Articles

Sisyphus's Broadband: Exploring models of rural community participation in digital infrastructure and connectivity

Dr. S. Ashleigh Weeden, University of Guelph, *ashleighweeden@gmail.com*

Dr. Wayne Kelly*, University of Manitoba, *kellyw@brandonu.ca*

Dr. Sarah-Patricia Breen, Selkirk College, *sbreen@selkirk.ca*

*corresponding author

Acknowledgements: Portions of this research was funded by the Mitacs Accelerate program, with support from City West. We would like to gratefully acknowledge the support and guidance received from Dr. Robert Long at City West and the contributions of student research assistants McKenna Dubois and Ishith Nigam.

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Abstract

Rural communities continue to face inequitable access to Internet connectivity, and pervasive digital divides in both infrastructure and capacities remain. A growing number of rural communities have taken (or attempted taking) active roles in the connectivity landscape. The literature investigating these community-led initiatives is emergent, with little understanding about the range of rural community-led initiatives and little empirical evidence to guide community decision-making in terms of which approach, if any, to use. This paper outlines the development of a set of rural community models with the aim of inviting further refinement and challenge of these models and to help communities understand the challenges and options for building local Internet access.

Keywords: connectivity; broadband; rural development; public policy; capacity

Introduction

Across the globe rural communities continue to face inequitable access to digital infrastructure and Internet connectivity, including limited and/or legacy infrastructure, subpar service delivery, market monopolies, and limited local capacity to invest in and leverage appropriate solutions to these challenges. As a result, there are pervasive, multiple, and layered digital divides that exist between rural and urban regions, as well across socioeconomic divisions within rural communities and regions. In the face of this, a growing number of rural communities have been, or have tried, carving out active roles in the connectivity landscape. The result is a range of community-led initiatives aimed at addressing the digital divides at the local scale, each with varying degrees of success.

While there is extensive and growing literature on the adoption and impact of Information and Communications Technology (ICT) on rural places in North America and Europe (Lægran, 2002; Pant & Hambly Odame, 2017), the body of literature investigating the origins, scope, scale, and impact (positive and negative) of rural community-led connectivity initiatives in Canada is emergent. Attempts within the literature to identify and explain differing community-led connectivity initiatives remain limited, as does the discussion of the potential, impact, and efficacy of community initiatives within the broader regulatory and legislative context. There is little understanding about the range of connectivity options available and little empirical evidence to guide community decision making in terms of which, if any, these communities could pursue. Both in Canada and internationally, there remains a dearth of methods and measures to study rural Internet connectivity beyond its technical and/or

econometric aspects (Ashmore et al., 2015; Salemink et al., 2017), and there are no agreed-upon 'best' approaches to evaluating connectivity initiatives (Gomez & Pather, 2011; Heeks, 2010; OECD., n.d.). More evidence is needed to identify, test, and validate community initiatives, as well as to provide guidance for communities seeking solutions to their connectivity challenges, especially with specific consideration of the Canadian context. While the body of meaningful ICT literature in is growing, it does not necessarily translate appropriately to the legal, political, and socioeconomic context of community connectivity in Canada and other comparable jurisdictions. Failure to acknowledge and address this gap within the literature may lead to ineffective or inappropriate cross-jurisdictional assumptions. As such, when considering community-led rural broadband extension, adoption, and evaluation in Canada, the question "is anyone any better off?" remains challenging for both researchers and communities alike. Communities are thus left wondering what approach should they use to try and connect their communities, and are these efforts worth it? This paper responds to these questions by presenting models developed in Canada to help rural communities navigate the challenge of understanding different community broadband approaches. This article also explores the literature around community broadband initiatives in Canada that were the base for those models, identifies some of the corresponding realities in the United States and Europe and then shares the findings from research in rural British Columbia that helped develop and evaluate these models of community broadband initiatives.

