

The Impact of Internet Access in Indigenous Communities in Canada and the United States:

An Overview of Findings and Guidelines for Research

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“We’re copying what
our parents used to do,
but in modern ways.”

Lucassie Arragutainaq

Manager of the Sanikiluaq Hunters and
Trappers Association, Nunavut

Introduction

The Internet Society commissioned this report to provide an overview of findings to date on the impacts of the Internet in Indigenous¹ communities in Canada and the United States. It begins by summarizing the theory of the role of information, and by extension, information services such as the Internet in the development process, followed by a review and analysis of the available research on the effects of information services for:

- Personal use
- Health care and education
- Business and commercial activities
- Non-profit organizations and local/tribal governments.

This report then examines how online and mobile software and games are being developed to preserve and promote Indigenous languages and to share knowledge of Indigenous cultures, and how Indigenous enterprises and organizations are operating communications networks and providing digital services, concluding with evaluation planning, research design and indicators that could be included in future evaluations of the impact of the Internet in Indigenous communities.

While focused on the Internet, the research review includes relevant studies of the impact of information technologies in general, and connectivity, particularly broadband, which is required for many Internet applications. The examples are drawn primarily from Alaska and northern Canada, but include references to experiences in other regions of North America and in Hawai'i. The research review was augmented with a workshop at the 2019 Indigenous Connectivity Summit² to identify, from a community perspective, indicators that could be used to assess the impact of the Internet in Indigenous communities.

1 In this report, the term Indigenous is used to refer to American Indian, Native Hawaiian, First Nations, Alaska Native, Métis, and Inuit. When referencing other reports, the term in the original report is used (such as Aboriginal).

2 See <https://www.internetsociety.org/events/indigenous-connectivity-summit/>

Overview: The Internet and Development

Information is the Key

The Internet has become a crucial part of the social and economic well-being of people living in Canada and the US. Connectivity is especially valuable for small and isolated communities without local access to information resources (whether they be medical specialists, education opportunities, elders in distant communities, and so on).

Access to information is obviously critical for education and training, as well as for health services to obtain advice on diagnosis and treatment of cases beyond the local expertise or capacity of local facilities, but it is also critical to running businesses and organizations, and preserving and promoting Indigenous languages and cultures. The ability to share information online can open new markets for local products, ranging from harvested foods to crafts to Internet applications and software. And sharing Indigenous knowledge about climate and the environment can contribute to management strategies for land and water resources.

Other benefits may require more complex types of information seeking or use by people with institutional affiliations, such as members of community organizations, entrepreneurs, employees of tribal businesses or non-profit organizations. For example, trappers would benefit if their local tribal council could search online for a distant auction that would pay high prices for their furs. Indigenous guides would benefit if an ecotourism lodge could promote its wildlife expeditions online. These indirect benefits, while apparently obvious, are often overlooked.

The Context

Demographics

As of 2016, in Canada more than 1.6 million people (or 4.9 per cent of the population) identify as Aboriginal. There are 618 First Nations communities, which represent more than 50 nations or cultural groups and 70 Aboriginal languages. First Nations and Métis peoples (referring to a collective of cultures that resulted from unions between Aboriginal and European people)³ live throughout the provinces and territories, particularly in isolated or remote communities in the northern regions of British Columbia (BC), Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Labrador.⁴

Three-quarters of Inuit live in 53 communities across the far northern regions of Canada (known as Inuit Nunangat):⁵ Inuvialuit Settlement Region (Northwest Territories (NWT), Nunavut Territory, Nunavik (Northern Quebec) and Nunatsiavut (Labrador). There are also significant Inuit populations in Canadian cities such as Montreal, Ottawa, Winnipeg, and Edmonton.⁶

Nationally, the US Indigenous population is about 4.2 million, including members of 573 tribes living on more than 300 Indian reservations and in cities and towns throughout the country. Indigenous people comprise about 16 per cent of the population of Alaska, including 231 federally recognized tribes. There are more than 200 villages scattered over a land area of 1.7 million sq. km., many without road access, and accessible only by air or water. Alaska is home to at least 20 native languages belonging to four distinct language families. In Hawai'i, about 10.2 per cent of the population identify as Native Hawaiians or Pacific Islanders.⁷

It is well documented that in both northern Canada and Alaska, Indigenous populations are relatively young, households are often large and housing availability is limited. Incomes are generally lower than the national average and often seasonal, while the cost of living is much higher because of the high costs of fuel, food and supplies, all typically transported (by ship or often by air) from distant sources.⁸

3 See <https://indigenousfoundations.arts.ubc.ca/metis/>

4 StatsCan. (2017, October 25). Aboriginal peoples in Canada: Key results from the 2016 Census.

5 See <https://indigenouspeoplesatlasofcanada.ca/article/inuit-nunangat/>

6 See <https://www.itk.ca/about-canadian-inuit/>

7 US Census. (2018). Quick Facts. Estimates as of July 2018.

8 See <https://www.itk.ca/wp-content/uploads/2018/08/Inuit-Statistical-Profile.pdf>

Connectivity

In both Alaska and northern Canada broadband access is limited, as is access to robust and reliable data about Internet access in many rural and remote communities. Due to small populations in rural and remote areas affecting data quality and problematic broadband mapping regimes, available information sources often provide an incomplete picture of Internet access in Indigenous areas. Available information is improving, but gaps persist.

