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Information and Communication Technologies (ICT) and Remote and Rural First Nations Communities: An Overview

Susan O'Donnell
National Research Council

Mary Milliken
National Research Council

Corinna Chong
National Research Council

Brian Walmark
Keewaytinook Okimakanak Research Institute

Abstract:

Information and communication technologies (ICT) are valuable tools used to establish and maintain connections within and between remote and rural First Nations communities across Canada, and between urban centres and these communities. For the past decade, various research projects have investigated different aspects of ICT use by and with these communities. However, an overview of this research has not been published. This paper, a literature review, explains the history of ICT and First Nations communities, policies and partnerships for broadband services in First Nations, how remote and rural First Nations are accessing and using ICT, and how to make the broadband networks and ICT sustainable.

1 The history of ICT and First Nations communities

Since at least the early 1970s, remote and rural First Nations communities in Canada have been using information and communication technologies (ICT) for a variety of purposes. The most common ICT - radio, television and telephony - remain widely used today in remote and rural First Nations communities. Canada's Anik A-2 satellite, launched in 1973, brought network radio, television and improved telephone services to the north (Chouinard, 1983). In 1974, the Wawatay Native Communications Society established the first community radio system in partnership with First Nations in Ontario's far north (Budka, Bell & Fiser, 2009). By the mid-1980s, remote First Nations communities in Northern Ontario were building local cable plants and receiving public satellite television broadcasts from Wawatay, TVOntario, and the Canadian Broadcasting Corporation; 10 years later, this expanded to commercial satellite television and the multi-channel universe (Fiser, Clement and Walmark, 2005).

By the mid-1990s, there were also more than 60 newspapers and almost 50 radio stations run by Aboriginal organizations across Canada. Aboriginal media saw their mission as informing the public about experiences that are consistently manipulated by the mainstream media to discriminate against Aboriginal peoples (O'Donnell & Delgado, 1995). In 1995, this media and communications strategy expanded to the internet. Several First Nations had a presence on the internet and many were using email to network with each other and with their supporters. To keep the general public informed of their activities, they routinely emailed press releases and bulletins to public internet sites (O'Donnell & Delgado, 1995). In 1999, the Aboriginal Peoples Television Network (APTN) was launched (Roth, 2005).

A decade later, the use of ICT by First Nations and their recognition of the importance of this activity had grown considerably. By 2009, the Assembly of First Nations (AFN) - the national political organization representing First Nations across Canada - had passed five resolutions at their annual general assemblies recognizing the need for First Nations communities to have adequate broadband connectivity and access to ICT. At a major Aboriginal research and policy conference in Ottawa that same year, the AFN outlined a strategy for an equipped First

Nations broadband network. They saw the network as part of a broader plan for economic, social and cultural change based on knowledge and information. The AFN's "e-Community ICT model" builds upon a common network model employed by Canadian institutions and corporations and has five themes: First Nations capacity development, First Nations connectivity, human resources development, information management, and service delivery and partners (Whiteduck, J., 2010).

2 Policies and partnerships for broadband services in First Nations communities

In Canada, there is a universal service requirement for telephone service but not for internet service. Unlike for telephone services, no regulatory mechanism exists to force Internet Service Providers (ISPs) to provide services in any particular area of the country. Canada's commercial ISPs say they need to have a business case (a proven return on investment) before developing broadband infrastructure and services in rural and remote areas; they have been reluctant or slow or have refused to do so without significant government investment. As a consequence, it can be very challenging to build the partnerships necessary to develop broadband infrastructure and provide internet services in many remote and rural regions of the country.

Given the lack of commercial interest, different levels of government in Canada have become involved as partners and contributors to develop broadband infrastructure in remote and rural areas. However, government policy to support broadband in remote and rural First Nations communities is underdeveloped and uncoordinated among many different departments and program areas. Since 1996, a variety of funding initiatives, strategies, and projects, usually with limited time frames and specific objectives, have been implemented that have supported the development of broadband infrastructure and increased use of ICT in First Nations communities (Perley & O'Donnell, 2006).

First Nations SchoolNet and the RMOs

The federal government program most directly responsible for increasing the use of ICT in remote and rural First Nations is First Nations SchoolNet. The program was initiated by Industry Canada in 1996; in late 2006 it was transferred to Indian and Northern Affairs Canada, and the program budgets were reduced in subsequent years. As of May 2010, the future of the program is unclear.

