AFTER BROADBAND: A STUDY OF ORGANIZATIONAL USE OF BROADBAND IN SOUTHWEST ALASKA

A Report of the Institute of Social and Economic Research
University of Alaska Anchorage

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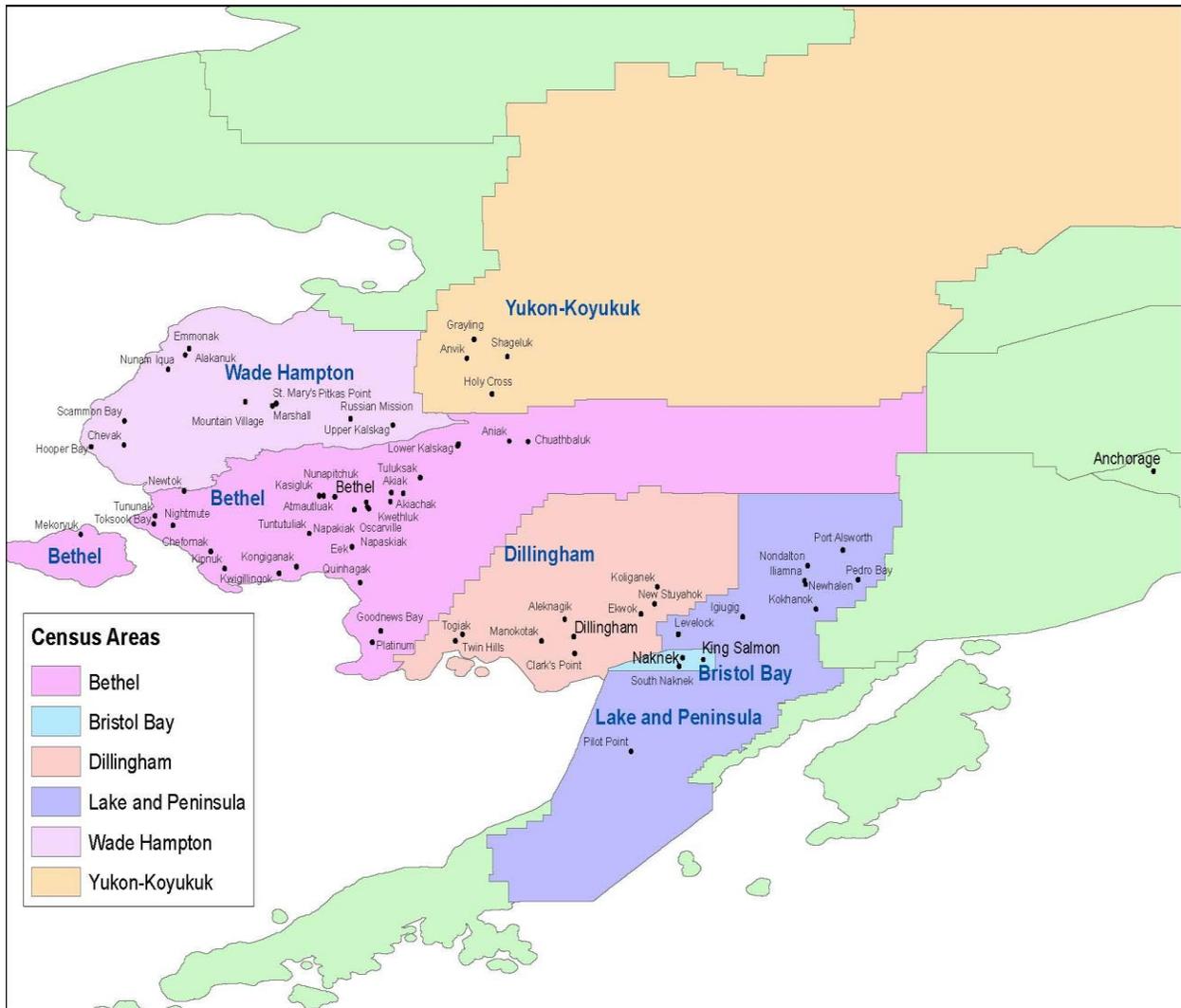
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June 2015

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TERRA Southwest Region showing Census Areas

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OF BROADBAND IN SOUTHWEST ALASKA

"Speed is everything out here. It opens up everything."

- Respondent, concerning impact of broadband in rural communities

Executive Summary

The purpose of this research was to gain a preliminary understanding of how organizations including large and small businesses, Native corporations and organizations, and local and regional governments are using broadband that is now available in much of southwest Alaska. To learn about community access to broadband, interviews were also conducted with library and school staff in communities where broadband had been installed under the OWL (Online with Libraries) program. Further, the study identifies research from other sources that could help to predict what socio-economic impacts the availability and adoption of broadband may have in rural Alaska.

Financial institutions use online connections for teller services and credit and debit card processing, and stated that more people in rural communities now have debit cards that they can use for online purchases and bill paying. Large retailers use online services for payroll, for point-of-sale (POS) transactions, and online ordering. Seafood processors rely heavily on connectivity with their head offices (generally in the lower 48) for administrative services including payroll, accounting, shipping and receiving, purchasing, and ERP (enterprise resource planning), and access data base software to track fish tickets. Seafood processors also provide Internet access for their employees, most of whom are seasonal and from other states or countries.

Tourism businesses use broadband for online reservation systems and for guests, who increasingly demand connectivity even for remote vacations. Village corporations and tribal councils use online services to help their residents obtain hunting and fishing licenses and fishing permits, to learn about funding opportunities, and to file reports on grants.

Local Governments connect online for interoffice communications and for payroll and other administrative functions. Other online applications and services include providing remote desktop access from other agency sites, use of online tools for land management and mapping, training including webinars for workforce development, and providing access to social services for clients. An economic development organization sends newsletters to communities electronically and packets of documents to its board members rather than relying on fax or courier.

Websites are important for tourism-related businesses to advertise and promote their businesses and for nonprofits and local governments to provide information about their services.

Broadband now plays many roles in rural education. Most students are required to use the Internet for class assignments. High school students can connect to classes in advanced subjects in other communities, and may complete online courses for college credit. Libraries remain important locations for community access, with residents going online to connect with friends on Facebook, as well as to download content for e-books, file income tax, and apply for jobs and government benefits. School and library Wi-Fi provides access inside and near the buildings for residents with smartphones.

Despite enthusiasm for broadband and the adoption of many broadband-based applications and services, most organizations interviewed identified problems with broadband, particularly with the pricing, stating that the terrestrial broadband network is too costly for them to take full advantage of online services and applications.