The purpose of this paper is to demonstrate initial indications of what enables community broadband models to be successful, and to help communities to understand what models may be appropriate to use when developing local access to the Internet. The paper will first present the conceptual models of community-led connectivity and then we frame these models within the community informatics field by reflecting on the challenges and realities that rural communities face when trying to develop local access to the Internet. Using the findings of a targeted, Community-Based Research project exploring two rural case studies, combined with a review and analysis of related literature, this paper presents the development and evolution of conceptual models for community-led interactions within the connectivity arena. In doing so, we hope to both examine the merits of such conceptual models, as well as challenge other scholars to explore, test, refine or refute these models – thereby growing our collective understanding of the socio-cultural dynamics and governance arrangements of community-led initiatives. We begin with an overview of key bodies of literature and the methods used for this paper, followed by a presentation and discussion of the resulting models, before sharing our conclusions and implications for community access initiatives and government policy.

Literature

The Importance of Connectivity to Rural Development

The importance of digital infrastructure and Internet connectivity for enabling critical social, economic, and political life has received increasing attention and recognition over recent decades, while the connection between access to Internet connectivity and community resilience has received increasing attention in the last half-decade (Roberts, Anderson, et al.,

2017; Roberts, Beel, et al., 2017). Internet access has become increasingly vital for facilitating access to a range of day to day critical activities and services, including employment, education, health, banking, and more (Ashmore et al., 2015b; Hallstrom et al., 2017), as well as influencing social cohesion (Wallace et al., 2017). The impacts of the ongoing COVID-19 pandemic have emphasized the increasing importance of access to reliable, affordable Internet connectivity for facilitating safer, sustainable socioeconomic engagement (Britnell et al., 2020).

In rural Canadian contexts, access to Internet connectivity[i] has long been associated with discussions of uneven development and its consequences for the immediate and long-term futures of rural people and communities (Hambly & Rajabiun, 2021). Canada has been championing the importance of a connected society since the public launch of the Internet in the 1990s (Middleton & Sorensen, 2005). Both policy actors and community practitioners have also long been aware of the divide in rural and urban connectivity and the challenges in connecting rural areas (Ramírez, 2001), and Canada's first strategy that focused on connecting rural Canada was developed in 2001 (The New National Dream: Networking the Nation for Broadband Access. Report of the National Broadband Task Force, 2001). However, while policymakers have recognized the rural digital divides in Canada since the public first started using the Internet, Canada has struggled to close these divides and it remains an issue to varying degrees across rural communities (Weeden & Kelly, 2021a). One of the challenges is that policymakers in Canada have continually adopted market stimulation approaches for broadband development to address the urban-rural digital divide (M. B. McNally et al., 2016; Rajabiun & Middleton, 2013). A National Broadband Task Force report recommended direct investments in rural infrastructure beginning in 2001, a recommendation that was repeated by a Telecommunications Review Panel in 2006. Resulting funding has continually focused on stimulating ISPs to expand and provide services in areas experiencing market failure, resulting in the pervasive divides in those areas (Ashton & Girard, 2013; M. B. McNally et al., 2016; Weeden & Kelly, 2021a).

As socioeconomic development becomes increasingly tied to digital infrastructure, there remains a frustrating 'chicken and egg' problem associated with both researching and implementing rural Internet connectivity: approaches address either community capacity or digital infrastructure, rather than treating the two as intertwined processes that can and should be approached holistically and progressively (i.e., these processes often work as interacting feedback loops and much is missed when they are framed as separate spheres of influence). Evidence of the prevalence of such 'either or' approaches in both research and practice can be found in Salemink et al.'s 2017 review of 157 papers on digital development and rural development in advanced countries. They observed "two major strands of research: connectivity research and inclusion research" (p. 360), with the former focused on the persistent and growing infrastructural divide between rural and urban areas (i.e., 'hard' digital capacity), and the latter focused on the challenges to technological diffusion and lower digital

[i] Throughout this paper, 'rural Internet connectivity' and 'rural broadband' are used interchangeably, as is the common usage by rural communities. We acknowledge that, in technical terms, the Internet is the network of machines/computers, servers, et cetera that are connected and controlled through networking rules and norms, while broadband is the technology that is used to connect individual devices or users to the Internet.

skill-attainment (i.e., 'soft' digital capacity) associated with rural regions. They argue that "generic policies in this field [connectivity] neglect specific local needs" and that the central paradox facing rural regions is that "rural communities are most in need of improved digital connectivity to compensate for their remoteness, but they are least connected and included" (Salemink et al., 2017, p. 360).