In 2016, the Canadian telecommunications regulator, Canadian Radio-television and Telecommunications Commission (CRTC), established a speed target of 50 Mbps download and 10 Mbps upload for all Canadians, including residents of remote regions.⁹ Yet as of 2018 (the most recent year for which data is available), only 71.2 per cent of households in the Yukon and 61.8 per cent in the NWT had access to fixed Internet speeds of 50/10. The situation is worse in Nunavut, where less than half of households have access to at least 5 Mbps, and no households have access to speeds up to 16 Mbps or faster. For First Nations on-reserve, only 31.3 per cent of households have access to the 50/10 target speeds.¹⁰

Data from the US Federal Communications Commission (FCC) is more problematic.¹¹ The FCC currently defines broadband as 25 Mbps download and 3 Mbps upload speeds. In its most recent reports, the FCC estimates that 92.3 per cent of the US population has access to 25/3 service (alternatively, this means that broadband service is not available to 24.7 million people).¹² However, this data is widely viewed as flawed. In 2019, Microsoft reported that, in fact, only 49 per cent of the US population has access to broadband speeds, meaning it is unavailable to 162.8 million people.¹³

Microsoft's data does not include specific information about reservations, Alaska, or Hawai'i; therefore, the only source is the FCC. According to the Commission, nationwide 35 per cent of tribal lands lack access to terrestrial high-speed broadband Internet,¹⁴ while the 2016 US Census American Community Survey estimates that approximately 32 per cent of American Indian and Alaska Native households lacked access to a computer with a broadband Internet subscription.¹⁵

However, given the results of the Microsoft study, it can be assumed that the actual rates of access are much lower. A recent survey by Morris and Howard (2019) found that residents on tribal lands are predominantly using smart phones to access the Internet, but 50 per cent of respondents stated that their Internet use was limited because they could not afford enough data in their cell phone plan.¹⁶

9 See <https://crtc.gc.ca/eng/archive/2016/2016-496.htm>

10 CRTC. (2019). Communications Monitoring Report 2019.

11 See <https://www.publicknowledge.org/blog/the-consequences-of-a-broadband-deployment-report-with-flawed-data/>

12 US Census. (2018). Quick Facts. Estimates as of July 2018.

13 See <https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RWptEB>

14 FCC (2018).

15 US Census Bureau. (2016). 2016 American Community Survey 1-Year Estimates.

16 Morris, T., Howard, B. (2019). Tribal Technology Assessment: The State of Internet Service on Tribal Lands, American Indian Policy Institute, Arizona State University.

Macro Studies: Impacts at the National Level

It has been well documented that high-speed, affordable broadband, and the access to online services it makes possible, is a foundation stone of modern society.¹⁷ Numerous macro or national studies have analyzed the impacts of broadband, the Internet, and cellphones. For example, the World Bank reports that evidence from a panel survey of broadband in countries where at least 40 data observations are available 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 US.¹⁸

Often, studies do not explain the “chain of inference” – which information-related activities actually accounted for increases in economic indicators? It is also difficult to determine the extent to which the findings of these studies would apply to Indigenous communities in North America, as they differ in population density, economic activities, and demographics, not only from the conditions in most of Canada and the US, but from most rural regions of industrialized countries. Several factors highlighted in some studies, however, do appear relevant in understanding the impact of the Internet in all contexts:

- **Adoption:** High adoption rates appear necessary for positive rural economic impact.
- **Education and skills:** Employees and business owners with more education and skills are likely to benefit more in terms of employment and business revenue than 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 (such as mining and fisheries) could also benefit.

Indigenous Languages and Cultures

Around the world, Indigenous people are using the Internet to preserve their culture and history. The Inuit Circumpolar Council represents approximately 160,000 Inuit in Alaska, the Canadian Arctic, Greenland, and Chukotka (Russia), and uses a variety of online media to share cultural materials and to address shared issues such as climate change, ocean resources, and natural resource exploitation.¹⁹

Videoconferencing provides a means for elders to communicate in Indigenous languages. Indigenous elders in the Canadian Atlantic provinces and in Ontario and Saskatchewan meet via videoconference for discussions in their own languages. In the Atlantic region, the only opportunity some elders have to speak Mi'kmaq is during these videoconferences, as there are no other native language speakers in their communities.²⁰ Many use video to record the stories and wisdom of Indigenous elders for future generations, the resulting video documentaries accessible through Indigenous websites or shared through YouTube.

17 United Nations Broadband Commission. (2015). The State of Broadband 2014: Broadband for All. <https://www.broadbandcommission.org/publications/Pages/SOB-2014.aspx>

18 World Bank. (2009). Information and Communications for Development 2009: Extending Reach and Increasing Impact. <http://issuu.com/world.bank.publications/docs/9780821376058>

19 See www.inuit.org and www.iccalaska.org.

20 O'Donnell et al. (2016).

Examples: Language revitalization

In 2014, the Alaska Legislature passed a bill declaring 20 Alaska Native languages as official State languages.²¹ Alaskans are using technology to help preserve and revitalize these languages. To encourage use of the Yugtun language in southwestern Alaska, the Yugtun language app²² has games and lessons, accompanied by pictures of local people acting out words and phrases.²³ Another initiative is Yuarcuun, a Yupik-led group with a mission to revitalize Eskimo/Inuit languages using computer science tools.²⁴

In 2018, the language app, Duolingo,²⁵ added the Native Hawaiian language, ʻōlelo Hawaiʻi, to its roster of languages. Duolingo worked with Kamehameha Schools to develop the app, which is currently being used by more than 500,000 people (more than the entire Native Hawaiian population). Kāʻeo Duarte of Kamehameha Schools said, “Bringing ʻōlelo Hawaiʻi to this platform builds on the tradition of our ancestors in the nineteenth century who embraced the new technology of print to pass on our traditions, literature and history.”²⁶