Since 2002, the program has provided funding for six First Nations SchoolNet regional management organizations (RMOs) across Canada. The RMOs work in their particular regions to advance broadband infrastructure and applications in the First Nations schools and communities. The six RMOs are: Mik'maw Kina'matneway / Atlantic Canada's First Nation Help Desk (Sydney, Nova Scotia); The First Nations Education Council (CEPN-FNEC, Wendake, Quebec); Keewaytinook Okimakanak (K-Net, Sioux Lookout, Ontario); Keewatin Tribal Council (Thompson, Manitoba); Keewatin Career Development Corporation (KCDC, La Ronge, Saskatchewan); and the First Nations Education Steering Committee (FNESC, Vancouver, British Columbia) (Whiteduck, T., 2010).

The First Nations SchoolNet RMOs have collectively been responsible for much of the broadband infrastructure development and subsequent use of ICT in remote and rural First Nations. First Nations SchoolNet was established to provide internet access, computer equipment and technical support to First Nations schools on reserves across Canada. The program has become the backbone for broadband networks and ICT in many remote and rural First Nations across the country. Although the program focuses on First Nations schools, the infrastructure developed under this program has spread to other applications and uses within communities (Whiteduck, T., 2010).

A recent evaluation of the First Nations SchoolNet program by the funders Indian and Northern Affairs Canada (INAC, 2009) found that the Regional Management Organization (RMO) delivery model is both effective and efficient. RMOs have developed partnerships with both the public and private sector to reduce costs, maximize opportunities and provide economies of scale. This has largely supported the success of the program in positively contributing to educational outcomes, cultural education, cultural and linguistic preservation, mitigating isolation and allowing access to other essential services in the schools and the communities (INAC, 2009).

The RMO in the most eastern region of Canada is Mik'maw Kina'matneway/ Atlantic Canada's First Nation Help Desk (<http://firstnationhelp.com>). The Atlantic Help Desk facilitates the development and use of ICT for education, innovation, and creativity. The organization encourages youth to be producers as well as consumers of information. Initiatives include MMTV News (Mi'kmaq/Maliseet TV) and a web site archiving video clips of

elders. Videoconferencing is key to many initiatives including national meetings and sharing student-generated content on legends, social issues, and education. The Help Desk website is an educational resource for First Nations youth and interested mainstream students alike (O'Donnell et al., 2009).

The First Nations Education Council (FNEC) is the SchoolNet RMO in Quebec (in French: Conseil en Education des Premieres Nations - CEPN) (www.cepn-fnec.com). FNEC, an association of First Nations and communities, aims to achieve full jurisdiction over education. They will do this while "respecting our unique cultural identities and common beliefs, and promoting our languages, values and traditions" (FNEC, 2009:3). FNEC's technology department has been very active. FNEC's videoconference services support training and communication via teleconference in all the First Nations communities of the region. In 2008-2009, videoconference activities rose by 40% and utilization hours increased by 50% compared to the previous year. Requests for videoconference meetings are made by the education and health sectors, INAC, and FNEC employees. At least 58 videoconference systems have been installed in the First Nations schools and health centres of Quebec. Certain Band Councils also use this technology (FNEC, 2009). The videoconference sites are all listed in a directory that can be viewed on the FNEC Website. FNEC is also engaged in: fibre optic development for First Nations in Quebec, software creation services, technology training services (including CISCO-ICT training), a "My School on the Web" project, and support for many other technology-related activities (First Nations Education Council, 2009; Whiteduck, T., 2010).

To give a final example, K-Net is the First Nations SchoolNet RMO in Ontario (www.knet.ca). K-Net is the broadband services division of the Keewatinook Okimakanak (KO) tribal council. In 1996, KO and K-Net became Industry Canada's First Nations SchoolNet Helpdesk serving Northern Ontario. The same year, CAP sites (Community Access Points), also funded by Industry Canada, were established in 10 of the First Nations in that region. In 2000, Keewatinook Internet High School was launched, a digital telephone service was implemented in North Spirit Lake and Keewaywin First Nations, and videoconferencing and high speed data connections were established. The following year, K-Net became one of Industry Canada's SMART sites and the KOHS-NORTH (Telehealth) Network was launched (TeleCommons Development Group, 2004). In 2005, K-Net launched the Northern Indigenous Community Satellite Network, working with its partners to provide broadband services to remote communities in Ontario, Manitoba, and Quebec. K-Net remains a leader in broadband communication services for remote and rural First Nations in Canada. From its office in Sioux Lookout, Ontario, K-Net provides web, Internet, satellite and videoconferencing services, and infrastructure to remote communities in northern Ontario. K-Net sees its responsibilities as helping to sustain distinctive and minority cultures, planning and acting on community needs, mobilizing communities, encouraging and supporting individual use of ICT, and providing observations on how to foster and encourage community-based use of ICT for social interaction (Beaton, Fiddler & Rowlandson, 2004; Carpenter, 2010; Fiser & Clement, 2009; KORl, 2005; O'Donnell et. al, 2009).