The Digital Divides

Rural-urban conflict and inequity is common, despite the interdependences and synergies that exist across rural and urban spaces (Vodden et al., 2019). While many have moved away from the 'rural/urban' dichotomy and now use the 'rural/urban continuum', or have moved away from 'rural/urban' entirely to focus on place-based approaches, the persistent and widening gap between access to Internet connectivity in rural regions compared to urban regions means that the 'rural/urban divide' remains pragmatically accurate for describing dynamics of geographic inequity on this issue. There are in fact multiple divides, including those between rural and urban regions, within communities and regions of all types, as well as across individuals – layered through additional factors including gender, race, and socio-economic status (Hambly & Rajabiun, 2021; Weeden & Kelly, 2021b).

Digital inequities have been shown to limit rural options and opportunities (Hollman et al., 2020). For example, the digital divides were thrown into sharp relief throughout the continuing COVID-19 pandemic, serving to emphasize the disparity between urban and rural regions, as well as across different rural regions (Meyer, 2019; Weeden & Kelly, 2020, 2021b). The digital divides are multi-faceted, including: the physical infrastructure needed for connectivity and services access; the skills and insights to appropriately seek and/or evaluated proposed infrastructural investments; and the related skills and capacity to fully benefit from that Internet access (Salemink et al., 2017; Weeden & Kelly, 2020). In addition to being multi-faceted, digital divides are pervasive, continuing even once physical access to connectivity is established (Heeks, 2022), as infrastructure quickly becomes dated and/or requires new capacities and skills to use once installed, requiring rural areas to play continuous catch up. Despite acknowledgement of the digital divides, every order of government in Canada continues to struggle to deliver equitable access to connectivity in rural areas (Meyer, 2019) and to develop policies and programs capable of meeting rural needs (Weeden & Kelly, 2021b).

Connectivity in Rural Canada

Many Canadians, primarily those in rural and remote areas, still do not have access to broadband Internet (Canadian Radio-television and Telecommunications Commission, 2016).[ii] Political commentator David Moscrop described Canada's telecommunications industry as "three companies in a trench coat" (2022, para. 1). While humorous, the observation is astute. Canada

[ii] Definitions of 'broadband' continue to evolve and often differ across international jurisdictions and between legislative and practical/applied employment. In Canada, the CRTC defines broadband as "an always-on, high-speed connection to the Internet through the facilities of an ISP. The term common refers to Internet access via cable and DSL but can include other technologies including wireless HSPDA and 1X that provide download throughput of greater than 1 Mbps" (Canadian Radio-television and Telecommunications Commission, 2015).

has been repeatedly ranked as one of the least competitive telecommunications markets in the world, with three firms controlling more than 90% of the wireless market (Montogomery, 2020) and a merger of two players raising concerns about the further consolidation of the industry (Moscrop, 2022). The merger has now been completed resulting in two major firms controlling almost all the wireless market (CBC, 2023). Despite several decades of research, recommendations, and commentary from journalists, expert task forces, municipal associations, research institutions, and communities themselves stating the importance of getting difficult-to-connect rural regions online, Canadian governments have "largely relied on large telecommunications corporations—and little competition between them—to build broadband infrastructure (both wire and wireless based)" (Authors, 2021, p. 213) (see also Smythe, 1960; Babe, 1990; Joseph, 2018). The consolidation of Canada's telecommunications industry also makes it difficult to compare Canadian cases to other jurisdictions, further underscoring the need to address gaps in the literature that are specific to Canada (and to rural Canada in particular).

