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Innovation and Digital Connectivity: Comparative Policy Approaches for Connecting Rural Communities in the United States and Canada

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Current approaches to achieving basic broadband connectivity are fairly well understood from a technical standpoint (Hilbert, 2016) and in specific locales, such as urban settings (Baker, Hanson, and Myhill, 2009), but have been less effective in rural areas, and to a number of underserved populations. Cataloging and evaluating the array of tools, approaches, and partnerships (public-private, purely private, intergovernmental, etc.), would provide useful information for policy makers working on connectivity initiatives. Looking past the importance of basic access, the dimensions of robust connectivity must be understood by unpacking its various aspects. Consider the distinction between simple access—connectivity—and the *usability* and, hence, utility of broadband and associated information-related technologies.

Both rural connectivity and usability pose implementation challenges, given disparate populations, variable terrain, and highly variable, even unpredictable, costs to build and sustain access. Broadband connectivity is relatively common in urban areas, for instance, about 97% in the United States. Conversely, rural connectivity, estimated at about 74% in the U.S. and 46% in Canada (albeit at different speeds), reflects the challenges of building and maintaining access, both in the United States (USDA, 2019; NACO, 2020; FCC, 2020) and in Canada (Gaspard and Khan, 2021; Hambly and Rajabiun, 2021). Typically, the narrative on connectivity is addressed in terms of supply and demand. We argue in this paper, that an overlooked set of actors have an important role to play. These stakeholders—intermediaries—include institutions such as universities, trade groups, and other industry-related organizations (Baker, Gaspard and Zhu 2021). Intermediaries can provide additional opportunities to link resources for connectivity, funding, and infrastructure and the places and people that may want or need the connectivity. This paper reviews the availability of rural connectivity in the United States and Canada, explores the role of intermediaries for

connectivity, and discusses two cases (universities in the United States and the SWIFT rural broadband initiative in Canada) and the associated policy implications for connectivity advancement.

Rural Connectivity in the United States and Canada

Common definitions of rural communities include sparse populations and distance from an urban center (Reimer and Bollman, 2009). Rural communities often struggle for access with varying degrees of distance and isolation from population centers and access to goods and services (Pant and Odame, 2017). From limited health and social services availability to precarious employment and limited or at best, variable, access to broadband, the differences between urban and rural places have been especially pronounced during the pandemic (Weeden and Kelly, 2020). Relative to the United States, United Kingdom, and Australia, Canada has a higher standard (50/10 download/upload megabits per second [Mbps]) of connectivity coverage (see Table 1).

The need for public investment in rural broadband is reflective of the limited business case for solely private sector investment. Most common, in both Canada, and the United States, are hybrid approaches, in which public subsidies are used to incent the private sector to provide connectivity and access to broadband services, where lacking. As one of its many rural connectivity programs, the U.S. Federal Communications Commission (FCC) uses reverse auctions to encourage private sector activity in rural places with limited or no service. In Canada, various funds and programs subsidize private sector investment to promote rural connectivity.

Missing from much existing research is an in-depth examination of the linking mechanism between funding and connectivity. From locally based not-for-profit

Table 1.

Country	Rural population % (World Bank, 2018)	Connectivity rates of households Note: various speeds and technologies
Australia (Julian Thomas, et. al, 2020)	19%	“Internet access” National: 76% Capitals: 78% Rural: 73%
Canada (CRTC, 2020)	18%	50/10 Mbps National: 87% Urban: 99% Rural: 46% First Nations reserves: 35%
United Kingdom (Ofcom, 2021)	16%	“Superfast” broadband, at least 30 Mbps (download National: 96% Urban: 98% Rural: 83%
United States (CRS, 2019)	14%	25/3 Mbps (minimum) National: 94% Urban: 98% Rural: 74% Tribal regions: 68%

organizations to universities, a variety of intermediaries work to leverage either funding or infrastructure/service offerings from providers to foster connectivity in underserved rural places.

In each country, the core actors include private industry carriers, as well as the public sector (federal, state, provincial, municipal), with various other institutions operating as intermediaries. In Canada, for example, Southwestern Integrated Fibre Technology (SWIFT) and Eastern Ontario Regional Network (EORN), are two not-for-profit Ontario-based organizations that aggregate the interests and resources of smaller rural communities to promote connectivity by running procurements. Others, such as O-Net in Olds, Alberta, built their own not-for-profit organization dedicated to providing rural broadband to their community. Analyses of instruments for financing and delivering rural broadband are emerging contributions to the literature (Millard, 2020; Gaspard and Khan, 2021) and merit further attention as policy options for jurisdictions grappling with connectivity.