Other policies and initiatives to increase broadband and ICT use

Aside from First Nations SchoolNet, a number of other Canadian government programs have supported increased broadband penetration and ICT use in remote and rural First Nations communities. They have not been aimed directly at First Nations but rather at remote and rural communities or marginalized populations.

In 1996, Industry Canada and Human Resources Development Canada established the Community Access Program (CAP). CAP sites are places where community members can access computers and the internet in supported, culturally-appropriate settings, and many of them were set up in remote and rural First Nations across the country. (As of May 2010, the CAP program funding is precarious, having been cancelled twice in as many years only to continue at the last minute; the future of the program is uncertain at the time of writing.)

In 2000, the K-Net RMO was successful in its application to Industry Canada's national SMART Communities Initiative; K-Net became the only Aboriginal SMART community demonstration project in Canada. K-Net has also successfully leveraged funding from Industry Canada's Federal Economic Development Initiative in Northern Ontario (FedNor). Other federal departments that have provided funding to K-Net and other RMOs across Canada include Human Resources and Skills Development Canada (Carpenter, 2010).

In 2001, the National Broadband Task Force was established to propose strategies to increase connectivity for Aboriginal and rural Canadians, and in 2002, the government created the pilot program Broadband for Rural and Northern Development (BRAND) to bring broadband to remote and rural areas (Howard, Busch and Sheets, 2010). In 2009, federal government infrastructure funding was again made available to increase broadband connectivity

in remote and rural regions; many of the First Nations SchoolNet RMOs took this opportunity to partner on funding applications to increase broadband bandwidth in remote and rural First Nations communities.

Also at the federal level, the Connecting Aboriginal Canadians policy initiative combined two federal programs - Gathering Strength and Connecting Canadians (CC) - and partnered government and key national Aboriginal organizations to develop the Aboriginal Canada Portal in 2001. It became evident that cultural consideration is as important as improved technological infrastructure, and that governments need to tailor their support for the different approaches taken by Aboriginal people to preserve their diverse cultures and control their image (Alexander, 2001). The federal CC program overemphasized the technological side and undervalued the human side of the public-private partnerships created to build community-based networks. Fiser & Seibel (2009) compared different community-based networks created to address the digital divide in rural, remote, and underserved urban communities, and also compared the investment paradigm of CC programs to those in the US and other OECD (Organisation for Economic Cooperation and Development) countries. Measuring the results of the CC programs is difficult because there is no long-term tracking of the grassroots organizations that received funding. Fiser and Seibel (2009) concluded that funders need a better policy framework to complement project-based funding so they can make more efficient decisions about how to support broadband infrastructure development in First Nations communities.

3 Broadband network and ICT access and use in First Nations communities

There are no data available on rates of ICT access and use by residents of remote and rural First Nations communities; this research area is almost non-existent.

Broadband connectivity at the community level

Levels of connectivity to First Nations communities vary considerably across the country and by region. Fiser (2010, forthcoming), in collaboration with the First Nations SchoolNet RMOs, presents the most comprehensive analysis to date of First Nations community connectivity. The analysis mapped Statistics Canada Census Subdivisions (CSDs) with 2009 data from internet service providers. Using this methodology, their research identified that 426 First Nations CSDs (49.2%) have no residential broadband/high speed access greater than or equal to 256Kpbs (kilobits per second); 355 First Nations CSDs (41%) have residential broadband access greater than or equal to 256Kbps but less than 1.544 Mbps (megabits per second); and 85 (9.8%) have residential high speed access greater than 1.544Mbps. However this data pertain to availability only, and cannot identify how many households in the CSDs actually subscribe to internet services.