For rural and remote communities, connectivity is critical for accessing services that may otherwise not be possible due to distance (Canadian Radio-television and Telecommunications Commission, 2016). In 2016, the Canadian Radio-Television and Telecommunications Commission (CRTC) recognized Internet as an essential service, establishing a universal service objective of 50/10 Mbps and unlimited data – for homes, businesses, and as many major transportation roads as possible at an affordable rate (Canadian Radio-television and Telecommunications Commission, 2016). The CRTC estimates that as of the end of 2021, 38% of rural households still lacked service that meets CRTC's service objective; in comparison, less than 1% of urban households still lack access to 50/10/unlimited service (Weeden & Kelly, 2021b).

McNally et al. (2017) argued that the continuing challenges in connecting everyone in Canada to equitable, affordable, reliable Internet service is because "the central conflict in Canadian telecommunications policy is between two irreconcilable goals: facilitating capital accumulation for the dominant firms constituting the telecom oligopoly versus enhancing democratic potential and human rights through the use of communicative technologies" (Authors, 2021, p. 213) (see also McNally et al., 2017, p. 44-45; Winseck, 1997, 1998). Despite decades of advocacy, policy, and programming, and the significant amount of resources attached to these efforts, Canadian governments have yet to durably close the connectivity gap between rural and urban regions, especially in regions where market failure results in ineffective telecommunication competition and service delivery, pointing to overall policy failure regarding telecommunications service delivery and sector management. This failure is due to multiple factors, including jurisdictional confusion and ineffective regulation, with overlap remaining between orders of government pursuing different connectivity initiatives and little concerted attention directed towards reconfiguring the telecommunications landscape as a whole.

Gaps in connectivity infrastructure and services for rural regions across Canada continue despite ongoing market stimulus initiatives undertaken by both the federal and provincial governments in partnership with the private sector (Weeden & Kelly, 2020). The Federal Government has made a series of funding announcements related to improving connectivity, most notably and substantially, the $3.225 billion Universal Broadband Fund, which received a

$475 million top-up announced in November 2022 (Government of Canada, 2022). Despite the CRTC Policy, and significant public and private investments, myriad challenges remain to rural access to quality and affordable connectivity (Hambly & Rajabiun, 2021). Although there has been significant spending by all orders of government on this issue over the last several decades, the impact is poorly understood. While there have been some attempts to demonstrate the impact of investment in connectivity in Canada (e.g., Esser-Haines, 2022), the significance of the overarching impact of government stimulus is unknown and unevaluated (McNally et al., 2017).

The lack of depth in Canadian evaluations of digital divides differentiates the country as an important case-site in light of the comparatively rich literature produced by evaluations of the same in the United States and, to some extent, in Europe. Further, Canada is a federal parliamentary democracy operating within a constitutional monarchy, differentiating its governance and legal context from the United States and many other international jurisdictions. Emphasizing this trend, Mack et al.'s (2023) recent review of literature at the intersection of broadband and rural development reviewed just over 100 papers, with screening processes producing results that were heavily weighted towards American studies, although some studies from Europe, the United Kingdom, and Australasian were also included. A decade prior to Mack et al. (2023), Yoo (2014), compared broadband deployment in the United States and Europe, finding that the United States led the European Union across many measurements at that time. Previously, Picot & Wernick (2007) addressed some of the underlying causes for these discrepancies by exploring the role of government in broadband access. In contrast, in a similar timeframe, Schejter (2009) argued that the United States could learn from what they argued was "better" European broadband policy implementation, underscoring a recurring issue of determining what is meant by 'good' policy or interventions in addressing digital divides. This tension can also be found in the work of Picot & Wernick (2007), who analyzed the United States, Korea, and Europe, and found that South Korea's leading position, at that time, was due to the "active role of government in fostering broadband on both the supply- and demand-side" (p. 671). The US broadband market was found, in contrast, to be characterized by "a strong emphasis on competition aspects of regulation" (Picot & Wernick, 2007, p. 671). However, the insights drawn from this literature do not map neatly or meaningfully onto the legal, political, or socioeconomic context of Canada or other similar jurisdictions. As noted above, reviewing literature on different mechanisms for broadband deployment and the role of different actors, including governments and public organizations at different scales (such as the community level), reveals a comparative lack of consideration of and insight into how Canadian institutions and communities engage in the broadband landscape. Developing Canadian counterparts to contributions like Ali's (2021) recent *Farm Fresh Broadband*, which included analysis of the interaction meta, macro, and micro-level dynamics and the relationship between public and private interests, may help to reveal different characteristics and practices than those found in other jurisdictions (see McNally et al., 2017 and Hambly & Rajabiun, 2021) and support new insights into motivations, implications, and impacts of the Canadian approach to broadband deployment policy and management. This paper represents our efforts to supply an initial piece to this large puzzle.