While the scope of this study was too limited to estimate long-term benefits, it found that broadband is highly valued and increasingly important to businesses and nonprofit organizations and local governments in southwest Alaska. Broadband helps businesses to be more efficient in their operations and to extend their reach to new customers and suppliers. It also helps to improve the effectiveness of public sector services such as those provided by borough and city governments and extends access to education and training. Broadband is also likely to be an important component of strategies to develop ecotourism and other ecosystem services.

1. Introduction

The TERRA Southwest project extended terrestrial broadband to 65 communities in southwest Alaska in 2012-2013. (Since then, terrestrial broadband has been extended to Nome and Kotzebue, and some surrounding villages.[1]) In mid-2012, ISER conducted a telephone survey with residents from 340 households, a sample drawn from the approximately 9400 households in communities that were to receive broadband in southwest Alaska. The interviews were designed to learn whether and how residents were currently accessing the Internet, and to obtain their predictions of whether they would sign up for broadband, and, if so, how they would use it. The results were published in "An Analysis of Internet Use in Southwest Alaska", part of a report entitled *Toward Universal Broadband In Rural Alaska* which also included a literature review.[2]

The purpose of this "after broadband" study was to gain a preliminary understanding of how organizations including large and small businesses, Native corporations and organizations, and local and regional governments are using broadband that is now available in much of southwest Alaska. To learn about community access to broadband, interviews were also conducted with library and school staff in communities where broadband had been installed under the OWL (Online with Libraries) program. Further, the study identifies research from other sources that could help to predict what socio-economic impacts the availability and adoption of broadband may have in rural Alaska.

The original research plan was to conduct a similar telephone survey of households in the region 18 months after broadband was installed to learn about adoption rates, how adopters were

using broadband, and what problems or barriers they encountered, if any, in using terrestrial broadband. However, sufficient funding to replicate the residential telephone survey was not available, so it was decided to conduct interviews with a selection of organizations in the region representative of the economic sectors and services in southwest Alaska.

2. Research Methodology

Telephone interviews were conducted with a sample of 33 businesses and organizations representing the major commercial and service activities in the region. They included:

- Banking: banks and a credit union

- Tourism: Tourist lodges, hotels, and a guiding service

- Retail: Major retail chains and village stores

- Commercial fishing: Seafood processors

- Other for profit entities: Small businesses, Native regional and village corporations

- Native organizations: Tribal councils and a regional Native association

- Local/regional government agencies: Boroughs and city governments

- Other nonprofit organizations: Economic development corporation.

The larger organizations were based in the hubs of Dillingham/King Salmon and Bethel; some have back offices in Anchorage or outside Alaska. Regional organizations based in the hubs serve villages in their region. Smaller organizations were located in villages throughout southwest Alaska.

In each case, we sought to interview a person knowledgeable about the communications services accessed by the organization, as well as how communications facilities and services were used. For most of the organizations, we interviewed IT managers or the equivalent; in some cases we interviewed general office managers or other administrators.

In addition, staff of 8 libraries, 2 school districts, and a regional University of Alaska Fairbanks (UAF) campus were interviewed. The libraries all had upgraded broadband as part of the OWL project. The purpose of these interviews was to learn about how the libraries and schools were using the upgraded broadband facilities, and the extent to which students and other residents were using these facilities and/or home broadband connections.

3. Technologies and Technical Support

3.1. Connectivity

All organizations use the Internet or other dedicated online networks. While several organizations use the terrestrial broadband network, some still rely on satellite networks, and one uses both technologies.

Financial Institutions: Bank branches use satellite facilities; one statewide bank purchased and installed capacity from a third party before its executives knew about TERRA. The credit union uses terrestrial facilities.

Retail: One large retailer has a VPN (virtual private network) tunnel dedicated for computers and phones plus some public network capacity. Another terrestrial broadband user had previously been using dial-up with fax backup.

Seafood Processors: One processor uses a commercial GCI Advantage IP package with speed of 768 kbps. Another uses an AT&T MPLS network with 1.5 mbps up and down speeds. Processors use terrestrial networks where available, or otherwise satellite links to communicate with remote locations such as Egegik.

Tourism: Lodges, hotels, and guiding services use broadband, with one stating it uses GCI's highest package to serve guests; some scale back in winter. One tourism operator has multiple satellite connections.

Village corporations use whatever is available; some had installed VSATs from HughesNet or Starband.

Government organizations in the hubs primarily use DSL, with some transitioning from previous satellite networks.

Native Associations: The Bristol Bay Native Association (BBNA) uses both terrestrial and satellite networks.

Pricing of terrestrial broadband and pre-existing contracts for satellite communications were the major reasons that satellite users stated they had not adopted terrestrial broadband (see section 8 below). Local governments, small businesses and nonprofits stated that they could not take full advantage of broadband services such as webinars and videoconferencing because of the charges for exceeding data caps on the terrestrial network. Because of the costs for exceeding bandwidth caps, to save money, BBNA staff wrote their own software to allocate their usage between terrestrial and satellite providers.

3.2. Computers and Other Devices

The number of computers and other devices operated by the organizations ranged from 5 or fewer for small businesses to more than 50 for some regional governments and tribes to more than 100 for some seafood processors. Many said that all of their employees use computers or other devices for work. Stores and banks also have ATMs. Most respondents said that all of their devices were online.

3.3. Smartphones

Use of smartphones for business and organizational purposes (as opposed to personal communications) is increasing, but organizations have various policies about smartphone use.

Banks point out that customers can now scan checks using their smartphones, and can scan codes using their phones to debit charges for some services such as taxis. Borough governments said they can scan checks for deposit using smartphones.

A seafood processor stated that 170 employees have smartphones, but no tablets are allowed. Smartphones can be used in the field for operations and sales.

An economic development organization says that smartphones are important for village outreach: voice, text, and photos can be emailed back from villages. A tribal council uses smartphones to allow direct contact with a VPO (village public safety officer). Some tribal councils allow residents to bring in their own devices including smartphones to offices where the tribe supplies Wi-Fi and network connections. Others don't allow employee or other devices because of concerns about viruses.

3.4. Technical Support

Technical support models vary. Seafood processors and large retail operations have back office support in Anchorage or at headquarters in Seattle, other sites in Washington State, or in Canada. Government agencies and tribes may have one person with IT skills to manage their network and equipment. Some rely on carriers (such as GCI, UUI, or HughesNet) and others contract with a technical support vendor in Anchorage. A borough government was able to share technical support with the school district located in the same building. Others depend on someone in the community, and the smallest businesses and organizations do the best they can, and some "learn from kids."

Training for employees in online skills varies. A seafood processor provides "onboarding" for new hires, including training in screen-sharing using Microsoft Link. Some small organizations provide basic training in online skills, software, and virus protection. Others have no formal training for employees, but rely on experienced staff to help others.