In Canada, software and keyboards were first developed for computer composition with the syllabic writing system used for Ojibway/Cree and Inuktitut languages. Now the Government of Nunavut is developing new tools to help Inuktitut speakers work more easily on computers, as part of efforts to contribute to establishing Inuktitut as the working language of the government. Nunavut Utilities is a package of Microsoft Office tools to make working in the Inuit language easier; it contains a syllabic font converter, a transliterator to convert text from roman orthography to syllabics, or vice versa, and orthographic rules checkers. Also, the Inuktitut Naqittautit app allows users to type in syllabics on Apple and Android devices.²⁷

A recently launched mobile app and web platform called Siku, the Inuktitut word for sea ice, allows users to trade observations about dangerous conditions, document wildlife sightings and trade hunting stories. The app was developed by the Arctic Eider Society, an organization based in Sanikiluaq, Nunavut, on an island in Hudson Bay where residents hunt eider ducks for food and collect down for clothing and duvets. The app integrates weather, sea ice and satellite imagery, and allows users to add their own terms for dangerous conditions. Through Siku, hunters can upload information and tag other areas of interest, such as wildlife they have tracked. Siku is available as an online platform as well as a mobile app that runs on Android and iOS. Lucassie Arragutainaq, manager of the Sanikiluaq Hunters and Trappers Association, explains: “We’re copying what our parents used to do, but in modern ways.”²⁸

Example: Using video games for culture and language

The video game, Otsi: Rise of the Kanien’keha:ka Legends, developed with youth in the Skins Game Development Workshop from Kahnawake Mohawk Territory in Quebec, merges many traditional stories into a journey in which the player becomes the village hero. Mikan, another video game, is an adaptation of the Anishinaabe version of a traditional Ojibwe moccasin game. Mikan players click on moccasins to find birch bark carvings of tools and belongings related to harvesting wild rice. Throughout the game, players hear Anishinaabemowin, the Anishinaabe language spoken around the Great Lakes region.²⁹

21 HB 216. (2014). An Act adding the Inupiaq, Siberian Yupik, Central Alaskan Yup’ik, Alutiiq, Unangax, Dena’ina, Deg Xinag, Holikachuk, Koyukon, Upper Kuskokwim, Gwich’in, Tanana, Upper Tanana, Tanacross, Hän, Ahtna, Eyak, Tlingit, Haida, and Tsimshian languages as official languages of the state. Juneau: Alaska State Legislature.

22 See <https://bbonline.bbc.net/2020/01/07/learn-yupik-with-the-new-yugtun-language-app/>

23 Ross, I. (2019, October 15). Learning Yup’ik on the go: A New Language App for Bristol Bay. KDLG Dillingham, Alaska. <https://www.alaskapublic.org/2019/10/15/learning-yupik-on-the-go-a-new-language-app-for-bristol-bay/>

24 Liu, C. www.yugtun.com

25 See <https://www.duolingo.com/>

26 See <https://www.nbcnews.com/news/asian-america/language-learning-app-duolingo-adds-hawaiian-lessons-n917861>

27 See <https://www.gov.nu.ca/culture-and-heritage/information/computer-tools>

28 See <https://www.cbc.ca/news/canada/north/inuit-app-land-siku-1.5384727>

29 LaPensée, E. (2017, March 2). Video Games encourage Indigenous Cultural Expression. The Conversation. <http://theconversation.com/video-games-encourage-indigenous-cultural-expression-74138>

Personal and Social Internet Use

Like most Internet users in North America, Indigenous residents are using digital technologies for a wide range of personal and organizational purposes, including: contact with family and friends through social networking, email, online banking and bill paying, online shopping, access to online government services, and education. Facebook is generally the most popular means of online information sharing by individuals and local organizations, including job postings and local news. In fact, use of the social media platform is higher in northern Canada than in the southern regions of the country.³⁰

Some innovative applications include local online buy-and-sell, online fundraising, and software for learning Indigenous languages. A resident of Iskut, a small community in northern British Columbia (BC) said, residents of Iskut “are ‘power users’ compared to people in cities. They don’t have local shops – they shop online. Their whole life is online.”

A resident in southwestern Alaska commented after broadband facilities were installed in a remote community, saying, “Now I see a lot of changes; people can do their shopping on Amazon, fill out PFD [Permanent Fund Dividend] 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.”³¹

Health Care

Information and communications technologies (ICTs), including the Internet, can be used to support a range of health services for Indigenous and remote communities, including the following:

- **Emergencies:** to summon immediate medical assistance, both locally, and from emergency responders in distant locations (such as medevacs by plane).
- **Consultation:** between primary health care providers and regional physicians, or between regional physicians and distant specialists.
- **Remote diagnosis:** for example, transmission of medical data and images; interpretation of data by distant specialists.
- **Patient monitoring:** for example, transmission of patient data from home or rural clinic, often coupled with follow-up through local medical staff.
- **Training and continuing education:** of health care workers, paraprofessionals, physicians, etc.
- **Public health education:** of specific populations such as expectant mothers, mothers of young children, groups susceptible to contagious diseases, etc.
- **Administration:** ordering and delivery of medications and supplies, coordination of logistics such as field visits by medical staff, accessing and updating of patient medical records, transmission of billing data, etc.
- **Data collection:** collection of public health information such as epidemiological data on outbreaks of diseases.
- **Research and information sharing:** such as access to medical databases and libraries and consultation with distant experts and peers.