There is currently no published research on the specific broadband connectivity needs of remote and rural First Nations communities. In 2001, the report of the National Broadband Task Force (Industry Canada, 2001) stated that a minimum symmetrical speed of 1.5Mbps per second per individual user, capable of supporting 2-way symmetrical data circuits, was required and that applications such as peer-to-peer file interactions and videoconferencing would increase individual user demand for symmetric bandwidth in the 4Mbps-to-6Mbps range. Organizations that coordinate and manage the community connectivity for remote and rural First Nations (First Nations SchoolNet RMOs) have documented a need for a minimum 10Mbps connection to the schools in the First Nations. In most cases, a 10Mbps circuit will provide enough bandwidth for shared access to videoconferencing, data transfer, voice services, and basic internet use. As well, these connections are scalable as new applications are introduced. When fibre is installed in a community it is even more cost effective to have a 10Mbps circuit rather than the 1.5Mbps (T1) circuit that First Nations presently are accessing. This level of infrastructure provides the opportunity for the circuits to be scalable, to 100 Mbps, if the design permits and the demand and applications require this bandwidth (Communication with B. Beaton and K. Burton, 2010).

Types of technologies used

As mentioned, research suggests that about half of First Nations communities do not have access to residential broadband internet, and there are no current data available on the use of email, the internet, or the web by First Nations communities. There is one study available on a vibrant social networking site, Myknet.org, used by members of First Nations communities in Northern Ontario. The study demonstrates that in this region at least, many community members are using the internet (Budka, Bell & Fiser, 2009).

There are also publications discussing the use of online video by First Nations, although again no data are available on how widespread the use of online video is in the communities (O'Donnell et al., 2009; Hancock & O'Donnell, 2009; Perley, 2009).

The First Nations SchoolNet RMOs in most regions of the country have expanded their services to include their own videoconferencing bridging hardware and support. There have been a number of publications on the use of videoconferencing in remote and rural First Nations (Gibson et al., 2009; McKelvey & O'Donnell, 2009; Milliken, O'Donnell & Gorman, 2009; O'Donnell et al., 2009 and 2010; Perley & O'Donnell, 2006). This same videoconferencing infrastructure is the primary resource available for many telehealth applications in remote and rural First Nations communities; many of the First Nations SchoolNet RMOs have service agreements with Health Canada to use this infrastructure to support health services in the communities.

The authors are aware that other kinds of ICT are used in some remote and rural First Nations communities - such as cellphones, mobile and wireless devices and others - but there is no published information on this topic. Keewaytinook Mobile (www.mobile.knet.ca) is one example of a community-based cell phone network available in remote communities in Northern Ontario.

How First Nations communities are using ICT

First Nations communities are using ICT for a range of purposes. Primary uses include health and education, but community members are using ICT for many other reasons as well.

Across Canada, the First Nations SchoolNet (FNS) program is the best example at a national level of using technology to support community-based learning in remote and rural First Nations communities. In their recent evaluation of the program, INAC (2009) found that FNS remains an integral part of First Nations education on-reserve. The program has enhanced the educational experience of First Nations students, provided them with valuable skills and capabilities which have increased their competencies, improved their outlook on learning as well as their confidence in their futures. The program has also provided students with the option of staying in their communities with their families as they complete their education through distance learning which has positively affected retention and graduation rates while providing access to opportunities similar to students from provincial schools (INAC, 2009).

When students and other learners can engage with training and education in their own communities, they remain connected with their social networks. There are many examples of distance education programs in remote and rural First Nations communities but few examples of ongoing programs that use technologies extensively to engage young people in formal education and connecting with young learners in other communities.

One notable example of community-based learning on this model is Keewaytinook Internet High School (KiHS), an innovative program servicing schools in remote First Nations communities in northern Ontario. Potter (2010) and Walmark (2010) outline how KiHS provides a community-based educational option for First Nations high school students through the use of internet technologies. Students who remain in their home communities may access a quality high school program through KiHS while participating in community life. KiHS students earn ministry-inspected credits towards their Ontario Secondary School Diploma at the intermediate and senior levels, and experience life in a high school setting. KiHS gives parents and communities an opportunity to actively participate in the educational experience of their children through local involvement in the program.

Since 2003, Keewaytinook Okimakanak's K-Net supported the development and delivery of the Grade 7 and 8 Online Supplementary courses in literacy, numeracy and science (www.ned.ca). The original goal of the program was to prepare students for continuing their high school program within the KiHS program. Over the years this program became a professional development and social networking service for First Nation teachers and students as well as a complementary resource for First Nation schools struggling to provide a quality education program for senior elementary school students.