4. Broadband Applications:

4.1. Responses by Sector

All organizations stressed the importance of online connectivity for email. All but the smallest businesses stated that they used their connectivity for administrative functions including payroll, accounting, employee recruiting, and human resources functions.

Financial institutions use online connections for teller services, credit and debit card processing (sometimes by a third party), access to data bases outside Alaska, and foreign banking information. Financial institutions noted that more people in rural communities now have debit cards that they can use for online purchases, bill paying, etc. One respondent commented: "Five years ago no one had cards; now 80 percent have debit or credit cards." In Dillingham, taxi customers can now pay for rides with debit cards. Rural businesses such as village stores can

now scan checks for instant deposit rather than having to mail them to the regional bank branches.

Some financial institutions also use computer conferencing, shared screens to view documents, and remote desktop services (RDS).

Retail: Large retailers noted online usage for payroll and for point-of-sale (POS) transactions at cash registers. One uses Microsoft's online RMS (Remote Management System) and one uses Microsoft's online payroll software. Retailers also mentioned file-sharing, some ordering from vendors (although most is centralized), and surveillance video cameras. None apparently use videoconferencing to rural hub locations, although one stated that videoconferencing is used between Anchorage and its out-of-state headquarters. One large retailer also accepts online order for delivery to villages.

Seafood Processing: Seafood processors rely heavily on connectivity with their head offices (generally in the lower 48) for administrative services including payroll, other human resources functions, accounting, shipping and receiving, purchasing, and ERP (enterprise resource planning). Other business management software includes a customized Oracle data base, a hosted SAS solution, and Microsoft's MS Link collaboration tool, and file-sharing including Excel spreadsheets. Monitoring of systems by IT staff for maintenance and security can also be carried out remotely.

Seafood processors also use data base software to track fish tickets which are required by the Alaska Department of Fish and Game to document commercial harvest from a public resource. Some fish processors now use the state's online eLandings system which generates printable tickets.[3]

Another important use of broadband is to provide Internet access for their employees, most of whom are seasonal and from other states or countries. Some provide Wi-Fi for seasonal employees to use their own devices, and some provide Internet kiosks. One said it had a separate network for employee use because of concerns about viruses and volume of usage.

Tourism and Small Business: Tourism businesses use broadband for online reservation systems and for guests, who increasingly demand connectivity even for remote vacations. Some process credit cards for guest payments, and most rely on websites as an important means of providing information to potential clients and generating business.

Village corporations and tribal councils use online services to help their residents obtain hunting and fishing licenses and fishing permits. They also use broadband to learn about funding opportunities online and file reports on grants at the federal government resource www.grants.gov. Some access webinars to provide training for employees. In some communities, residents can come to the tribal office to do job searches and fill out forms online.

Local Governments: Email for interoffice communications, a website to provide information to residents, and administrative functions such as payroll are important to local governments. One

respondent said they can now download software upgrades for accounting; previously the staff could not get access or downloads would fail.

Other online applications and services include providing remote desktop access from other agency sites, use of online tools for land management and mapping, training including webinars for workforce development, and providing access to social services for clients.

An **economic development organization** sends newsletters to communities electronically rather than relying on mail or fax. It also sends out packets of documents to its board members rather than relying on fax or courier. It obtains information online for local residents about fisheries and vessel acquisition, and stated that many of the services it accesses for clients are based in Anchorage.

4.2. Websites

Websites have also become an important source of information for clients of organizations in the region, and a marketing tool for some local businesses.

Financial institutions provide online banking, financial information for customers/members, insurance, mortgages, and recruit employees on their websites.

Boroughs provide information for the public about the borough and its communities, notices about meetings, agendas, and forms. They also include contacts and other information for residents about the borough. The websites are also used for borough governance through making available newsletters, notices, lists committee members, and meeting minutes, etc.

Retailers provide information about their company and stores, sales flyers, weekly ads, and staff recruitment. One retailer uses its website to allow residents in the villages to order directly online.

Seafood processors provide information about the company and recruiting employees. Staff of one company can access an internal version of Microsoft SharePoint for sharing of documents, photos, calendars, etc.

Tourism-related businesses use websites to advertise and promote their businesses as well as to provide information about their services such as guiding and sport fishing. A lodge owner stated: "We depend on our website for a lot of our business." His lodge is also a fuel provider and hosts state government and helicopter crews.

4.3. Most Important Online Services

Of the various broadband services they use, respondents were asked to list which were most important.

Most respondents cited email as the most important service.

Financial institutions noted the importance of connectivity for automatic teller machines (ATMs), teller services, direct deposits, and mortgage payments.

Larger retailers noted the importance of point-of-sale (POS) systems for retail management systems and access to credit information.

Small retailers stressed the importance of being online for credit card POS services, online banking, paying bills, accounting, and computing and filing business taxes.

Seafood processors state that connectivity is critical for business operations, especially accounting, inventory, payroll, and human resources systems.

Village corporations noted that they must prepare and submit quarterly reports, and that they are now able to do this online, as well as to communicate with government agencies and do stock transfers and online trading. They can use remotely-shared desktops when they need to share information to make quick decisions. They are also able to manage accounts and export data (such as with QuickBooks), and can manage use of Alaska Quest cards (for food stamps and other subsidies for residents).

Tourism businesses stated that it was important to stay in touch with clients through email, and that customers look at websites and then send email to book lodge space or trips with a guide. Clients also want to stay in touch with family and friends in the lower 48. Online services can also be important for managing their businesses such as communicating with bookkeepers and buying supplies online.

Tribal councils noted the importance of email to keep in touch with people in their communities and with students. They also mentioned the use of online banking, ability to check the status of their bank accounts and monitoring spending through use of credit cards rather than cash, as well as administrative functions including employee payroll direct deposits, bookkeeping and use of QuickBooks, applying for grants, submitting reports and paying federal taxes. They also pointed out that they can buy supplies online and make online reservations for tribal council-related travel.

Local governments said that being online helped with funding to get quick access to requests for proposals and then to apply for grants, and that broadband made it faster and easier to go to grants.gov for grant requirements and paperwork. They also referred to the savings in time and access to funds through scanning checks for banking, and saving money by doing online searches for purchasing supplies and equipment.

One respondent also mentioned that being online helped the local government keep up with Alaska news through online access to sources such as the *Alaska Dispatch News*, KTUU, and *Tundra Drums*.

5. Education and Community Access

As noted in the TERRA "before broadband" report, both schools and libraries have been important for community access in southwest Alaska. Since it was not possible to do a household survey, we wanted to learn from librarians and educators whether more students were using broadband at home for coursework, and whether community access at schools or libraries was still an important service in the community, since two-thirds of residents in the 2012 household survey said someone in their household accessed the Internet elsewhere in the community, and 60 percent said they thought they would continue to do so even if they subscribed to broadband at home. We interviewed staff of libraries that had received broadband upgrades as part of the OWL (Online with Libraries) project, as well as staff from school districts and the regional UAF campus.