30 See <https://www.cbc.ca/news/canada/north/nunavut-suicide-action-plan-1.4178922?cmp=rss>

31 O'Donnell, Beaton, B., McMahon, R., Hudson, H., Williams, D., Whiteduck, T. (2016). Digital Technology Adoption in Northern and Remote Indigenous Communities in Canada. Report to Innovation, Science and Economic Development Canada (ISED). First Mile Connectivity Consortium (FMCC). <http://firstmile.ca/wp-content/uploads/2016-ISED-FMCC.pdf>

Example: Telemedicine

The Alaska Federal Health Care Access Network (AFHCAN) has extended the use of the Internet for telemedicine throughout rural Alaska where trained medical professionals are scarce. AFHCAN uses equipment designed to be simple and cost effective, consisting of a personal computer and peripherals including an electrocardiogram (EKG), an electronic otoscope for observing otitis media, and a digital camera.³²

A review of 125,000 cases over an 11-year period showed that telemedicine saved both time and money:

- Some 80 per cent of all telemedicine consults prevented patient travel from villages to regional hospitals or regional hospitals to Anchorage, although a few cases “caused” travel, as patients with conditions requiring treatment by physicians were identified that would otherwise have been missed.^{33, 34}
- A review of teleconsultations for Medicaid cases over six years found that travel was avoided in 75 per cent of cases, resulting in net savings of more than \$2.8 million to Medicaid. In addition, the teleconsults 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 this study.³⁵
- Prior to the use of telemedicine, 47 per cent of new patient referrals had to wait five months or longer for an in-person ENT (general otolaryngologists, or ear, nose and throat specialist) appointment. By 2007, only three per cent had to wait that long, with the rest able to receive specialist consultations over the AFHCAN network.³⁶ By eliminating the need for a face-to-face encounter with the specialist, the use of telemedicine reduced the number of referrals from ENT specialty clinics by more than 95 per cent. The cost savings were significant as round-trip airfare between Nome and surrounding villages cost \$300 to \$400 per patient. Annual cost savings in one year alone from the prevention of in-person appointments reached \$250,000.³⁷

Several lessons from Alaska’s telemedicine experience are relevant, not only to Alaska, but to other remote and Indigenous regions:

- **Saving time:** Telemedicine links between a community health worker and doctor at a regional hospital can enable patients who would otherwise have to wait for a visiting doctor or for arrangements to be sent to a regional clinic to be seen quickly.
- **Saving money:** The AFHCAN system saves money as well as time. As noted, these savings have been dramatic; over six years, for every dollar spent by Medicaid on reimbursement, \$10.54 was saved on travel costs.³⁸
- **Improving quality:** Catching patient problems early may prevent deterioration of patient conditions; as such, consultations may also be valuable for preventive care.
- **Designing for sustainability:** The AFHCAN planners selected or adapted equipment that is rugged and able to withstand field conditions, such as power and temperature fluctuations and cramped space, and is easy to use.

32 Ferguson, S. (2011, May). What Works: Outcomes Data from AFHCAN and ANTHC Telehealth: An 8 Year Retrospective. Native Tribal Health Consortium. Anchorage, Alaska.

33 Ferguson, S. (2011).

34 See Hudson and Parker. (1973).

35 Ferguson, S. (2011).

36 Hofstetter, P., Kokesh, J., Ferguson, S., and Hood, L. (2010, June). The Impact of Telehealth on Wait Time for ENT Specialty Care. *Telemedicine and E-Health*. 16(5), 551.

37 Hofstetter et al., (2010). 555.

38 Ferguson, S. (2011).

Education and Training

The following are the most common goals of applications for use of the Internet in education:

- To augment classroom instruction, for example, by adding supplemental materials, research resources, opportunities to practice skills, etc.
- To provide instruction in schools without qualified teachers (for example, to teach foreign languages or advanced science or mathematics courses).
- To provide continuing education opportunities and training, such as high school completion programs for adults; to offer college courses in remote communities and at job sites; to provide training for eligibility for jobs or promotions, etc.

These goals may also be combined with the need to save time and/or money: for example, to enable employees and teachers to upgrade qualifications in their communities rather than traveling to classes or taking leaves of absence to attend distant courses, or to enable a specialized instructor to stretch limited educational funds by teaching students simultaneously in several remote locations.

Indigenous organizations may also share training materials online. For example, Kuhkenah Network (K-Net) in northern Ontario uploads training videos to YouTube and archives webcasts that may be streamed by remote communities as needed. The First Mile Connectivity Consortium (FMCC), representing Indigenous communications providers, argued at regulatory hearings on broadband as a basic service in Canada, that YouTube is an important development tool and not a luxury.³⁹

Example: Education

In northwestern Ontario, Keewaytinook Internet High School (KiHS), provides conferencing, email and other online services for students in Ojibway and Cree communities studying to receive their high school diplomas.⁴⁰ There are no high schools in the remote communities; teenagers must leave to attend high school in distant towns or cities. Many of the students taking correspondence courses are young people who dropped out of these high schools or their parents did not want to send them so far from their families. KiHS now offers courses from grades 9 to 12 accredited by the Ontario Ministry of Education. In 2019, 36 students graduated from KiHS and participated in a web-streamed celebration with fellow students, family members and community leaders.⁴¹

Remote residents may also now access numerous online training and higher education courses. For example, KiHS has partnered with the Cisco Online Academy, which offers computer and network-based training for a variety of skill levels. In the northern British Columbian community of Iskut, some residents have taken distance education courses online from various BC institutions. One respondent completed a Bachelor of Commerce degree online. The education manager pointed out that a teacher would have to miss a week of class to drive and then fly to meetings in Vancouver.⁴²

39 First Mile Connectivity Consortium (FMCC). (2015). Testimony in CRTC Telecom Notice of Consultation 2015-134: Review of Basic Telecommunications Services. Ottawa.