Connectivity in Canada

Nationally, 87% of Canadian households have broadband connectivity at the standard 50/10 Mbps speed. Disparities emerge, however, when connectivity is compared across urban and rural locations. Almost all (nearly 99%) of *urban* households in Canada meet a 50/10 Mbps connection standard, compared to roughly

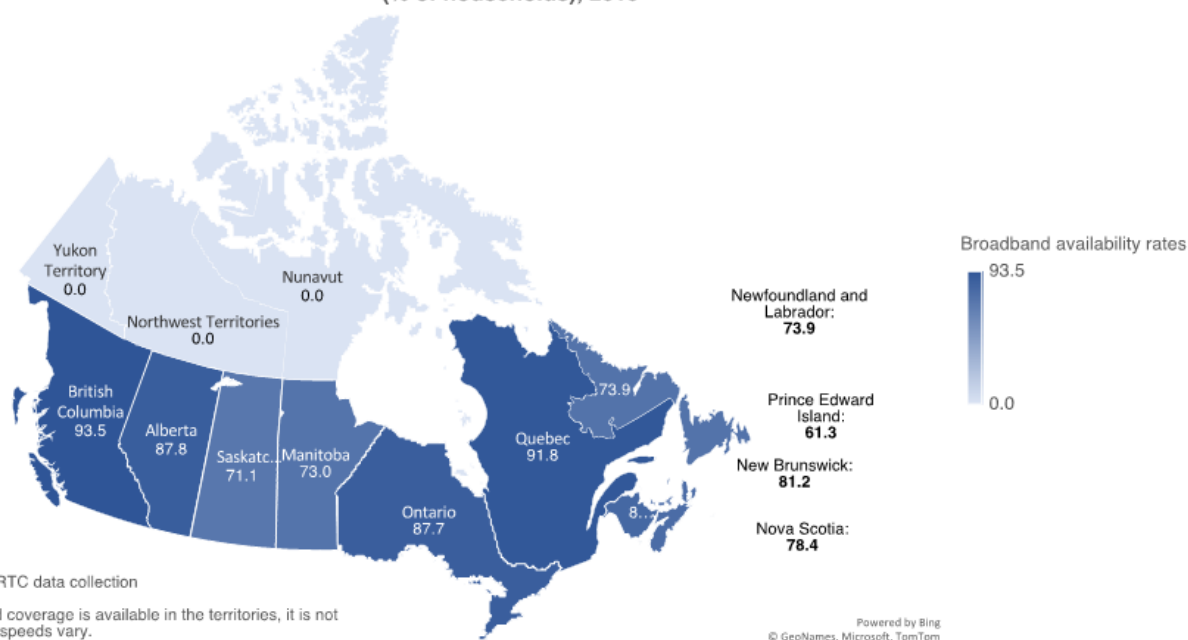
46% of rural households and 35% of households on First Nations reserves. In Canada, nearly 20% of the population lives in a rural place, which means that a not-insignificant portion of the population is more likely to experience connectivity challenges. Higher rates of rural connectivity in British Columbia (93.5%) and Quebec (87.7%) may be the result of increased provincial engagement in connectivity, with initiatives and funding to leverage investments from the private sector and federal government.

Canada has made a well-defined political commitment to connecting Canadians “wherever they live,” reflected in mandate letters to ministers from the prime minister (Gaspard and Khan, 2021). When combined, various sources of federal funding for rural broadband amount to \$8 billion (CAD) with an additional \$1 billion (CAD) announced in the 2021 federal budget (Gaspard and Khan, 2021). Past estimates by the Auditor General suggest that broad connectivity could be achieved for approximately \$6.5 billion (CAD) if multiple forms of technology were used to connect Canadians. Falling within that range, TELUS (one of Canada’s three major telecommunications service providers) estimates that it would cost between \$6 billion (CAD) and \$10 billion (CAD) to connect the 14% of Canadian households currently without access (TELUS, 2020).

In a 2021 survey of instruments for funding rural broadband connectivity, Gaspard and Khan (2021) concluded that Canada’s approach would benefit from

Figure 1. Broadband service availability in Canadian provinces and territories

Broadband service availability, 50/10 Mbps and Unlimited Data Transfer and province/territory (% of households), 2019



Source: Reproduced from Gaspard and Khan (2021), Figure 3, with data from CRTC, 2020.

streamlining and diversification, with the various federal departments and agencies coordinating internally to adjudicate applications and requests for funding. These approaches require data and recognition that differentiation between urban and rural places is necessary. TELUS estimates that the cost of connectivity is 2.5 times greater in rural places than in urban places. With different costs, terrains, consumer uptake, and demand, policy governing spectrum and instruments for financing and delivery should reflect these differences as well. In Canada, typical cost-sharing arrangements between public and private sectors range from 50/50 private-public to one-third private and two-thirds public.