5.1. Technology

Connectivity: Before OWL, several libraries stated they used satellite services from vendors such as HughesNet, Starband, and Niasat. Others mentioned AT&T and GCI, which also have provided service via satellite.

Using the Internet for Assignments: Most respondents said that teachers require students to use the Internet outside of class to complete homework or projects. One commented: "Most of the students are required to go online to finish up homework projects online. We use Google Apps and Google Docs so we require the students to download their assignments and then send them to the teacher."

Some schools do not allow access to Facebook, YouTube or iTunes on school computers or other devices.

Taking Computers Home: School policies concerning whether students could take laptop computers or tablets home with them varied. In one community, only high school students could take computers home during the school year. In another, students could take computers home if they set up agreements at school about care and usage and received a password. In another, experience with damaged computers in the first year of home use resulted in a decision not to let students take computers home.

Where students could take computers home, some schools said it was fine for families to use students' computers at home; while one said other family members weren't supposed to use the computers, but " but we know they did."

Smartphones: Educators and librarians are seeing increased use of smartphones by young people. Students use them for Facebook and downloading music and games. Most schools don't allow smartphones in schools. One educator commented: "Smartphones are not generally allowed in schools … because it uses too much bandwidth and takes away from educational use by students at school."

Videoconferencing: The OWL project provided equipment for webinars and videoconferencing. A librarian noted: "We have Tandberg systems in place; they are nice high end video conferencing technology devices made and designed for rural Alaska specifically so other districts have these." However, some librarians are still learning how to use the equipment, and applications of broadband such as videoconferencing at OWL library sites have been slow to take off: "We've had OWL here for two years now and people are just learning about what is possible with it; the first year no one really knew what to do with the equipment."

5.2. Broadband Use for Education

The extent of use of online courses in schools varies among school districts. Some schools offer several classes from online sources, and one educator said "one kid has all online classes." Adults take online courses at home or at the library, or in one community at the village council building and other village council related building.

As small schools have few teachers and limited specialties, course offerings are supplemented with distance education classes, and students supplied with laptops can connect to classes in advanced subjects such as math in other communities. Some high school students are now taking college classes before they finish high school. The school district respondent said that the district is on a standards-based system, so that once students finish a standard they can move on, and many complete high school early. If students want to continue schooling, they can take courses for college credit.

Other examples include:

> An adult took a Yup'ik course online, and did a lot of coursework in the library.
> A librarian said he was taking accounting courses online.
> An adult was able to complete her GED online: "She left school and wanted to get her diploma; She was an older student, so she applied to the school board because she was over age." The respondent noted that some other adult students had taken online courses to get their high school diplomas.
> A teacher of a popular aviation class went to the library in McGrath and offered the course over the OWL network.
> Residents can use the OWL network to complete online classes required for occupational endorsements.
> The UAF Bristol Bay Campus operates outreach centers in King Salmon, Togiak and New Stuyahok with computer labs and Internet access where students can take online classes.

Some libraries want to expand capacity for adult distance education. One librarian noted: "We provide distance delivery equipment here and are hoping to expand this service to community members." Another added: "Right now we're not reaching capacity in this area; we're not satisfied with the number of people so we want to expand that more; in the past year we moved from an old dilapidated building to a new building and now have the ability to reach a lot more people."

5.3. Public Access to Broadband

Schools and libraries remain important locations for public access, with policies varying among communities. Comments included:

"Our school is open to the public at certain hours of the day; a lot of people use it if they don't have Internet at home."
"Community members can come in and get access to our network but only with their own devices."
"People here love coming to the library. They use computers and smartphones for a lot of things."
"The public can access [the Internet] only at the library and at the CVRF office, but only to apply for fishing related jobs."
"The community wanted to conduct an all-day meeting [using school Internet facilities], but we couldn't do that because it would take away the bandwidth from the school purposes …" but when OWL came into the community, its facilities could be used for the meeting.

However, an IT coordinator for a school district noted that community use contributes to congestion: "We have computers the community can use, but had over use problems, a lot of crowding on the network…. I'm working [on a package] giving district personnel an ID number that gives them priority working online and community access gets what's left**."**

Librarians point out that they can provide e-book readers and download materials. Since we have broadband, and then wireless kids have been coming up [to the village Library) a lot... Instead of books, we provide Kindles. We download different sets of materials geared toward different ages… kids love using the Kindle Books.

A school administrator added: " I see a lot of people teaching other people how to use things… .I had a kid who had a Kindle at home … but they didn't have Internet at home, so I told her to bring her Kindle to the school and set her up on OWL; and taught her how to load books on it. I went to a school board meeting (we do all our school board meetings and professional meetings by videoconferencing now) and came back to the school, and she was still here loading books."

Another librarian gave examples of community use: "We sometimes get about 20 people coming up here on a daily basis trying to get access to the Internet for different things. Mostly it's basically to communicate with family members outside the community using Facebook. And … a lot of them have been looking for jobs here in community and places like AVCP, or making sure they're caught up with their unemployment filing." They also use the Internet at the library for filing income tax, signing up for their PFD (Permanent Fund Dividend), and applying to college or applying for jobs.

As noted above, some tribal councils said they also provide broadband access to residents at their offices, either by providing Wi-Fi and broadband access or publicly available computers.

Wi-Fi for public access:

Wi-Fi in schools and libraries helps to extend broadband access, but policies vary. Comments included:

> "People come to use Wi-Fi after school or work if they don't have it at home."
> "We have open Wi-Fi hot spots by schools and the [school] district office so we often see a lot of community members hanging out at night time using their smartphones."
> In another community the Wi-Fi reaches 10 to 15 feet outside: "We have kids on the school steps after school is out to finish homework or play games; it's like a parking lot with parked cars, and people hang out by the school to access the Internet after the library closes or school is out.
> Another noted "You have to be close because of the metal around the school, but you'll see parents bringing kids their kids to the playground and they will be using their devices accessing Wi-Fi."
> However, some limit access to open hours: "When the library is not open, we shut off the Internet." In another community the Wi-Fi "is password protected and not available after hours."

Access in Summer:

Most communities have some public access available in the summer. One school district plans to hire local tech interns who will run the labs; "these are students that have graduated from high school and are interested in technology."

A librarian stated: "Winter hours are after 4 pm. I emailed the tech guy in Akiak… to turn on the Internet for the summer library hours" Others pointed out that there were additional access sites in their communities in the summer: "We have what is called a community office center at the tribe. Also, the library is open in summer until 8 pm…. Everybody checks out books, videos, and DVDs and they have same access to the computers and work station as students. All our computers [3 laptops and work station] have parental blocks on them." "Fishermen can also access the Internet at the fishermen's hall; it has wireless for Internet just for summer."