40 See <http://kihs.knet.ca/>

41 Beaton, B. (2019, June). Personal communication.

42 O'Donnell et al. (2016).

Businesses and Commercial Activities

After broadband was introduced in southwestern Alaska, a study found that it is highly valued and increasingly important to businesses, non-profit organizations, and local governments. Access to online services helps businesses to be more efficient in their operations and to extend their reach to new customers and suppliers. Broadband also helps to improve the effectiveness of public sector services such as those provided by local governments. Internet usage 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. Examples from the research include:

- **Financial institutions** use online connections for teller services, credit and debit card processing (sometimes by a third party), access to databases outside Alaska, and foreign banking information. Financial institutions noted that more people in rural communities now have debit cards they can use for online purchases, bill paying, etc. One respondent commented, “Five years ago no one had cards; now 80 per cent have debit or credit cards.” This increase was viewed as a positive change as rural residents can use the cards to shop online and pay bills.
- **Rural businesses:** For example, village stores can now scan checks for instant deposit rather than having to mail them to regional bank branches.
- **Retail:** Large retailers (that operate general stores in many communities) use online services for payroll and Point-of-Sale (POS) transactions at cash registers. One large retailer also accepts online orders for delivery to villages.
- **Seafood processing:** Seafood processors (a major industry in southwestern Alaska) rely heavily on connectivity with their head offices for administrative services, including payroll, other human resources functions, accounting, shipping and receiving, purchasing, and ERP (enterprise resource planning). Monitoring of systems by IT staff for maintenance and security can also be carried out remotely. Seafood processors also use database 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.⁴³
- **Tourism and small business:** Tourism businesses use the Internet for online reservation systems and for guests who increasingly demand connectivity 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, such as for guiding and sports fishing.

Example: Local economic development

The Oomingmak Cooperative in Alaska showcases on its website the clothing knit by Native Alaskan women from the fine wool of the muskox (qiviut, said to be the warmest in the world). Inuit in the Canadian Arctic sell highly valued soapstone carvings and artwork online from their communities.

Internet connectivity can also be important for local economies. For example, sell/swap groups on Facebook have been called “Nunavut’s version of the sharing economy.”⁴⁴ Almost all Nunavut communities have sell/swap groups. Many communities also have auction groups and public service announcement groups. These online groups serve an important role for intra and intercommunity trade.

43 See <http://www.adfg.alaska.gov/index.cfm?adfg=fishlicense.fishtickets>

44 Nunavut Broadband Development Corporation (NBDC). (2015, July 14). Submission to the CRTC Telecom Notice of Consultation 2015-134 Review of basic telecommunications services.

Non-profit Organizations and Government

In Alaska, village corporations and tribal councils use online services to help their residents obtain hunting and fishing licenses and permits. They also use the Internet to learn about funding opportunities online and to file reports. Local governments said that being online helped with funding, quick access to requests for proposals, and applications for grants. Borough staff use broadband to participate in state webinars for employee training.

In some communities, residents can come to the tribal office to search for jobs and fill out forms online. Staff may also help clients access social services. Some tribal governments access training webinars for workforce development. A tribal government manager said they could now download software upgrades for accounting, when previously the staff could not get access or downloads would fail. In the Canadian Arctic, local and regional government staff have complained that slow access to the Internet results in waiting for hours for needed software upgrades to download.

Tribal councils and local governments note the use of online banking; the ability to check the status of their bank accounts and monitor spending through use of credit cards rather than cash, as well as administrative functions, including: employee payroll direct deposits, bookkeeping, applying for grants, submitting reports and paying federal taxes. They also refer 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.

Indigenous community governments in Canada also use digital services for administrative functions. For example, Iskut First Nation in northern BC note similar applications and savings in time and money by using the Internet. Key digital applications for the band are email, payroll, online banking and accounts payable, and filing. The band saves time and money with online banking and filing reports online.⁴⁵

Indigenous governments in both Alaska and Canada use online tools for land management and mapping. In northwestern Ontario, Poplar Hill First Nation operates a comprehensive lands and resource mapping system for its traditional lands. This tool has also been used to digitize all aspects of the community infrastructure including buildings, roads, electrical, cable, water, wastewater, and housing.⁴⁶

Energy Conservation

In rural Alaska, the Internet is being used for energy conservation to manage power. Alaska has abundant wind resources primarily in the western and coastal portions of the state. There are currently 28 wind installations operating in rural communities. The availability of wind resources in combination with the high cost of diesel electricity generation in rural Alaska makes wind power an economical and clean alternative to traditional fossil fuels. Researchers estimate that a typical 1000-kW wind turbine can displace about 17,800 gallons of diesel fuel per year, a savings of nearly \$55,000 to an electric utility paying \$3.10/gallon for diesel fuel.⁴⁷

Remotely located software can be used to manage wind/diesel operations. For example, the village of Kokhanok has wind turbines with software connected to the University of Alaska Fairbanks, which can optimize the use of wind versus diesel power. Perryville has 14 small wind generators with online support.

Reductions in Staff Turnover

Researchers have hypothesized that reducing isolation can help reduce personnel turnover. While causal data is difficult to obtain, it appears that Internet access is at least a contributing factor. There is anecdotal evidence from northern Canada, Alaska, and the Australian Outback that the ability to stay in touch with family and friends makes isolated postings more tolerable, and that access to professional development education online may also contribute to reducing turnover among field staff. Costs associated with high turnover include not only recruitment and relocation, but also lost productivity while positions are unfilled and new staff adapt to local conditions.^{48, 49}

45 O'Donnell et al. (2016).

46 O'Donnell et al. (2016).

47 Rural Energy Alaska Project (REAP). <http://alaskarenewableenergy.org/index.php/clean-energy-in-alaska/wind/>

48 Hudson. (2006).

49 See <https://human-resources-health.biomedcentral.com/articles/10.1186/s12960-019-0432-y>

Indigenous Communications Providers and Digital Services

In addition to using the Internet for a wide range of personal and community purposes as discussed above, some Indigenous residents have organized to provide information facilities and services for their communities or region. They not only deliver services for Indigenous residents, but also provide jobs, and training for those jobs.