The dominance of American and, to a lesser extent, European and Asian contributions to the field makes consideration of the Canadian context even more compelling. The combination of the lack of effective policy and programming, the lack of evaluation of previous and current investments in addressing rural digital inequities (McNally et al., 2017), and few considerations of specific social-cultural dynamics and governance arrangements of community-led initiatives in Canada appear to produce a major gap in knowledge. The result is limited information available to academics and to guide decision-makers. As observed, "questions remain about the role the public sector can play in fostering the emergence of high-quality broadband connections that meet growing demand for reliable, affordable, ultra-high speed/low latency Internet access" (Hambly & Rajabiun, 2021). This question applies to the public sector at every level – federal, provincial/state, regional, and community.

Methods and Project Overview

The purpose of this research project was to develop a typology of community broadband models and then to analyze specific case examples of community broadband projects in order to ground truth and refine the models to reflect on the realities of communities building local Internet access. Development of the models began with a jurisdictional scan to identify initiatives in rural British Columbia (BC), a thematic analysis of the literature, and a community-based research approach to undertake two case studies for in-depth analysis of two of the initiatives.

Community-Based Research approach

Community-Based Research (CBR), is a research approach that engages the participating community or groups in aspects of the research design, data collection, and analysis. CBR projects are focused on contributing back knowledge building and or action, and this is of equal importance to the academic's research goals for the project (Halseth et al., 2016). This project engaged community research partners in the research design and review processes to ensure that the research being conducted in this project contributed accessible knowledge back to the participating communities. CBR has been identified as particularly useful for exploring digital technology use rural contexts due to the ever evolving and non-linear nature of technology use (Baskerville & Wood-Harper, 1996; Beckinsale & Ram, 2006; Flicker et al., 2008). The evolving nature of technology use combined with the distinct and diverse realities of rural communities creates unique circumstances related to digital technology in rural areas (Salemink et al., 2017; Stillman, 2005). As an approach to research, CBR can increase the depth and contextual understanding of an issue (Beebeejaun et al., 2014; Halseth et al., 2016). Through CBR, the exploration of the unique realities of rural connectivity can contribute to both knowledge and capacity building amongst participating researchers and communities. In addition to contributing back to participating communities, CBR was utilized in this project to enable a deeper contextual examination of the connectivity approaches and models being used.

This research focused on connectivity within rural BC, Canada and was informed by two student-led CBR case studies on rural community connectivity initiatives. Despite BC being

considered a leader in connectivity and technology in Canada, the province has uneven connectivity access, with connectivity posing a challenge for the rural parts of the province (Mark, 2022). Many rural places are being left behind – particularly the more remote and Indigenous communities (Breen & Robinson, 2021). Estimates indicate approximately 33% to 60% of rural and Indigenous communities in BC lack affordable connectivity options that meet current CRTC standards (Kondopulos & DeBruijn, 2020; KPMG, 2019; Mark, 2022), although these figures change frequently as investments continue to be made, with recent estimates indicating 23.5% of rural BC remains un or underserved (Esser-Haines, 2024). Rural BC also pays an estimated 23% markup for Internet services compared to urban areas (Kondopulos & DeBruijn, 2020; KPMG, 2019; Mark, 2022).