6. Health Care

Research for this project did not include health care, as health care providers in southwest Alaska have had dedicated satellite-based access to broadband for several years, with most funding provided from the FCC's Rural Health Care Program.[4] However evidence analyzed by ANTHC (the Alaska Native Tribal Health Consortium) on benefits of telemedicine from data collected over several years provides valuable insights into the benefits of connectivity for rural health care.

More than 575 health aides in 200 villages provide nearly one-half million patient encounters per year.[5] The AFHCAN (Alaska Federal Health Care Access Network) was established in the 1990s to provide greater support to village health aides by adding a terminal in each clinic with a computer and peripheral equipment such as an electronic otoscope, EKG

monitor, and digital camera. The system was originally designed to operate over low bandwidth, but upgrades now include videoconferencing for training and patient consultations, and current implementation of an electronic health records (EHR) system.

ANTHC and its partners at regional Native hospitals have collected data on several applications of telemedicine and their impact on patient care and savings in costs of health care delivery. By 2011, AFHCAN had an 11-year operational history with more than 125,000 cases. A review of these cases showed that telemedicine saved both time and money. The analysis showed that 20 percent of all specialty consultations at ANMC for rural cases are turned around in 60 minutes, 50 to 60 percent are turned around in the same day, and a total of 70 to 80 percent are turned around within 24 hours. Some 80 percent of all telemedicine consults prevented patient travel from villages to regional hospitals or regional hospitals to Anchorage, although one or two cases "caused" travel, as patients with conditions requiring treatment by physicians were identified that would otherwise have been missed.[6]

Preventing patient travel results in significant cost savings because medical evacuations are very expensive; in addition, evacuated patients under 18 years of age need to be accompanied by an escort such as a parent or guardian. A review of teleconsults for Medicaid cases from 2003 to 2009 found that travel was avoided for 75 percent of cases, resulting in net savings to Medicaid of more than $2.8 million. For every dollar spent by Medicaid on reimbursement, $10.54 was saved on travel costs.[7] In addition, the teleconsultations that resulted in avoiding travel prevented an estimated 4,777 lost days at work and 1,444 lost days at school for the patients in the study.[8]

7. Benefits of Broadband in Southwest Alaska

In general, benefits of rural telecommunications including broadband can be classified in terms of:

- *Efficiency*, such as managing operations of rural businesses, reducing travel, and filing online reports and business data
- *Effectiveness*, improving the quality of services provided such as in health care and education
- *Equity*, reducing the distance barriers between rural and urban communities by providing access to information, entertainment, education, and other services not otherwise available remote communities
- *Reach*, enabling Alaskans to extend their range electronically to market Native crafts, tourism, and other local assets.

Efficiency: Respondents noted that many of the applications they listed above enabled them to save time and/or money. Transmitting documents online was cited my many as obviously faster than using the postal service, and the ability to email scanned documents requiring signatures was both faster and more reliable than faxing: "We can email anything containing signatures rather than via fax and hoping it gets to them."

Ordering spare parts online for public works saves both time and money for local governments, while online shopping allows both small businesses and nonprofits to get access to

supplies and equipment at better prices and with more choices than available locally. Downloading software is faster and simpler than ordering software that has to be mailed on CDs or other media.

Economic development and local government agencies state that previously, they had to use fax or air courier to get documents to communities. Tribal councils said that they are now able to contact people online about council meetings, and email flyers, which are both faster and cheaper than mailing letters or phone calls.

Online banking and bill-paying are clearly much faster than mailing checks, but these services also give more timely access to funds and reliable information about bank accounts. Some respondents also noted time saved compared to using their previous dial-up service, which was very slow and unreliable. Concerning online banking and bill paying: "Previously we would get bounced off when [the connection] timed out."

Effectiveness: Both commercial and nonprofit organizations cited the value of online resources for training, to improve the effectiveness of their employees. Local governments and tribal councils provide more effective services by helping residents to obtain information online. Egovernance services such as provision of hunting licenses and fish tickets and online forms for applications for government benefits improve the effectiveness of government services in rural areas. Online course materials and sources for research can help to make rural education more effective.

Equity: A major benefit of rural broadband can be to reduce disparities between rural and urban residents. In southwest Alaska, access to online banking and business services, and more timely access to training and grant opportunities are examples of improved equity. However, as discussed below, more skills and business training may be needed to achieve greater equity with urban residents.

Reach: Tourist-related businesses such as hotels, lodges, and guiding services use websites and Facebook to reach new markets: "When you get the word out online using Facebook a lot more people can see what you are doing businesswise; if one person 'likes' it on Facebook, you can get word out quickly to a lot of potential customers." Websites have become an important marketing tool to reach fishing and hunting enthusiasts outside Alaska. A guiding service representative stated: "They see what they want to do on the website, and pick out what they want, and call us to book their package." Others are designed to let customers book reservations online. A large retailer operates a service that allows residents in the bush to place online orders that are delivered through SpanAlaska, a freight transportation service.[9]

7.2. Importance of Broadband for Work

After responding to specific questions about broadband usage, participants were asked to assess the importance of broadband for their work, and the potential impact of broadband in their communities.

Services not otherwise available:

Several online features offer access to services and opportunities that previously were not available. Skype allows family members to stay in touch visually and groups to hold virtual face-to-face meetings. Webinars and online classes provide training and educational opportunities that were not previously available.

Staff of organizations as well as community residents have access to online data bases, professional services, and government information that previously was not available to them.

Importance for Work:

All respondents felt that broadband was important for their work. The following are some of their comments:

A **seafood processing** manager said that it was very difficult to do payroll, manage logistics, and track inventory when the network isn't working.

A **tourism business** manager stated**:** "It's pretty important – [without it] a lot of things wouldn't be possible like our website, and being reliably able to get in touch with our clients."

Village corporations:
"It's very important; it's a primary communications tool; with purchases and contacts from the outside world."
"It's very important because we need to keep up with our contacts with our business activities especially when dealing with Anchorage businesses and subsidiaries that we own."

Tribal councils:
A tribal administrator stated: "It's important – from a scale of 1 to 10 I'd say about 10." "It's so much easier than using the fax line when it's down and we don't have any idea if they received everything on the other end." He said that it's essential for business tasks such as transferring funds and using debit cards, and very important for dealing with granting agencies.
"Right now in my position as Tribal Administrator every day I have to go online to get into our company file; it's very important for decisions we have to make. I do that every day."

City administrators:
"On a scale of 1 to 10, I would say 8 or 9; seems like most of the information is digitally available now so that's how I get my information now."
"It's now a big part of our community, and a lot of the work we do depends on it, especially with the big bosses."