Community networks, local Internet service providers operated by and for communities, are connectivity solutions often ideally suited for Indigenous communities in North America.⁵⁰ They provide a sustainable solution to address the connectivity gaps that exist in underserved remote, and rural areas around the world, and are a viable alternative access model for communities where a market-based solution does not exist. They have been successfully deployed in varied contexts across the world, and have seen success in Canada and the United States.

Example: Indigenous Community Networks

The Kuhkenah Network (K-Net) provides information and communications technologies (ICTs), telecommunication infrastructure, and application support in First Nations communities across a remote region of northwestern Ontario. K-Net is a program of Keewaytinook Okimakanak, a Chiefs Council established by six First Nations in the region to provide support services for their communities. Kuhkenah is an Oji-Cree term for “everyone, everywhere.” Apart from providing telecommunications services, K-Net also provides computer networking support, training and capacity building programs to strengthen computer and telecommunications expertise, technological expertise and advocacy for members, among others.

In 2019, the Internet Society worked with the Native Hawaiian community of Pu‘uhonua O Waimānalo to establish a network that now serves all of its 90 residents. Prior to the deployment of this network, Pu‘uhonua O Waimānalo residents had no access.⁵¹

Other Indigenous commercial and non-profit organizations develop software and deliver technology services. For example, Animikii Indigenous Technology in BC is an Indigenous-owned digital agency that has delivered technology solutions exclusively for Indigenous communities and organizations for 15 years. Animikii (meaning “thunderbird”) provides business services, website design, custom software development, design and branding and digital communications.⁵²

50 See <https://www.internetsociety.org/issues/community-networks/>

51 For more information about what this network means to the residents of Pu‘uhonua O Waimānalo, see: <https://www.internetsociety.org/blog/2019/10/these-are-our-first-roadways-internet-access-and-self-determination-in-puuhonua-o-waimanalo/>

52 Gilpin, E. (2019, February 13). Indigenous Technologists using Tech Tools as Path to Self-Determination. National Observer.

Evaluation: Planning, Indicators, Methodologies

Information and the Development Process

In designing the evaluation of Internet projects, it is necessary to consider the role of information in the development process. Information technologies and services provide not simply a connection between people, but a link in the chain of the development process itself. As discussed above, the ability to access and share information can contribute to the development process by improving effectiveness, equity, efficiency, and reach. However, none of these benefits occur in isolation.

Those who need to access or share information must have the necessary skills or have access to a resource person (“infomediary”) to help them. Other factors may also need to be considered, for example, access to credit for inventory or spare parts, a reliable transportation system to get goods to market, or a curriculum that can be adapted to new teaching methods and information sources. Thus, in order to learn how the Internet may contribute to development, we must also understand what information is needed in the communities, and what other factors may influence the initiation and impact of activities that may be considered developmental from economic, social, and/or cultural perspectives.

In thinking about users and potential benefits, concepts from economics and diffusion theory are helpful:

- **The early adopter:** Some people may be more likely to use online services sooner than others, for example, those with more education and those with clearly defined information needs such as teachers, community leaders, artisans who need to find markets, and business managers who need to contact suppliers and do payroll and taxes.
- **Indirect benefits or externalities:** The user may not be the real beneficiary. For example, the user may be the health aide or nurse, the librarian, or the tribal administrator, while the beneficiaries are patients, students, and community members in general.

Short-Term Versus Long-Term Impact

There may be some significant short-term examples of the value of access to information, for example, health workers receiving assistance and saving lives, local governments finding and successfully applying for grants online, etc., but much of the impact is likely to take longer and be much more indirect. Access to timely information about prices and markets for local products may generate more income, and students with access to the Internet may be more likely to qualify for jobs or training for future employment. These benefits may result in more local people being employed, or fewer young people leaving, but these effects take time.

While planning evaluation that can capture these longer-term benefits, researchers should also look for evidence of Internet usage that could lead to longer-term impact, such as students doing research online for school, adults taking courses online to finish high school or for continuing education, and people using online services to learn Indigenous languages or skills.

Evaluators should document these changes, and identify the impacts that could result over time, and the barriers that could impede longer-term impacts, for example, lack of funds to continue a project, unaffordable usage charges, lack of local jobs for newly trained workers, etc.

Evaluation as Learning: The Process

It is important that the community not perceive evaluation as judgmental, but rather as an opportunity to:

- Provide feedback on what is working well and what needs to be changed or improved.
- Plan for the sustainability of the project.
- Identify successful strategies and lessons learned that could be shared with other projects or networks.

Evaluation can appear threatening or a waste of time to community leaders. One way of reducing such tensions is to suggest that what they have learned would be useful to others starting a similar project, by asking them for example, 'What problems did you face and how have you solved them, or tried to solve them?' and 'What advice would you have for someone else starting a project like yours?'

Another strategy is to involve the local people who have helped to implement the project in identifying what information would be useful to them and then train them to be interviewers and data collectors. In this way, the participants themselves hear from the community and collect information on how people are using the Internet and what problems or barriers they face. The danger in this approach is that the data collection may be biased if the participants 'tune out' any negative feedback. However, if they approach the data collection as a learning process, and if they are trained in asking questions consistently and coding the responses accurately, the evaluation will be much more valuable to them.