K-Net supports KiHS and is a key participant in MoodleFN (www.moodlefn.knet.ca), a heavily-customized version of Moodle (www.moodle.org), a Learning Management System that allows people to create and manage their own e-learning programs (Walmark, 2010; Whiteduck, T., 2010). The goal of the MoodleFN Project is to promote and support quality e-learning programs in First Nations schools and communities in Canada. It provides teachers

and students with a secure, managed online learning environment that can also host special events on a structured platform. Different online communication tools are available including blogs, wikis, and discussion forums.

The First Nations Education Council (FNEC) in Quebec has developed online educational content and games for children; the material has high cultural value and significance and encourages the students to learn about their culture while they are having fun. The educational materials are available in both official languages on the FNEC website; the games were distributed in DVD format to all First Nations schools in the region and are also available online (Whiteduck, T., 2010).

In a final example of ICT for community-based learning, the Atlantic region RMO, Atlantic Canada's First Nation Helpdesk, supported a project called MMTV (Mi'kmaq/Maliseet TV) News. MMTV was a place for students in First Nations schools in the Atlantic to produce, record, edit and broadcast local, national and international stories. The Helpdesk used multi-site videoconferencing to broadcast the clips to schools in the region and anchor them to a newsdesk, emulating a television news broadcast. Using this technology, students learned about group cooperation, journalism, and current events (Whiteduck, T., 2010).

ICT is also used for health training and education - including for community health workers and community members generally. This includes mini-courses on health by videoconference for First Nations communities in British Columbia (Johnson, 2008) and a special event with partner Keewaytinook Okimakanak Telemedicine and the VideoCom project on telemental health (Gibson et al., 2009). Other uses of ICT for health training and education include web-based social work education to First Nations community members in Quebec (Ives and Aitken, 2008), multiple technologies uses for Aboriginal nursing students at the University of Manitoba (Russell et al., 2005), and continuing medical education by videoconference (Heaton, 2006).

Over the past decade, the use of telehealth has increased. Telehealth refers to providing health services over a distance using telecommunications networks. There have been many studies published on the clinical use of ICT in remote and rural First Nations, including for general clinical consultations by videoconference (Bruner, 2009; Carpenter and Rowlandson, 2009; Ward, 2009); telemental health (Brasfield and Clement, 2007; Gibson et al., 2009; Reid, 2008; River Valley Health, 2006); remote speech pathology and audiology (Eriks-Brophy et al., 2008; Polovoy, 2008); tele-ophthalmology (Williams, 2010); telehomecare (Coulson and Vermette, 2008); telerehabilitation (Coulson, 2010); and rheumatology services (Jong & Kraishi, 2004).

ICT is used for sharing health information. This includes culturally-sensitive health information on the web (Friedman and Hoffman-Goetz, 2007), a website to address the crisis number of suicides in First Nations (NAHO, 2009), a website for community-based health information (Jarvis-Selinger et al., 2008), online health discussion forums (Donelle & Hoffman-Goetz, 2008) and integrated health website to address diabetes issues (Ho et al., 2006), and videos on health topics, such as FASD and Native Parenting (Whiteduck, T., 2010).

First Nations are using ICT to support being of and with the land. A common belief among Aboriginal peoples in Canada is that the relationship they have with the land shapes the cultural, spiritual, emotional, physical, and social lives of individuals and communities (Wilson, 2003). In addition, this balance is maintained through living a life of stewardship and harmony with the earth. Uses of ICT include creating three-dimensional and web-based visualizations of landscapes (Lewis and Sheppard, 2006), electronic resources for co-managing lands and resources (Greskiw and Innes, 2008; Lulua and Flannery, 2009), websites and other technologies for training and mentoring community water operators (Gurstein, Beaton and Sherlock, 2009; Stewart et al., 2009), and digital tools to assess archaeological evidence (Jules and Steves, 2008).

First Nations are using ICT to support language, culture and traditional knowledge. Traditional knowledge and teaching can create a positive, healthy identity and self-image and help people cope with collective trauma. Language is also closely connected to identity, health, and relations (King, Smith & Gracey, 2009). Uses of ICT to support First Nations languages include an online Oji-Cree dictionary (Beaton, Fiddler & Rowlandson, 2004), a syllabic computer keyboards in Cree and Oji-Cree (Fiser, Clement and Walmark, 2005), audio podcasts for the benefit of Aboriginal languages (Phillips, 2009), and videoconferencing to support a multi-community event on Native language resources (O'Donnell, Beaton and McKelvey, 2009).