The Economic Development Corporation representative noted that broadband is "essential for outreach to our 17 communities."

7.3. Potential Impact of Broadband on Communities

Respondents were also asked: "What impact do you think access to broadband will have on your community?"

Financial institutions noted that the use of debit cards has increased: "Five years ago no one had cards; now 80 percent have debit or credit cards." This was viewed as a positive change as rural residents can use the cards to shop online and pay bills.

Local governments: A local government representative pointed out that the Internet can be used for energy conservation to manage power. Kokhanok has wind turbines with software connected to UAF, which can use to optimize the use of wind/diesel. Perryville has 14 small wind generators with online support.

Borough staff use broadband to participate in state webinars for employee training. Concerning education, "Schools have embraced webinars; students can take courses from Pennsylvania or Wyoming; students can[even] take music lessons online." Computer labs for public use enable residents to apply for jobs, update resumes, and access state government websites.

The **Economic Development Corporation** notes that fishermen can use cellphones rather than two-way radios on the water; and can even go online on the water from their boats.
He added **"**I think it's good for kids here in this area to have high speed Internet to see what's out there instead of being isolated and sheltered."

Librarians and school administrators also commented on the impact of broadband in their communities to facilitate communicating with friends and family, shopping and making appointments, accessing government services, and accessing information for school and distance education:

> "Speed is everything out here. It opens up everything."

> "Now I see a lot of changes; people can do their shopping on Amazon, fill out PFD applications, go to Facebook to connect with relatives, make doctor appointments all through the Internet, and that never used to happen before. People make their appointments before they go into town, or make reservations or do other airline business online."

> "In 2007, I noticed that a lot of people just didn't like to go into the school because of past bad experiences, but now they go to the school so they can access the Internet for things like Facebook, and real life purposes. It's really different now because we have access and the Internet works really well; people feel better about using it -- they're more comfortable using it on their own rather than having someone else do it for them. People are saying … I want this at my house because it's convenient…. I think the kids have a lot to do with it They need it to finish homework when school is out because so much of their distance learning is through the Internet."

8. Problems and Limitations

Despite enthusiasm for broadband and the adoption of many broadband-based applications and services, several organizations identified problems with broadband, particularly with the pricing, stating that using the terrestrial broadband network is too costly.

8.1. Affordability

Almost all nonprofits and small businesses noted problems with affordability. Several stated they could not use all the applications they wanted to use, or could not use some applications as much as they wanted, such as webinars, Skype, and videoconferencing. Some organizations limit the bandwidth employees can use, for example by forbidding streaming.

Financial Institutions: A bank manager said that if more bandwidth were available, they could provide video for training. The bank now uses WebEx without video. The credit union representative said that terrestrial broadband was too expensive; some members use smartphones for online banking and debit/credit cards.

Local governments: A borough employee said that they would like to do videoconferencing with communities, but found it too costly. Assembly meetings including 15 people from villages are now by phone, but it was "too limiting; we can't see facial expressions or body language." The respondent noted that the borough is not allowed to use school district or medical clinic videoconferencing. Another expressed concern that use was constrained by download caps and the charges for overages.

A Native association "blows through" the terrestrial bandwidth caps; it has to allocate traffic between DSL and satellite to save money; an IT staffer wrote program to allocate usage.

Households: Concerning observed household use of broadband in their communities, many commented that the price was too expensive for some residents. For example: "At first there were a lot of people signing up and it was a good thing, but some people cut it off and see it as bad because their families tend to go over [the caps]." Another noted that some people who signed up in response to advertising in 2012 were getting bills of $400 to $600.

A respondent reflecting on his own household use said that "The biggest problem is Internet caps; we can't use [the service] much for music or movies; we get to the cap and then for a third of the month limit use or don't use it." He noted that the high prices for data overages made it difficult to take online courses because the family couldn't afford to exceed the caps and had to limit or stop using broadband for the latter part of the month.

Another stated that the pricing of data overages made it difficult for some families who had moved to the community from out-of-state. Nonworking spouses were not able to use Skype much to stay in touch with family members. One added "a lot of families are getting separate phone and Internet providers because when they combine them both, the fee is really expensive."

8.2. Capacity

Capacity and quality of service are still concerns for some locations. A seafood processor said that most of their locations don't have speeds more than 768 kbps so they can't do Skype or videoconferencing. Some small communities (such as Sleetmute and Egegik) don't yet have broadband, but would use it if it were available.

Terrestrial broadband is generally seen as superior to satellite-based service. There were few comments about terrestrial broadband reliability, although a couple of respondents noted that there was sometimes congestion on the network. A few complained about the variable quality of satellite service, but have continued to use satellite services such as HughesNet because of their fixed prices.

One respondent commented: "Here we have devices. We are device rich, and bandwidth poor."

A lodge owner stated that clients wanted to upload photos and access video, and didn't understand the limitations: "We have the biggest package they offer but we can't do videos here especially during fishing season, it's bad. So we just do a lot of emailing and do select times for our updates for photos and other updates…. Our clients sometimes don't understand that and they just stare at us when we tell them about how big uploads and downloads make our lives difficult."

Educators also noted bandwidth limitations. "YouTube is very helpful for visual learners, but video takes a lot of bandwidth." "Sometimes the Internet gets really slow when there is overuse. Sometimes we have to ask kids to log off their smartphones because teachers can't log onto to input grades to PowerSchool" (a web-based student information system).

8.3. Other Concerns

Other issues raised by a few respondents included concerns about security for credit card transactions, inappropriate use such as employees on Facebook and letting their kids go online at work. Other mentioned the need for training for employees both to assure appropriate use and to get the most benefit from available applications.

9. Potential Long-Term Social and Economic Impacts

It is not possible from this study to determine the extent to which access to and utilization of broadband may impact social and economic development in southwest Alaska. The timespan since the introduction of broadband is relatively short, and because of funding limitations, the sample of institutions (government, private sector, nonprofits) differs from the household sample in ISER's "before broadband" study. However, an examination of the results of this study coupled with other studies of rural broadband can identify potential impacts of broadband in rural Alaska. A comprehensive literature review was included in the 2012 report *Toward Universal Broadband in Rural Alaska* with a bibliography of more than 175 reports, studies, and publications on broadband relevant to rural Alaska.