Identifying Objectives

In planning an evaluation, it is important to understand the objectives of the project. This may seem straightforward enough, but the various stakeholders such as donors, partners, and various community groups may have quite different objectives. Also, the objectives may be rather vague or general, such as ‘empowering local people’ or ‘creating new economic opportunities.’ In addition, reasonable timeframes for achieving different objectives may vary. For example, teaching digital literacy may be accomplished much more quickly than generating new jobs for the community.

One approach to identifying objectives is to ask the various stakeholders: ‘What would make this a successful project?’ Their answers might include:

- Access to the Internet for everyone in the community.
- Community residents trained in digital literacy.
- Usage of the Internet by specific groups: for example, women, young people, entrepreneurs, etc.
- Sustainability: the ability of the project to continue to operate past the pilot phase.
- Economic development in the community, for example, job creation, better prices for products, new outlets for products from the community, etc.
- Social development in the community, i.e., the adoption of better health practices, improvements in school completion rates, and new job skills.

Having made these goals explicit, the evaluators must then devise methods and tools to determine to what extent the project achieved them. Questions they need to consider include: How do we define Internet access? How should we define sustainability? How can we isolate the effects of the project from other factors that might influence community development?

Research Design

Stories and anecdotes can yield useful insights and lessons learned from individual projects. However, while interesting, stories alone may lead to unsubstantiated conclusions or over generalizations. Well-designed case studies can provide more depth and analysis invaluable in understanding the experiences and lessons learned in particular communities, but they may not address fundamental questions of causality, for example, whether Internet use actually contributes to the creation of new jobs or new sources of the revenue for the community.

Where there are several project sites or opportunities to track over time, it may be possible to gauge longer-term impacts and issues of causality through research designs known as ‘quasi-experimental,’ for extraneous factors cannot be controlled in a field setting as they can in a laboratory setting. The following designs are not perfect, but are superior to stand-alone case studies in improving the validity and generalizability of findings:

- **Before-After:** Collecting data on specified indicators before and after the introduction of connectivity for Internet access.
- **After-Only:** Where no baseline information is available, it is difficult to isolate and quantify impacts. However, strategies that can be used here include: retrospection, i.e., asking the users to remember how they got the information or carried out the task before they could use the Internet, and contrary-to-fact questions such as: ‘If you did not have access to the Internet, how would you do this, or could you do this?’

The limitation in both of these designs is that they can lead to false conclusions such as ‘using the Internet created more jobs’ because they do not control for extraneous factors that might have had this effect anyway, such as a new funding initiative or a new road. Validity and generalizability can be improved by adding a control group.

- **Matching:** Evaluators can gain better insights into causality if they can add a group of sites without Internet access that are similar in population size, isolation, economic base, etc., and collect the same data at all of these sites.
- **Random selection:** It may be possible to use randomly selected sites if there is a large number of sites to draw from, or if the project can be designed to randomize selection of where the facilities will be installed. However, this approach may also appear to penalize communities that aren’t selected for the project.
- **Multiple measurements:** Whether or not a control group of sites can be included, collecting data at several points after Internet service is likely to provide better insights into causality than any single ‘After-Only’ data collection. Later waves of data collection will also help to determine whether Internet use dropped off after initial interest, or whether demand and applications changed over time.
- **Sampling:** In collecting community data, using a systematic approach to drawing a sample (rather than interviewing the first people encountered or people known to the interviewers) strengthens the validity of the data. Examples include random selection of households, or every nth household.

Indicators: Measuring Outputs and Outcomes

The following are examples of indicators that could be used in evaluation of Internet impact in Indigenous communities. These indicators were developed through desktop research, interviews, and a workshop at the Internet Society coordinated 2019 Indigenous Connectivity Summit held in Hilo, Hawaii.

Internet users:

- Demographic information about Internet users and nonusers: age (or age categories), gender, student/non-student, education levels, employed/not employed, etc.
- Number of Internet users who had not previously been online or had rarely been online.

How users connect to the Internet:

- On phones, tablets or computers at home, at school, at work, at a library, at community or tribal center, etc.
- Whether they use their own or shared devices.
- Before the project, how they went online (if they did).

Frequency of Internet and online access:

- Several times per day, daily, several times per week, occasionally, never, etc.

Purpose of Internet use:

- How people use the Internet – for example, for personal/family communication, for work, for school, for connecting with interest groups, for education or training, etc.
- How users previously accomplished these tasks (or did not).

Digital literacy:

- How people learned to use the Internet: by themselves, from friends or family, at work or school, etc.
- Whether training was offered on digital literacy, and if so, demographic profiles of those who attended.

Business use:

- How local businesses use online services.
- If business use changed after the network installation.
- Whether online services have contributed to saving time, saving money, generating new business, etc.

Non-profit organizations, local and tribal governments:

- How these organizations use online services.
- What benefits or changes online access has made in serving community residents, running their organizations, obtaining funding, etc.
- What problems, or difficulties they face (if any) with online services.

Schools:

- How online services are used in schools.
- Whether students are expected to use online services to complete assignments or projects.
- Whether the school allows students to take tablets or laptops home.
- Any changes in curriculum or online courses offered.
- What changes (if any) teachers have observed after community access to the Internet.
- Number of students taking online courses; completion rates for these courses.

Libraries and other public access (such as community centers, tribal offices or schools if public can use their facilities):

- What online services are provided.
- How patrons use these services (for connecting with family or friends, for schoolwork, for webinars or other instruction or training, etc.).
- What assistance the staff provides.
- What changes or benefits (if any) staff have observed after community access to the Internet: more or fewer users, different types of usage, etc.