The Provincial Government declared rural connectivity an area of focus, announcing several investments to connect all BC communities as part of the new provincial economic development plan, with the goal of closing the digital urban-rural divide on an "accelerated timeframe" (Government of British Columbia, 2022). This commitment was reiterated in BC's 2023 rural strategy, which saw strengthening digital connections leading the priority list and promising to connect every community in the province to high-speed internet by 2027 (Government of British Columbia, 2023). An increasing number of small and rural communities in BC have become directly involved in connectivity projects (Mark, 2022). These projects have coalesced in response to the absence of affordable, accessible, and reliable broadband[iii] in areas not traditionally served by market forces. Two such projects were identified by the research team for further investigation via qualitative case study research: City West and Kaslo infoNet Society.

An evaluation of the two case studies was completed in the fall of 2021. The overarching evaluation approach identified 20 specific metrics taken from the literature related to the technological, social, political, economic, and physical aspects of connectivity. Metric data for each of the cases was collected from two types of sources.

First, secondary data sources were reviewed. Community profiles (Selkirk Innovates 2020) and census profiles (Statistics Canada 2016) were examined to identify and understand the technological, social, political, economic, and physical characteristics of Kaslo and the City West service area.

Second, the research team conducted a series of qualitative interviews with key stakeholders to better understand the approach taken, as well as to identify critical factors (Dubois et al., 2021; Nigam et al., 2021).[iv] Three types of interviewees were identified: internal

[iii] The term broadband commonly refers to high-speed Internet access that is always on and faster than the traditional dial-up access (FCC, 2014).

[iv] Throughout the paper, references to Dubois et al. (2021) and Nigam et al. (2021) refer to complete technical reports from the cases studied for the "Digital Readiness: An Evaluation of Rural Broadband Models in British Columbia" project. To review information and details about the cases that goes beyond the limitations of what can be included in this paper, including full details regarding the cases, desk research, and the process of development and refining the models, please see these reports.

interviewees - *individuals from the case communities/areas who were able to provide a strong understanding of how the telcom operates and the impact it has had on the communities it serves;* local external interviewees - *Local external interviewees included representatives from local government and individuals involved in community economic development*, and big-picture interviewees - *conducted with connectivity experts, industry professionals, and representatives from high-level government to provide insight into the circumstances surrounding rural connectivity in BC and Canada, including obstacles and possible solutions*. The team conducted 13 interviews between the two cases, eight with the Kaslo infoNet Society case and nine with the City West case. [v]

During the analysis stage, the secondary data and the interview content were analyzed against each metric within the evaluation, with the data relevant to each metric identified and summarized. The resulting compilation of the findings, broken down by metric, was reviewed to better understand which factors had a critical influence over the two cases, informing the model development and evolution.

As with any research, there are limitations to this evaluation, primarily as a result of the short duration of the project and the fact that it occurred over the summer of 2021 when many people were on vacation. Given that there were a limited number of interviewees and an unequal number of interviewees in each interviewing category, some perspectives may have been missed. Additionally, while interview data was triangulated against secondary sources, we acknowledge that there is limited information available related to some metrics.

Model Development and Evolution

To develop and refine the models of community-led connectivity activities, the following steps were taken. First, we explored the scope of potential models of community involvement in connectivity by performing a review of peer-reviewed and grey literature to identify existing approaches to connecting rural communities, focused on literature that had identified existing cases, as well as models of connectivity, the role of community in those models, and existing examples of those models in action. We also completed a jurisdictional scan of rural connectivity initiatives and developed an inventory of examples from within BC, as well as other notable examples from across Canada. This inventory represented a broad range of community-led connectivity projects that were completed, proposed, or currently underway. The inventory was used to augment the literature review and group discussions regarding the variables that make up our models of rural connectivity initiatives.

