strategy

The largest possible sampling frame for the focus groups was the populations of the anchor institutions in the NFBA and FRBA service areas that were compiled for survey recruitment. At the end of the online survey, respondents were asked for permission to be contacted for a follow-up interview. Those who responded negatively were removed from the sampling frame for the focus groups and other follow-up data collection activities; approximately 40% of NFBA anchors and 60% of FRBA anchors declined a follow-up interview. Note that institutions in the sampling frame that did not complete the survey were retained in the focus group sampling frame in the hope of recruiting some institutions to attend the focus groups and complete the survey.

4.2.2 Focus Group Data Collection

Focus groups followed a set protocol and list of topics, which was modified three times: (1) after the first round of NFBA focus groups, (2) in preparation for the Rural Health Partnership focus group, and (3) prior to beginning the FRBA focus groups. The topics included general background on the participants and their institutions, participants' impressions of their institutions' current broadband and technology, impacts of broadband on regional economic development, and factors that affect broadband access and use in their institutions, among others. The Rural Health Partnership focus group followed a separate list of topics focused on broadband and its impacts on healthcare.

4.2.3 Focus Group Data Analysis

Thematic content analysis of the focus group transcripts and moderator notes was used to uncover common themes arising from the discussions (each focus group was a unit of analysis). The codebook was developed through an iterative process that began with a list of themes that were noted as they emerged during the focus groups; additional themes were identified and others collapsed as each focus group was coded. Concepts were coded for frequency to facilitate an understanding of thematic trends. Throughout analysis, transcripts and notes were mined for direct quotations, as one of the main purposes of analysis was to bring the voices of the participants into the larger discussion.

4.3 Onsite Diagnostics

The research team conducted onsite diagnostics and broadband connectivity assessments for selected anchor institutions from the NFBA and FRBA service areas. Overall objectives of the onsite diagnostics were to (1) describe the existing broadband networks currently deployed in the regions' anchor institutions, (2) identify situational factors and issues that impact how anchor institutions deploy their broadband networks, and (3) determine ways that the regions' anchor institutions can improve their network deployments to increase connection speeds at the workstation and improve network security and business continuity.

4.3.1 Onsite Diagnostics Sampling Strategy

The onsite diagnostics methodology began with generating a pool of potential anchor institutions that qualified for onsite visits based on indication of interest in participating in this research. As with the focus groups, this list was not limited to those institutions that had taken the survey prior to the onsite visit.

4.3.2 Onsite Diagnostics Data Collection

The team developed interview questions about situational and technical factors affecting anchors' network deployment and broadband connectivity and a list of documents, such as network peak usage, workstation bandwidth speed tests, and a manifest of network equipment detailing age of computers and number of wireless access points throughout the network. The team then conducted the onsite visits, followed by generation of individual reports that provided an overview of the findings for each anchor and were provided to the individual anchors to assist them in understanding their institutions' situations and to recommend solutions to improve their networks and connectivity. The project team conducted 33 onsite diagnostics at sites representing all anchor institution types and each institution's broadband and network connection was unique to its individual situation.

4.3.3 Onsite Diagnostics Data Analysis

The diagnostics data analysis process had two phases: developing diagnostics reports from the onsite visits followed by compiling those reports into an aggregated document that was analyzed for overarching themes. First, the diagnostic teams entered their individual field notes into an electronic interview template after each onsite visit. The notes were compiled into a draft report template that went through several reviews for technical accuracy and completeness of information. Final drafts were sent to the participating anchor institutions for review and final reports reflected any changes identified by the institutions. Second, the master report was aggregated using a thematic analysis of the individual reports. The focus of this analysis was the identification of institutional needs. The themes emerged from both qualitative analyses of the interviews and quantitative analyses of the diagnostic metrics.

5. FINDINGS

Analysis is nearing completion for the NFBA project but is still in progress for the FRBA project. Focus group and diagnostics findings are reported for both projects, but survey findings are based only on responses to the NFBA survey.

5.1 Anchor Institution Broadband Connectivity and Training

A number of situational factors affect anchor institutions' ability to use broadband Internet in an effective way. These include connection speed of the Internet coming into the "front door" and the actual speed of workstations inside the building, staff and user comfort with broadband-related topics and applications, and broadband-related training availability for staff and users.