Use of online services in adult education and training:

- Access to online webinars, training courses, distance education, etc.; demographic information about participants in these courses.
- Outcomes of these activities: worker promotions, qualifications for local jobs, credentials for further education, etc.

Health care:

- Local health care facilities available and services provided.
- Number and type of health care staff: physicians, physician assistants, nurses, health aides, etc.
- Distance and time to reach nearest hospital.
- Whether local facilities use any online services for telemedicine (consultations), telehealth (mental health or other services), electronic health records, in-service training, public health activities, etc.
- For any applications, information on types of usage, data on saving time or money or providing services not otherwise available.
- If online services are not used, what barriers are perceived: lack of security or confidentiality, lack of training, lack of equipment, not budgeted, etc.

Barriers to Internet usage:

- What barriers community residents and organizations faced in accessing the Internet before the project: for example, unreliable connectivity, insufficient bandwidth, lack of equipment or access to equipment (smartphones, tablets, laptops, etc.) high prices for access, overage charges, etc.
- Barriers (if any) after community Internet installation: lack of skills, lack of equipment or access to equipment (smartphones, tablets, laptops, etc.), content not relevant, etc.

Findings from collecting this data can also help to identify potential longer-term impacts and expected benefits such as:

- Hiring or promotion of local people with skills learned or augmented online.
- Creation of new jobs or new or expanded businesses.
- Successful applications for new funding or investment.

- Development or use of new applications or software for community use (Indigenous content or languages, tools for mapping, etc.).
- Perceived improvements in quality of life (contact with distant family, access to distant goods or services, cost savings, etc.).

Sustainability

It is also important to collect data that can help to determine the sustainability of the project in participating communities and the likelihood that similar projects would be sustainable in other communities. Information should include:

Costs:

- Start-up costs, such as equipment, site, training, etc.
- On-going operating costs of the project, for example, personnel, supplies, spare parts, rental, utilities, technical support, etc.
- Costs for backhaul (middle mile or backbone, etc.).
- How costs (local and backhaul) are to be covered (charges to users, grants, subsidies, or some combination).
- Whether charges are considered affordable to users and sustainable for local network operators.
- Other sources of revenue the project could develop, such as selling additional services, finding major clients as underwriters, or building operating costs into a community budget.

Equipment:

- Any implementation problems: schedule, budget, etc., and their resolution.
- Whether the equipment proved reliable in field settings.
- Whether power supplies and backhaul networks are sufficiently reliable.

Support:

- Whether timely technical support and/or spare parts are available when needed.
- Whether local people have been trained and hired to operate and maintain the network.

Other Considerations

Confidentiality: It is important to preserve confidentiality and to respect community values. For example, respondents may not want their names used, or their ages or incomes revealed. Items can be designed with age ranges (under 18, 18 to 30 years, 31 to 50 years, over 50 years of age, etc.) and questions about employment or number of people employed in a household rather than income.

Pretesting: Survey questions should be pretested to ensure they are clear and easily understood, and that they do not ask for information considered to be private or inappropriate.

Serendipity and unexpected outcomes: Researchers should also be alert to anecdotes or examples of unexpected usage or outcomes. Examples from previous research include a trapper who uses online mapping to lay out a trap line, an artist who finds new customers thousands of miles away, young people who develop apps for learning Indigenous languages, and elders who use videoconferencing to share stories and memories with relatives in other communities.

Disseminating Results

The philosophy of evaluation as learning should also be reflected in how the results are shared with the various stakeholders. Simply sending them a copy of a research report may not be sufficient. Researchers should be prepared to return to the community and to meet with the community residents and local stakeholders to explain the findings. They may also be able to suggest changes that could be made in response to the feedback, such as providing outreach to underserved target groups, organizing more opportunities for training new users, reviewing pricing of access, etc.

Researchers may also be able to suggest other opportunities for learning and sharing information such as workshops and exchange visits between similar projects.

The evaluation results should also be made available to other entities concerned with universal access to the Internet, such as funding agencies, government ministries and regulators, and providers of social services. Presentations at conferences, papers in journals, and postings on the Web can also help to disseminate the findings to others interested in the impacts of Internet access in rural and Indigenous communities around the world.

Note that the data collected on the following indicators may include personally identifiable information. Safeguards must be in place to ensure individuals' data is protected.

Conclusion

The evidence from the research summarized above indicates that Internet use can contribute to social, economic, and cultural development in Indigenous communities. There are many examples of benefits in sectors ranging from health care to education to businesses to local governments. In addition, Indigenous people are becoming not only consumers but also producers of online services, ranging from local ISPs to Indigenous software, games, and apps.

The findings also indicate that other contextual factors need to be considered in understanding potential impacts of Internet access. Issues of affordability need to be addressed, and capacity building may be required for businesses, non-profit organizations, and local governments to derive maximum benefits.

The sections on evaluation outline research designs, techniques, and indicators that can be used or adapted for field evaluations of Internet projects in Indigenous communities.

Much could also be learned from further analysis of many of the projects reviewed in the report:

- What happened to adults who completed high school online in their communities? Did they use their credential to obtain jobs in their communities, or to qualify for additional training or higher education?
- What are the cost savings of telehealth in rural and remote Indigenous areas?
- Can the availability of Internet services, such as for contact with family members and for continuing education and training, encourage Indigenous people to return to their communities and/or reduce the turnover of employees recruited to work in Indigenous communities?
- How effective are the various online tools for teaching and using Indigenous languages?

Follow-up research on these initiatives as well as new research on recent community projects can help to increase our understanding of how Internet access and use can contribute to Indigenous communities.

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