Different mixes of approaches and actors have helped bridge connectivity gaps by working to encourage private sector efforts to build out the infrastructure needed for connectivity, where demand exists. Going beyond traditional supply and demand approaches, network intermediaries in Canada can help facilitate expanded approaches for achieving policy objectives within the existing system. The examples of network intermediaries with regional contexts, offer insights into how to innovatively pool resources and expertise to generate solutions taking into account current system-level challenges.

Connectivity in the United States

In the United States, 20% of the population, some 60 million, reside in rural places. Operating with additional

challenges are some 628,000 tribal households who lack access to standard broadband, a rate more than four times that of the general population (FCC, 2020). A 2019 study by the American Indian Policy Institute found nearly one in five reservation residents had no access to the internet in their homes (Howard and Morris, 2019).

An important factor in implementation decisions is the availability of explanatory data, as lack of a complete or comprehensive source of data capturing fully all aspects of the problem increases uncertainty of outcome. Pertinent to this, the National Telecommunications and Information Administration (NTIA, 2021b) observed that “there is no single data source that indicates definitively where broadband services and technologies are available, which speeds they provide, the cost of service, or the rate of subscriptions among individuals, households, businesses, or organizations.” In 2017, high-speed internet was available to about 93.5% of the population through fixed terrestrial technologies like cable, including about 73.6% of the rural population, and high-speed internet was available through satellites to virtually the entire population (Wilmoth, 2019).

In the United States, a range of public sector initiatives at the federal, state, and regional/local levels; public-private partnerships; NGO/advocacy-related activities; and purely private sector initiatives, address rural connectivity in different ways. Federally, direct program funding has come from multiple agencies, including the Department of Agriculture (\$167 million); the Department of Commerce (NTIA—\$1 billion for Tribal Broadband);

the Departments of Education, Housing and Urban Development, Labor, and Treasury; the National Science Foundation, and the Northern Border Regional Commission (NBRC). Broadly, the American Rescue Plan of 2021 included some \$360 billion to address rural connectivity issues. In addition, the FCC operates a series of targeted programs, including the Universal Service Fund (USF), consisting of the Connect America Fund for rural areas, the Lifeline Fund for low-income consumers to purchase internet services, and two funds for schools and rural health care.

States tend to favor incentive-based approaches, encouraging actors to develop connectivity initiatives rather than providing direct funding or public sector infrastructure. Additional policy strategies include research funding initiatives and new approaches to technology deployment, tax incentives, and job creation. States continue to establish programs such as broadband offices and task forces, and to expand the types of entities that can engage in broadband deployment projects or service provision (Read and Gong, 2021).

Overall, we examine the issue of rural connectivity from a multidimensional perspective—the components of the problem, the locale, actors, and possible policy approaches generated by actors:

- **Context of**, and associated **data** available for a given analysis. For instance, what are the geographic parameters, distance, density, and terrains used to inform problem definition?
- **Technological solutions**: What are the technological based solutions to rural connectivity, and how are they implemented?
- **Actor/stakeholder** interests need to be considered in policy alternatives for enhancing rural connectivity and to speak to their priorities and challenges.
- **Objectives/outcomes/impacts** of problem being solved. Does one solution (e.g., local government broadband) “break” another (e.g., subsidized competition with an incumbent carrier)?

Intermediaries and Their Roles

As the model of service provision becomes more nuanced, the number of involved actors increases. Users (the demand side) can include individuals, communities, institutions, or businesses. An increasingly important player in the provision of information services (including connectivity) are network intermediaries, which can take various forms and can have varied objectives. One such example includes innovation intermediaries, entities that act as an agent or broker in any aspect of the innovation process between two or more parties. Innovation intermediaries are recognized as crucial actors that can facilitate the innovation process (Howells, 2006).

An innovation ecosystem, such as might be present in a rural community, can embody organic and holistic bottom-up approaches to economic development that supports innovation (Gault, 2010). Innovation ecosystems are composed of individuals, communities, organizations, material resources, rules, and policies across large and small businesses, universities, colleges, government, research institutes and labs, and financial markets that collectively work toward enabling knowledge flows. When it comes to connectivity, intermediaries are used here in their functional or operational capacity, rather than how they are structured or classified. That said, the functionality or role of an intermediary can be assumed by an actor in the public, private, or third sectors. Business, industry and trade groups, universities, not-for-profits, government-adjacent entities, and economic development authorities can all serve as intermediaries. We focus in this paper on two types of innovation intermediaries: universities and multi-jurisdictional regional coordinating agencies. Universities are typically thought of in their capacity as trainers of knowledge workers or sources of basic research and innovation. But universities can also be translators or network enablers with economic or community development capacity. In terms of rural connectivity, universities can act directly, as providers; secondarily to conduct research in innovation that might generate new means of connectivity; or indirectly, to provide support, say, as part of a cooperative effort. An example of direct action is efforts by Diné College, a TCU (Tribal Colleges and Universities) in Tsaile, Arizona, to enhance student internet access. The college leveraged federal CARES (Coronavirus Aid, Relief, and Economic Security Act) (2020) funding to help purchase Wi-Fi hotspots and laptops for students.