ICT used to support literacy includes a program to support print-on-demand book services in remote First Nations communities in northwestern Ontario (Caidi and Walmark, 2006). ICT is also used to support musical

development (Masum, Brooks and Spence, 2005; Warden et al., 2009). ICT is also being used in British Columbia to develop community links to First Nations cultural resources in museums (Rowley, Sparrow and Schaepe, 2009).

First Nations are using ICT to support interconnection and interdependency. Traditionally, Aboriginal children were raised as part of interconnected, familial, tribal, band, and community webs of relation with shared responsibilities. These circles of connection were also combined to create wider social and religious communities. Prior to colonialism, values such as respect for all living things, individual responsibility, self-reliance, and proper conduct were taught in traditional practices and through positive role modeling and learning from oral traditions, stories, and games (Klinck et al., 2005). There is only one example in the literature of research on social networking in remote and rural First Nations. Budka, Bell & Fiser (2009) have studied MyKnet.org in northern Ontario, operating since 1999. The social networking service is run by K-Net, the broadband services and support organization discussed earlier. MyKnet.org is available to the approximately 45,000 people living in the region. There are 30,000 registered users and 25,000 active sites. More than half the 30,000 users are under age 25, signifying that this is "primarily a youth-driven online social environment." The network plays an important socio-cultural role by providing a means to build and maintain familial, friendship, and community relationships.

First Nations are also using videoconferencing to connect with each other. O'Donnell, Walmark and Hancock (2010) described a study that found that K-Net supports about 1,000 videoconferences and multi-site videoconferences a year, in addition to telehealth sessions. The findings suggest that the Atlantic Help Desk supports about 150 videoconferences and multi-site videoconferences a year. These videoconferences connect people in many different locations (sites).

First Nations are using ICT to support Elders. The presence of healthy role models in a community is extremely important for individual and community health and well-being. This is especially the case when understood in the context of the traditional Aboriginal systems of apprenticeship-based learning, deep and multi-layered forms of interconnection, and ecocentric identity formation. Elders living in a number of Saskatchewan communities (Whiteduck, T., 2010) and in communities in Ontario and Atlantic provinces (O'Donnell, Walmark and Hancock, 2010) have become involved in video conferencing, and use the medium to meet with each other and discuss issues they identify as important. The Elders regularly speak their Native languages in these sessions. In the Atlantic region, there are several examples where the only contact some Elders have with speaking Mi'kmaq is during these videoconferences, because there are no other Native language speakers in their communities. (O'Donnell, Walmark and Hancock, 2010).

A number of initiatives across Canada are using video to capture the stories and wisdom of First Nations Elders. A good example from the Atlantic region is the Dear Elders videos project available for viewing at the following URL: <http://dearelders.ca/>

First Nations are using ICT to support community self-reliance, resilience and self-determination. The argument that ICT can support self-determination has been made by several authors. Fiddler (2008) outlines how the UN Declaration on the Rights of Indigenous Peoples is a building block and guideline that Indigenous peoples and their states can use to pursue their collective rights and freedoms. Even without Canada's support of the Declaration, many First Nations across Canada have been actively pursuing these rights. ICT are powerful tools that can be used to realize these rights. With the engagement and commitment of First Nations communities, ICT can be developed and used in new ways that First Nations never thought possible. Fiddler argues that as global leaders, First Nations need to set the stage for the use of ICT in Indigenous communities and nations.

Along these lines, Perley (2009) notes that with the rise in websites for video sharing and the increase in resources to create and upload videos, there is potential for First Nations women to use this technology to represent issues they cannot normally address through mainstream media. Her critical analysis of the representation and participation of First Nations women in online videos provides some insight into how First Nations women are currently using ICT to question and challenge mainstream media assumptions and representations of First Nations women. Hancock and O'Donnell (2009) explore the potential for new media to provide a means for members of remote and rural First Nations communities to challenge problematic mainstream representations of First Nations identity. Online videos made by First Nations people may provide the means for a social movement that undermines the misrepresentations of First Nations culture and identities in mainstream Canadian media. McKelvey and O'Donnell (2009) describe a case of community use of multi-site

videoconferencing in 2007 that connected a number of First Nations communities across Canada for simultaneous audio-visual exchange. The event created a virtual space controlled by First Nations communities.

Entrepreneurial and economic initiatives are essential applications for the effective use of ICT in remote and rural First Nations. Local First Nation or individually owned Internet Service Providers are supporting the development and use of ICT in First Nations across the country. First Nation IT technicians and Online Content Producers are operating their own business. Many of these new businesses are located in remote and rural communities. For example, Angus Miles operates his own IT Service Centre out of Sachigo Lake First Nation (see <http://66.165.220.194/viewerportal/vmc/player.do?eventContentId=977>).