The majority of anchor institutions report having broadband types of connections (such as DSL, fiber, and Ethernet). Slightly under half of respondents (43.0%) have DSL connections, followed by fiber (22.0%) and Ethernet (21.0%). Anchors also report fairly high advertised connection speeds: 51.4% in the range of 1.6-10 Mbps and 27.6% at 10.1 Mbps or greater. Over 20% report connections of 5.1-10 Mbps, placing them over the FCC's minimum broadband speed of 4 Mbps [17], but 18.4% of institutions report advertised speeds at or below 1.5 Mbps. However, actual speed at individual workstations can be greatly diminished due to network design. For example, only 5.1% of institutions report an advertised connection speed less than 1.5 Mbps, but after conducting a speed test (using http://speedtest.net/) at one staff-only and one public workstation, this dial-up-level speed was reported by 26.0% at a staff workstation and 39.5% at a public workstation (Table 1).

Table 1. Advertised vs. measured speed

Speed Range	Advertised	Downstream Staff Workstation	Downstream Public Workstation
<1.5 Mbps	5.1% (n=5)	26.0% (n=20)	39.5% (n=15)
1.5 Mbps	13.3% (n=13)	3.9% (n=3)	--
1.6-5 Mbps	32.7% (n=32)	37.7% (n=20)	36.8% (n=14)
5.1-10 Mbps	21.4% (n=21)	15.6% (n=12)	13.2% (n=5)
10.1-20 Mbps	14.3% (n=14)	9.1% (n=7)	5.3% (n=2)
>20 Mbps	13.3% (n=13)	7.8% (n=6)	5.3% (n=2)

Response rates differed for each question on the survey; the response rates for these questions were n=98 (advertised), n=77 (staff), and n=38 (public).

Over 85% of staff are extremely or very comfortable with basic Internet skills (e.g., email and getting online), but only 26.4% of staff are comfortable with basic broadband topics (e.g, major uses of broadband). Only 62.1% report comfort with advanced Internet topics, including the important skills of searching for information and determining its accuracy. Advanced broadband and advanced wireless include skills like configuring internal and wireless networks, so it is conceivable that few staff members would have this expertise (Table 2). Comfort levels for public users are relatively low, even for basic skill sets (Table 3).

The largest percentage of institutions report no plans for staff training in the next year, but 34.1% are planning some advanced Internet training. There are almost no plans for advanced broadband training, so staff comfort levels in this area may not rise in the near future. Little formal training is planned for the public on Internet and broadband topics, but 75.0% of institutions are planning training on other topics (Table 4).

Table 2. Staff comfort with Internet-related topics

Topic	%
Basic email (n=76)	87.4%
Basic Internet (n=74)	85.1%
Advanced Internet (n=54)	62.1%
Basic computer (n=40)	46.0%
Basic wireless (n=23)	26.4%
Basic broadband (n=23)	26.4%
Advanced wireless (n=10)	11.5%
Advanced broadband (n=9)	10.3%

Response rates differed for each question on the survey; the response rate for this question was n=87. Does not add to 100% because institutions reported in multiple categories.

Table 3. Public comfort with Internet-related topics

Topic	%
Basic Internet (n=19)	42.2%
Basic computer (n=19)	42.2%
Basic email (n=15)	33.3%
Basic wireless (n=3)	6.7%
Basic broadband (n=3)	6.7%
Advanced Internet (n=3)	6.7%
Advanced wireless (n=10)	2.2%
Advanced broadband (n=0)	--

Response rates differed for each question on the survey; the response rate for this question was n=45. Does not add to 100% because institutions reported in multiple categories.