Economic analysis of broadband and other ICTs (information and communication technologies) examines both direct effects (such as the growth of the digital economy and online industries) and indirect effects (on GDP, employment and wages, industry structure and the organization of work). A World Bank econometric analysis of 120 countries showed that for every 10-percentage-point increase in the penetration of broadband services, there is a 1.2 percentage point increase in per capita GDP growth in high income economies, and a 1.38 percentage increase in developing countries.[10] The World Bank also reports that evidence from a panel survey of broadband in countries where at least 40 data observations are available (using quarterly data) suggests that a 10 per cent increase in fixed broadband penetration is associated with a 4.8 per cent increase in GDP per capita in the United States, but with lower rates in Europe.[11] Czernich et al. examine the effects of broadband on GDP per capita across OECD countries, finding that a 10-percentage point increase in broadband penetration raises national annual per capita growth by 0.9-1.5 percentage points.[12]

However, these national findings may not apply in rural or remote regions and sub regions. Also, as Katz notes: "broadband economic impact could be mediated by a lag effect, indicating that adoption does not automatically translate into growth, but that it would require the accumulation of intangible capital, defined as the changes in business processes and firm culture that lead to assimilation of improved business processes."[13]

A recent report (published in March 2015) presents findings from a systematic review of evaluations of the local economic impact of broadband.[14] The review considered more than 1,000 policy evaluations and evidence reviews from OECD countries. Of those identified, it found only 16 impact evaluations that met its minimum standards for research rigor, with methodologies designed to ensure that evaluations establish causality. Of the 16 evaluations reviewed, 14 found that broadband has positive impacts on the local economy. However, the study notes that "effects are likely to vary across types of firms, workers and areas, and may not be large in the aggregate."[15]

In summary, the evidence from the 16 studies showed that:

• "Extending broadband to an area can affect firm productivity, number of businesses, and local labor market outcomes (such as employment, income and wages).
• These effects are not always positive, are not necessarily large, and may depend on complementary investments by firms (for example, training workers, or reorganizing sales strategy or supply chains to take advantage of faster internet connections).
• Effects can vary across different types of industries and workers with service industries and skilled workers possibly benefiting more than manufacturing industries and unskilled workers.
• The economic effects of broadband tend to be larger in urban areas (or close to urban areas) than in rural areas."[16]

In general:

For firms and their workers, broadband should allow for efficiencies in production, both by lowering costs (for data storage, advertising or working with suppliers) and by enabling innovation (reaching new customers online, for instance, or employing big data analytics). Those productivity gains could translate into higher wages, and possibly higher levels of employment (although firms might well shed staff in response to technological change). At the same time, broadband may allow for more flexible patterns of work, including working at home or on the move. For some groups of people, such as those with caring responsibilities, more flexibility may increase labor force participation, which could in turn raise employment. More broadly, broadband may lower the barriers to starting a business, particularly in sectors like retail.[17]

The following are some findings from the studies that appear relevant for rural Alaska:

Productivity: Broadband can positively impact firm productivity. But effects are "not always positive, are not necessarily large and may depend on complementary investment."[18] Productivity effects can vary across different types of workers with skilled workers benefiting more than unskilled.

An evaluation of a Norwegian public broadband program found positive effects of broadband on overall productivity, although the effects were fairly small. Further, the study found that while broadband may help overall firm productivity, this is driven by gains to skilled workers and losses to unskilled workers.[19]

Employment: The study of Norwegian broadband suggests that effects may differ between skilled and unskilled workers, calculating that in 2005 the employment rate for skilled workers was 1.3 percentage points higher than it would have been without broadband, whereas for unskilled workers the employment rate was 0.9 percentage points lower.[20]

A study by Kolko found that the relationship between broadband expansion and employment growth varies across industries, and that the positive relationship is especially large for utilities; information; finance and insurance; professional, scientific, and technical services; management of companies and enterprises; and administrative and business support services. He also noted that the relationship between broadband and employment growth is stronger in places with lower population density, "consistent with the theory that smaller or more isolated areas may benefit more from high-speed connections, giving businesses in these areas access to larger markets." His conclusion appears relevant for rural Alaska: "None of the other place characteristics—such as having a more educated workforce, having a better climate, or being a vacation destination— affects the relationship between broadband expansion and employment growth." [21]

In an earlier multiyear analysis, Crandall et al. found that nonfarm private employment and employment in several industries was positively associated with broadband use. More specifically, "for every one percentage point increase in broadband penetration in a state, employment is projected to increase by 0.2 to 0.3 percent per year."[22]

Firm Entry: Kim and Orazem report a positive impact of broadband availability on business entry in US rural counties. In counties with larger population settlements (above 2,500) and/or

adjacent to urban counties, a 10 percent increase in broadband availability in these counties raises firm entry by 1.6 percent. However, in rural areas with similar settlements but not adjacent to a metropolitan area, the increase in probability of firm entry was only 0.2 percent, and in the sparsest rural counties, there was no effect on firm entry.[23]

Urban versus Rural Gains from Broadband: The economic effects of broadband tend to be larger in urban areas, or close to urban areas. Kandilov and Renkow found that broadband positively affected employment and annual payroll in metropolitan ZIP codes, but there are zero or negative effects upon these outcomes in semi-rural and rural ZIP codes.[24] Whitacre et al. found that there is no effect of broadband availability on employment in rural US counties,[25] but the same authors found reduced unemployment rates for high adoption counties.[26]

In a study of broadband in rural Germany, Fabritz suggests that the effects on employment rates are larger in rural areas, but that employment effects may vary by industry – with services seeing positive effects and no effect on manufacturing.[27] Fabritz found proportionately greater effects of DSL on employment rates in more rural areas. The study also found that areas with lower population density see an increase in employment rate with increased broadband availability, whereas the return in areas with higher population densities was zero.[28]

A study of rural broadband in Italy found increased revenue for small businesses run by highly educated owners, but no significant effect for businesses run by owners with low levels of education. The authors suggest that "results are consistent with a skills bias to the impacts of broadband, with greater impacts experienced by more skilled organizations."[29]

Policy: Policy-related findings that could be relevant for Alaska include:

- "Broadband, like many ICTs, is a 'disruptive' technology that creates winners and losers….
- It is not a silver bullet for local economic development;
- Broadband seems to benefit skilled workers more than low- or un-skilled workers;
- The effects of adoption and provision may differ. More work needs to be done to understand whether and how to encourage adoption and productive business use.
- Provision of broadband in rural areas may need to be subsidized, but "the economic benefits of doing so will not be as large as for urban areas."[30]

Implications for Alaska

It is difficult to determine the extent to which the findings of these studies would apply to rural or more specifically, remote Alaska, which differs in population density, economic activities, and demographics from most rural regions of industrialized countries. However, several factors do appear to be required to achieve economic benefits from broadband:

- **Adoption:** high adoption rates appear necessary for positive rural economic impact;
- **Education and skills:** workers and business owners with more education and skills are likely to benefit more in terms of employment and business revenue that less educated or skilled workers;

- **Industry sectors:** Service sectors such as finance, professional and public services are likely to benefit more than manufacturing or resource industries, but management and administration of the latter could benefit, particularly if they adopt efficient business practices.