Challenges to broadband network and ICT use

Simply extending broadband infrastructure and ICT services is not enough on its own to encourage social, cultural and economic development in rural and remote First Nations communities. Research consistently shows that many broadband and ICT diffusion projects face similar challenges that impede uptake and limit use at the community level. The first problem is that any program to extend service to a remote location will face costly and difficult technological challenges.

Secondly, many programs underemphasize the importance of access, and under-supply training, skills development and capacity-building within the community. The availability of training, skill development and community capacity building is a key factor in whether or not the potential of ICT in First Nations communities will be realized. Teachers and other staff in First Nations Schools in the Atlantic Region identified a lack of support and training as the main barrier to using communication tools such as videoconferencing and online videos (Simms, O'Donnell and Perley, 2008). Another study that examined the technical infrastructure, user interactions with it, the production and reception of audio-visual content, and the organizational and social relations in the community identified capacity-building within the community as key to ICT uptake (O'Donnell, Perley, Simms and Hancock, 2009).

The third missing element is often a close and equal partnership between funders and the community, with local input in the policy and project design and implementation processes and a community needs-based plan for the project. Local ownership of both the project and the resulting infrastructure is proving to be a key requirement for sustaining and successfully operating these networks and their associated applications. A series of forums dedicated to the digital divide affecting First Nations concluded that videoconferencing, video over IP, single window service delivery and online training were important tools for community social and economic development. It also stressed the need for significant community engagement and leadership in efforts to build, operate and maintain a national broadband network.

Each of the three challenges can be traced back to the inherent limitation of any project-based funding formula, which favours short term benefit over long-term sustainability, and lacks both the policy and funding support for these initiatives to continue beyond the project's end date.

4 Conclusion: Making the Networks and ICT Sustainable in First Nations

We conclude this high-level overview of ICT in remote and rural First Nations with a discussion of the research on making the technology sustainable.

The need for community-based and culturally-appropriate networks and ICT

While their positive effects on general populations have been enormous, ICT have often proven to be an inadequate means of effective communication among minority populations, including those of indigenous heritage. Digital divide issues such as cost, geography, and computer literacy hinder indigenous people from using ICT to meet their social needs (Dyson et al., 2007). In addition, the global nature of the internet, through which most ICT operate, precludes its ability to accommodate different cultural values, such that the target audience necessarily becomes the dominant 'Western' population (Pannekoek, 2001).

Language is a strong indicator of this bias; English is the overwhelmingly prevalent language used on the internet, while many scarcely-used and endangered indigenous languages are virtually non-existent (Pannekoek, 2001). As a result, the internet and associated technologies may fuel the disappearance of

indigenous languages even as the communities strive to preserve them. Furthermore, much of the existing material representing indigenous groups on the internet imposes an outsider worldview that misrepresents and objectifies the culture, thereby furthering a colonialist agenda and contradicting the holistic values that indigenous cultures uphold (Iseke-Barnes et al., 2007; Todd, 1996).

Examples of First Nation owned and managed ICT applications and networks that are contained in this paper, highlight how some of these challenges are being addressed by First Nations. When the local and regional language is supported by these communication tools, the people tend to embrace these technologies, identifying innovative and unique strategies for their use. MyKnet.org as a social network is also an excellent example of peer-to-peer capacity development in web and html programming support.

However, while remaining mindful of the risks associated with using ICT for indigenous communities, researchers and organizations have begun exploring the potential for these technologies to help develop and enhance health and wellness among First Nations communities. Thus far, researchers have identified the great potential for ICT to promote language preservation as well as cultural growth through digital recording hardware and software, online learning tools, community internet forums, and other such resources (Nickerson, 2005). By harnessing the ability of ICT to facilitate sharing, which makes up a rich component of the holistic worldview that indigenous cultures value, technologies can be used to benefit rather than marginalize these communities (Leclair et al., 2007). To deflect the globalizing force of technology, the literature highlights the importance of providing community members with access to localized online resources catered to community-specific needs (Dyson et al., 2007; Gordon, 2006). This will help to ensure the protection that aboriginal groups require to maintain ownership and control over their knowledge, language, and culture (Nickerson & Kaufman, 2005).