Table 4. Plans for training within the next year by topic

Staff Training Topic	%	Public Training Topic	%
None (n=32)	36.4%	None (n=66)	75.0%
Advanced Internet (n=30)	34.1%	Basic Internet (n=12)	13.6%
Basic email (n=20)	22.7%	Basic computer (n=12)	13.6%
Basic Internet (n=20)	22.7%	Other (n=11)	12.5%
Basic computer (n=19)	21.6%	Advanced Internet (n=11)	12.5%
Basic wireless (n=10)	11.4%	Basic email (n=9)	10.2%
Basic broadband (n=10)	11.4%	Advanced wireless (n=2)	2.3%
Advanced broadband (n=8)	9.1%	Advanced broadband (n=2)	2.3%
Health information technology (n=6)	6.8%	Basic wireless (n=1)	1.1%
Advanced wireless (n=4)	4.5%	Basic broadband (n=1)	1.1%
Advanced computer (n=3)	3.4%		
Technology integration (n=2)	2.3%		
Other (n=1)	1.1%		

Response rates differed for each question on the survey; the response rates for both questions was n=88. Does not add to 100% because institutions reported in multiple categories.

Educational resources and databases, email, and e-government activities dominate public Internet use at anchor institutions. Social networking and job search topics are also popular, as is the search for computer and Internet skills (Table 5).

Table 5. Public uses of the Internet

Topic	Uses
Education resources and databases (n=37)	88.1%
E-government services (n=30)	71.4%
Email (n=30)	71.4%
Services for job seekers (n=23)	54.8%
Social networking (n=23)	54.8%

Community information (n=22)	52.4%
Computer and Internet skills (n=21)	50.0%
Small business information (n=20)	47.6%
Investment information and databases (n=15)	35.7%
Services to immigrant populations (n=12)	28.6%
Other (n=6)	14.3%

Response rates differed for each question on the survey; the response rate for this question was n=42. Does not add to 100% because institutions reported in multiple categories.

5.2 Enablers and Barriers to Anchor Institution Broadband Adoption

Multiple factors contribute to or limit the success with which organizations are able to obtain, deploy, manage, and apply broadband. These factors can be demographic, technical, economic, political, or educational in nature and can originate within or external to an organization. Identified enablers likely contributing to anchor institution broadband success include: knowledge of broadband, its use, and how to deploy it; existence of a high-quality internal network; administrative leadership and support; available and trained IT staff; access to an ISP with inexpensive broadband; ability to develop a strategic plan leveraging various anchor institutions to obtain and deploy broadband; and interest and enthusiasm to experiment with and promote innovative applications of broadband.

Focus group and onsite diagnostics participants noted that few of these factors are fully developed, or even present, in their institutions. Some of the barriers likely to limit the success of broadband access, deployment, and use in anchor institutions are: lack of resources and/or knowledge about broadband and broadband applications; inability to contract successfully with ISPs; difficulties in educating potential users on how to use new broadband-based services successfully; lack of support from local officials, possibly impacted by their lack of awareness of broadband's potential; failed previous efforts to upgrade broadband availability and/or reduce its cost; resistance to change and organizational inertia; old, out-of-date network hardware and software; and individual mandates that prohibit anchor institutions from collaborating on broadband planning. These barriers highlight the importance of community awareness efforts—what broadband is, how it can assist anchors and residents, and the need for planning, education, and training.

5.3 Broadband, Anchor Institutions, and Economic Development

The NFBA and FRBA focus groups and onsite diagnostics activities uncovered a difficulty among rural anchor institution staffs in understanding (and measuring) the relationship between broadband and economic development, which manifest as:

- Lack of knowledge of the importance of economic development to a middle mile project;
- Uncertainty about how to use new and improved broadband availability to convince companies to move to their counties;
- Knowledge that broadband alone will not attract new businesses without better schools and government services; and
- Skepticism about the role of faster and less expensive broadband in facilitating economic development in rural Florida communities.

These findings suggest that the BTOP awards may have minimal impact on jobs creation, small business creation, and improved local economic development, especially in the short-term.

6. IMPLICATIONS

This research has several implications at different levels: institutional, community, and state/national. Additional research is needed into anchor institution broadband adoption; the literature focuses heavily on home adoption without regard to anchor institution adoption and its impact on home adoption. Other than the national broadband map (which is inherently flawed given the reliance on data provided by ISPs about availability rather than data on actual subscribership and use) and this study, little is known about anchor institution broadband adoption rates and enablers and barriers that affect anchor institution adoption. The Information Institute plans to build on this research by focusing on the following research topics, among others: empirical testing of the model for community-based broadband planning (discussed in section 6.2 below); ways in which broadband can be employed to facilitate economic development; and empirical, effective methods for measuring community impacts and outcomes from broadband.