However, Katz also notes several caveats: ".… broadband has a stronger productivity impact in sectors with high transaction costs, such as financial services, or high labor intensity, such as tourism and lodging. .… the impact of broadband on small and medium enterprises takes longer to materialize due to the need to restructure the firms' processes and labor organization in order to gain from adopting the technology .… Finally, the economic impact of broadband is higher when promotion of the technology is combined with stimulus of innovative businesses that are tied to new applications."[31]

10. Conclusions and Recommendations

10.1.   The Value of Broadband in Southwest Alaska

Broadband is highly valued and increasingly important to businesses and nonprofit organizations and agencies in southwest Alaska. Broadband helps businesses to be more efficient in their operations and to extend their reach to new customers and suppliers. It also helps to improve the effectiveness of public sector services such as those provided by borough and city governments. Broadband is also likely to be an important component of strategies to develop ecotourism and other ecosystem services through websites and online support for reservations and logistics.

10.2.   Telework

Broadband could provide new opportunities for rural Alaskans to work from their home communities. Many organizations hire remote employees for reservations, travel agency services and customer support. Jet Blue, for example, has a virtual call center of more than a thousand workers, many of whom are women, connecting to the airline's systems over the Internet using home computers. Artists, artisans, and crafts people can "set up shop" to market their wares globally on Etsy, a peer-to-peer e-commerce website focused on handmade or vintage items and supplies.[32] Writers and editors, as well as those with digital media and other skills media can obtain contract work through websites such as Elance, an online staffing platform.[33]

Another variation of telework, known as "microwork" uses online platforms that break down large pieces of business processes into discrete tasks of limited sizes, and distribute them to workers electronically. Examples include market research, data input, data verification, copywriting, graphic design, and translation. The most widely known microwork platform is Amazon Mechanical Turk (AMT), which is estimated to have 500,000 microworkers in 190 countries. The service enables companies to access a diverse, on-demand workforce, assign tasks needing human intelligence, and integrate the results into their business processes and systems.[34]

10.3.   Capacity Building

Several studies reviewed above indicate that broadband benefits are greater for skilled workers and for organizations that adopt new business practices: "… the internet and ICTs contribute to economic change, but that the extent of this change depends on how people and firms adapt to and innovate around technology. For example, a number of studies suggest that ICT investment only delivers productivity gains for firms who also introduce training for staff, and new ways of working."[35] Thus, while some organizations and individuals may benefit immediately from access to broadband in southwest Alaska, training for managers, employees, and individuals is likely to be necessary to achieve full benefits.

10.4. Technology Issues

Smartphones: Organizations contacted in this study vary in their current use of smartphones in their work. However, many who interact with the public note that smartphones are increasingly important for financial services, accessing websites and other information, and sending pictures from villages. Also, librarians and educators state that young people in their communities now tend to rely on smartphones to access online services. For broadband to be accessible in rural Alaska, upgrades to mobile broadband will be required, and mobile broadband speeds and pricing will need to be monitored.

Sharing Facilities: Schools, libraries and clinics in the region typically have videoconferencing facilities (with connectivity subsidized by the federal E-rate Program and Rural Healthcare Program). However, some respondents in this study stated that the school and health care facilities could not be used for other purposes. Also, some libraries had not yet taken full advantage of the videoconferencing facilities provided through OWL. It should be possible for organizations in rural communities to make use of these facilities, with appropriate consideration for existing priorities and the needs for security and confidentiality.

Satellite Services: Despite the availability of terrestrial broadband, several organizations in this study continue to use satellite facilities. Some isolated villages in southwest and other regions of rural Alaska are also likely to continue to be served exclusively by satellite for the foreseeable future. Satellite service will also be required as a backup for terrestrial broadband if there are not redundant terrestrial connections. Therefore, more attention is needed by state and federal planners to ensure that rural Alaska has adequate and affordable satellite broadband coverage.

10.5. Pricing

As noted in several studies referenced above, benefits from broadband require high levels of adoption, and not just availability. Pricing appears to be a significant barrier to adoption and utilization of software and services available over terrestrial broadband in southwest Alaska. Small businesses, governments, and Native organizations all state that they must limit their use of broadband, and cannot take advantage of some services that would be beneficial, including webinars and videoconferencing.

Middle mile services are not regulated at the federal or state level. However, based on the many observations from respondents about limitations on usage because of broadband pricing, a review of terrestrial broadband pricing is needed. Lower prices appear necessary if rural organizations and businesses are to gain maximum benefit from terrestrial broadband.

The following chart shows prices for connectivity in the TERRA Southwest region in 2015. These prices apply to business as well as residential service.

Villages in TERRA Region				
DOWNLOAD SPEED	UPLOAD SPEED	USAGE (GB)	OVERAGE RATE (PER MB)	COST PER MONTH
512 Kbps	128 Kbps	5	N/A	$29.99
2 Mbps	256 Kbps	10	$ 0.0100	$64.99
3 Mbps	512 Kbps	15	$ 0.0100	$74.99
4 Mbps	1 Mbps	25	$ 0.0075	$114.99
6 Mbps	2 Mbps	40	$ 0.0075	$164.99
6 Mbps	2 Mbps	60	$ 0.0075	$214.99
6 Mbps	2 Mbps	100	$ 0.0075	$314.99

In contrast, in Anchorage, available speeds are much higher, and prices considerably lower, with lower overage charges. The minimum download speed of 10 Mbps in Anchorage is not even available in rural Alaska.

Anchorage				
DOWNLOAD SPEED	UPLOAD SPEED	USAGE (GB)	OVERAGE RATE $10 Data Bucket	COST PER MONTH
10 Mbps	1 Mbps	40	5 GB	$59.99*
50 Mbps	2 Mbps	150	10 GB	$84.99
100 Mbps	5 Mbps	300	20 GB	$134.99
250 Mbps	10 Mbps	600	30 GB	$174.99

*In Anchorage before January 2015, GCI offered a rate of $39.99 for 10 mbps down/1 mbps upload with10 GB usage included, and $.01 overage charge per MB.

10.6. A Bandwidth Divide

Although broadband is now available, the problems of affordability could result in an ongoing "bandwidth divide" between rural and urban Alaska, and between rural Alaska and other parts of the U.S. and other countries. This disparity could create difficulties for both education and employment. Schools are already being required to conduct standardized tests online,[36] and are increasingly adopting online textbooks. Universities are offering MOOCs (massive open online courses) which could provide valuable opportunities for rural Alaskans, but require access to broadband.[37]

10.7. Conclusion

High-speed, affordable broadband has been described as a foundation stone of modern society.[38] This report provides evidence that broadband can be important for economic development and delivery of public services in southwest Alaska. However, issues of affordability need to be addressed, and capacity building may be required for businesses, nonprofit organizations, and local governments to derive maximum benefit from rural broadband.

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