Building community control and capacity

The final report of the Aboriginal Canada Portal Working Group (2004), with participants from government, national Aboriginal organizations and the World Summit on the Information Society (WSIS), identified and reported on the main challenges for ICT use in Aboriginal communities. The key findings of the group were that community involvement, champions and input are necessary at every stage of ICT development and implementation, and that while the government may be the enabler, the model for sustainability has to come from communities.

An important series of forums dedicated to the Aboriginal digital divide stressed the need for significant community engagement and leadership in efforts to build, operate and maintain a national broadband network (Aboriginal Connectivity Portal, 2006). Along the same lines, the Aboriginal Voice project consultations also identified the need for community input and control to set appropriate priorities and apply the technology in a meaningful and useful way in communities (Jock et al., 2004).

More recently, the Assembly of First Nations (Whiteduck, J., 2010) outlined the requirements for "the e-Community ICT model." The model is similar to the network development and IT maintenance model employed by institutions and corporations across Canada. Every First Nation community requires a broadband (fibre) connection and a local technical team to provide ongoing support for the telecommunications infrastructure. In this model, the community broadband fibre connection will support a wide range of community applications, including: online meetings, videoconferencing, high-speed internet, voice-over internet (VOIP), e-justice, mobile services, e-learning, e-administration, webcasting, telehealth, telemedicine, and e-commerce. The e-Community ICT model also includes building community capacity to use ICT as an integral part of the model (Whiteduck, J., 2010).

Many studies have identified the need for community capacity-building in ICT including: Gibson et al., 2009; O'Donnell et al., 2009; Peddle, 2007; Simms et al., 2008; Smith, 2008. For example, in his report on broadband in First Nations in BC, Smith (2008) points out that in urban centres, broadband systems are largely handled by the marketplace and maintained by skilled technicians. These factors are not present in most rural and remote First Nations communities and user fees are rarely adequate to cover system maintenance, support and upgrades. Policy initiatives relating to technical training (both for equipment and software) and funding for operational improvements will need to be ongoing and may need to grow over time.

Committing to ongoing funding and partnerships

The need for ongoing and sustainable partnerships between governments, First Nations and health service providers was also identified by many of the independent research studies.

The Aboriginal Canada Portal Working Group (2004) identified the need for horizontal partnerships for sustainability and “a close and equal partnership between funders and the communities.” Similarly, the successful Keewaytinook Okimakanak Telemedicine service has stated that in order to successfully deliver telehealth and telemedicine all levels of government need to be involved as well as the First Nations communities (KOTM, 2008). The AFN First Nations Telehealth Consultations identified critical success factors as ongoing partnerships, including partnerships with provincial service providers and stakeholders, and ongoing funding for networks, staffing, training and technical support (Gideon et al., 2009).

The key word is “ongoing,” funding. In contrast, project-based funding formulas favour short term benefit over long-term sustainability, and the resulting instability creates significant complications for the organizations receiving the funding and their staff (Gibson, O’Donnell & Rideout, 2007).

Developing broadband infrastructure

As discussed earlier, across Canada, telecommunications firms are slow, and in many cases unwilling, to extend broadband networks to remote and rural communities without significant government investment. This situation reflects the geography of the country and will not change in the future. Extending broadband services is cheaper in urban communities and more expensive in rural and remote communities because the costs include the lower volume of services and the high cost of construction and maintenance in rural and remote areas.

The most recent research on First Nations community connectivity suggests that significant new investments will be needed to increase broadband capacity in remote and rural First Nations. The data suggest that currently, about half of First Nations communities have no residential broadband or high speed access, about 40% of First Nations have residential broadband access, and about 10% have residential high speed access (Fiser, 2010, forthcoming). Communities need equitable access to broadband technology and more precisely, a comprehensive solution that is cost-effective, sustainable and viable to meet future and evolving technologies (FNEC, 2009).

To be sustainable, building, upgrading and maintaining broadband infrastructure in remote and rural areas will need significant ongoing investment by governments. SuperNet in Alberta for example was subsidized by the provincial government so it could cover 95% of communities across Alberta for a fixed rate irrespective of location in order to further develop the province socially, culturally and economically (Mitchell, 2007).

The geography of remote Canadian communities implies transportation access problems, long cable builds, and harsh climate. Building sustainable broadband infrastructure capable of telehealth delivery in remote and rural First Nations is and will continue to be costly. Travel and shipping telehealth equipment to some rural and remote areas can account for up to 40% of the project budget (Muttitt, Vigneault & Loewen, 2004). Rolling it out could also generate new and interesting possibilities for innovation and technical development. New engineering and technical solutions are needed to reduce these and related infrastructure costs.

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