6.1 Institutional Level

Administrators need to be aware of what broadband is, its importance, and how their institutions can use broadband to improve public services. This study and others find that building the network does not guarantee subscribership [27]; broadband adoption efforts must include training and outreach. Success requires education and awareness efforts to explain the basics of broadband and how various anchor institutions can use it to improve in-house productivity, as well as public services.

Second, administrators and IT personnel need to be aware that multiple factors affect broadband adoption and use, what those barriers and enablers are, and how to overcome them. The inability to contract successfully with ISPs or unsuccessful attempts to upgrade broadband or reduce its cost are significant barriers. Possible ways to overcome this include collaborative contracting or development of individualized procedures for institutions to upgrade and manage their broadband networks.

Third, broadband adoption and use is unlikely to occur without active planning efforts that include various stakeholder groups: administrators, IT and front line personnel, and users. Planning efforts should consider where the institution is now, the barriers inhibiting progress, where the institution wants to be in 5-10 years, and the enablers that can facilitate achieving those goals.

6.2 Community Level

Beyond the institution, the community faces similar issues, such as the need for education and awareness efforts, facilitation of enablers and minimization of barriers, and comprehensive planning. Community-level efforts need to focus on increasing subscribership, adoption, and use, which requires making broadband tangible and important for people's daily lives.

This research points to a need for a community approach to broadband planning, something that others also would like to see

[5, 16]. Bertot and McClure say that communities should pool resources, plan jointly, and look across needs to achieve economies of scale, better services, and more robust community technology infrastructure [5]. In the national broadband plan, the FCC echoes this sentiment, arguing that all stakeholders need to work together on broadband adoption and that this work should

be guided by a coherent set of guiding principles [16].

One possible approach to community-wide broadband planning is depicted in Figure 2. The model lays out an iterative process by which a community base organizes, conducts a community-based needs assessment, engages in planning and deployment, conducts outcomes assessment, and begins again to further the community's broadband deployment and adoption. Additional detail about this model and a possible role for libraries as lynchpin anchor institutions that can coordinate this process for communities is detailed in a recent paper [2].

The outcomes assessment portion is critical to the success of any broadband planning, deployment, and adoption effort. The FCC says that without funding program evaluation, the U.S. will not know what does and does not work [16]. The Pew Internet and American Life Project stresses the importance of evaluation for guiding broadband policy makers [20]. This research also indicates the substantial need for ongoing formative evaluation and outcomes assessment to ensure that broadband deployment and adoption projects are proceeding effectively and efficiently.