Operating as an amplifier or enabling agent in an *indirect role* represents an underexploited opportunity for universities in advancing broadband connectivity. By participating on multidisciplinary teams that incorporate industry representatives and academic staff and focus on community challenges, university researchers can become more effective citizens of their cities and economies (Chan and Farrington, 2018). Another option is to operate as nodes in innovation networks: the use of ICT to facilitate the establishment of virtual networks, allowing groups of rural entrepreneurs to connect with each other, and explore the obstacles, opportunities and solutions characteristic of broadband connectivity implementation in rural areas (Lyons, T., S. Miller, and J. Mann, 2018; Pew, 2020). Two examples of state-supported efforts include Virginia’s Commonwealth Connect Coalition and the North Carolina Digital Equity and Inclusion Collaborative, which bring together universities and private and public sector actors to work to close digital divides (Stauffer et al., 2020).

A Canadian provincial government report underscored the responsibility that academia shares with the government for the health of the workforce and economy

(Premier's Highly Skilled Workforce Expert Panel, 2016). Universities increasingly recognize the importance of their technology transfer, innovation, and workforce development mandates at both the local and the national level (Chan and Farrington, 2018). They provide an example of such a broadband-related collaboration: The multi-year project (Research Partnerships to Revitalize Rural Economies Project), involved five universities and focused on 1) rural knowledge work and entrepreneurship and 2) innovation and sustainability in creative rural communities. Sample projects examined the use of technology by remote small business owners and employment and wage modeling of the impacts of broadband deployment in southern Ontario.

An article by Chan, Hassanein, and Ivus (2011) demonstrated that where the government made costly broadband investments in a region, job employment rates and economic vitality significantly increased. Intermediaries such as SWIFT, a publicly funded multi-jurisdictional coalition, provide an interesting example of how to bridge the gap between the public resources required to promote rural connectivity and data gaps on available opportunities to build solutions. Established as a not-for-profit organization to improve connectivity in a cluster of 15 rural municipalities in southwestern Ontario (with subsidies from the governments of Ontario and Canada), SWIFT leverages public funding and pairs it with private-sector resources to bring connectivity to underserved areas. SWIFT developed robust internal mapping to identify service gaps. The exercise is time- and cost-intensive and other actors engaged in connectivity either did not have the resources, incentive, or data to undertake the exercise. SWIFT operates by providing funding to address infrastructure gaps. The intermediary allocates dollars within its service area based on connectivity needs and competition. Rather than having the government allocate dollars, it streamlines and targets procurements based on its in-depth knowledge of the area and its connectivity.

Comparative Assessment

By utilizing environments in which a variety of instruments can be applied, and not necessarily constrained by traditional supply and demand considerations, intermediaries can engage to close gaps and achieve the goal of connectivity. Canada's federal application and grant-based approach to funding rural broadband would benefit from integrating lessons in instrument diversification. In Canada, intermediaries are often able to successfully navigate the existing system to

access funding for rural broadband. In terms of process, local policy makers in both the U.S. and Canada would be well served by 1) defining a baseline context, 2) determining gaps in access, service, cost and awareness, and 3) designing and developing context-specific approaches to improve basic access, and useful connectivity. Community capacity, and need should be defined and aggregated on a geographic basis and up-to-date information ideally used in critical baseline analyses to determine place connectivity, gap analysis, nodes availability, and how resources can be applied to develop solutions.

Conclusion

As the cases of Canada and the United States suggest, implementation instruments—be they policy/regulatory, economic, financial, or technological—are most effective when designed to consider contextual conditions and reflect the diversity of the target community. A clear understanding of need is critical to attracting private-sector investments and offering sustainable solutions for communities. Mapping existing connectivity and community needs is essential for actors and intermediaries. Developing an understanding of what works and how would add to the literature, as well as provide insight for policy and decision makers. In summary, this analysis found that:

- To foster the deployment and long-term sustainability of rural broadband infrastructure connectivity, policy approaches and associated instruments must respond to contextual realities that reflect the diversity and needs of the community.
- Actors and intermediaries must conduct robust baseline assessment and build geographically based maps of connectivity and community needs (Ali, 2020).
- Attracting private-sector investments and offering sustainable solutions for communities requires a clear, empirically based articulation of needs, which can include direct (public) funding, tax incentives, directed program creation, and regulatory intervention.
- Absent broadband providers, a mix of implementation approaches (public sector, public/private, and non-profit) and intermediary engagement can address connectivity challenges in rural or underserved areas. There is no one-size-fits-all approach.

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