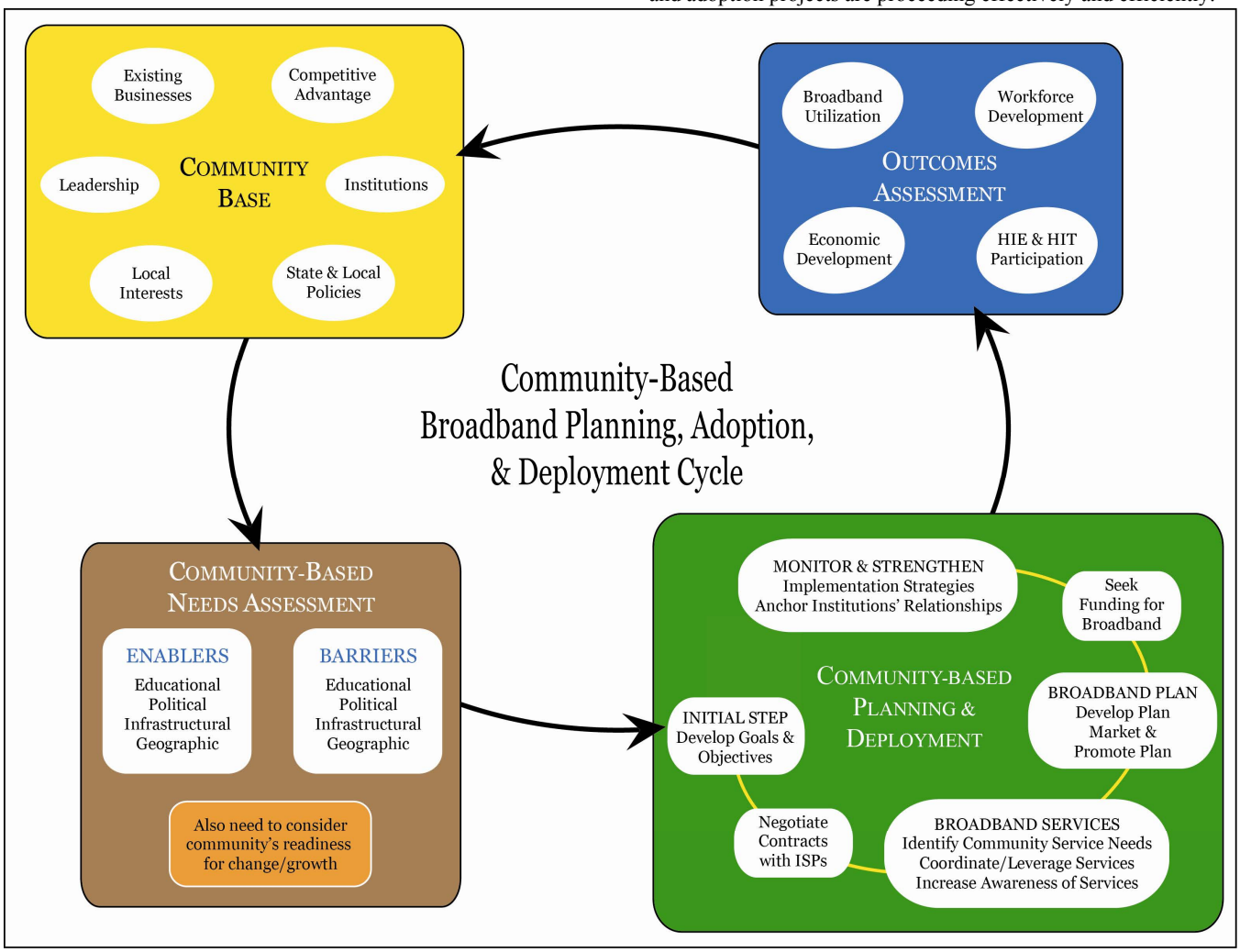

Figure 2. Community-Based Broadband Planning Model © Information Institute.

6.3 State or National Level

A critical state/national level issue is collection of and access to reliable data on broadband adoption and use. The national broadband map relies heavily on ISP-provided data of broadband availability, with only spotty coverage of broadband adoption data. To judge accurately broadband's impacts on communities, data must be available that show who has and has not adopted broadband, for anchor institutions and home subscribers.

Although broadband is touted as an economic development agent, measuring its economic impact is tricky. Assessing the economic impact of broadband is complicated by challenges inbtaining sufficient data on broadband use and the need to measure this impact over time—changes in the number of jobs available,

employment rates, and population growth cannot be measured effectively within a one or two year project [23, 26]. There are also confounding variables, such as other economic variables like the current recession [27]. Also, the degree to which economic growth would have occurred with extant non-broadband connections should be subtracted from total growth measured to identify the impact of broadband alone [23].

7. CONCLUSION

This paper presents findings from two research projects conducted in rural Florida anchor institutions utilizing a multi-method design including a web-based survey, focus groups, and onsite diagnostics. It finds that a host of situational factors impact broadband adoption in anchor institutions, both enablers and barriers, including administrative support, funding, broadband availability, and knowledge of what broadband is and why it is important. Understanding these enablers and barriers is critical to achieving widespread broadband adoption, but that adoption will not come without widespread broadband education and awareness efforts that explain the value of broadband so that it is tangible and relevant to people's individual lives. Such a training and awareness effort could be part of a community-based broadband planning model, through which multiple anchor institutions join together to plan, develop, implement, and assess broadband deployment and adoption in their community. Much work remains to be done in terms of the research and practical applications to increase broadband adoption and increase the U.S. ranking for broadband use compared to other countries.

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