Second, the identified approaches to addressing connectivity challenges were categorized into working models based on the qualities that emerged from thematic analysis of the literature: drivers; structure; approaches; benefits; challenges; and potential transferability.

[v] Note that some interviewees spoke to both cases. As a result, while 17 interviews were produced, they were completed with 13 interviewees.

Third, we then incorporated the findings of the two student-led case studies, triangulating and evolving models based on the results of the interviews with key stakeholders and thematic analysis of contextual information about the two community-led connectivity initiatives.

Using the CBR approach, this work was guided by consultation with subject matter experts, as well as discussions with researchers, rural community leaders, and key stakeholders in the rural connectivity landscape to validate and further identify the variables that were used to develop the proposed models. These combined methods resulted in the development and evolution of the rural connectivity models presented below. We invite other researchers to continue to refine or challenge these models over time.

Findings

Preliminary Model Development

Using the approach described above, we compiled the limited literature with examples of rural community approaches to connectivity. Among the examples identified, there are commonalities, but each takes differing approaches and focuses on different variables. For example, as part of their municipal road map, the Rural Ontario Municipal Association (ROMA) developed a spectrum of broadband options of activities for communities designed to assist communities in determining what type of role they could play (Rural Ontario Municipal Association, 2020)**.** Among the activity options included were: allowing the market to operate on its own, advocating for action, creating local incentives for Internet Service Providers (ISP), collaborating with ISPs, and a municipality-owned broadband network (Rural Ontario Municipal Association, 2020)**.** In another example, the Alberta Broadband Toolkit provided broadband business models and related examples based on infrastructure, network operation, Internet service provision, and ownership (private and public) (M. McNally et al., 2016)**.**

The review of existing connectivity initiatives helped to identify drivers, basic structure, variations in approach, pros and cons, and potential transferability, as well as to identify different structural variables that shape connectivity initiatives within BC and Canada more broadly (see Table 1). These structure variables were used as the starting point for the models.

Table 1: Structural Variables (adapted from Authors, 2022)

Structural Variable	Description
Timeframe	• Connectivity initiatives take substantial time to develop. • Timelines from initiation to sustainable operation or completion, and pressures to advance on a given timeline, are influenced by funding availability, jurisdictional leadership, and the nature of the project.
Level of Intent	• Ad hoc initiatives develop in response to pressures and opportunities.

Structural Variable	Description
	• Strategic action develops in response to external threats and opportunities while also seeking to shape existing long-term vision(s) for the future.
Action Type	• Communities have choices about their course of action – from minor, passive actions to major projects. • Some degree of informed advocacy is almost always present as a foundational element of community connectivity projects. • Changes to local policy is sometimes considered as part of planning and land use management processes. • Examples include infrastructure investment through municipal servicing processes; delivering services like a utility; aggregate community demand and negotiate service delivery procurement. • Decisions on the type of action depend on goals, available funding, leadership, and other structural issues.
Geographic Scale	• Community projects may expand to regional or larger scale projects. • The scale of a connectivity project ultimately determines the available resources, leadership, governance, and the overall structure of that project. • Jurisdictional confusion is a limiting factor in Canadian context. • Community initiatives face challenges in advocating for different approaches at the provincial or federal scale – the orders of government which, most frequently, are responsible for crucial funding and which, as a result, often dictate evaluation metrics.

Structural Variable	Description
Governance	• Ownership, Capital Orientation, Profit Structure: three separate factors that shape governance choices. • Who 'instigates' a project will determine the capital orientation. • Ownership and funding source for may limit whether that project becomes a long-term operational utility or similar body based solely on whether such a longer-term entity could become a profit-centre. • Public-private-partnerships further complicate decision-making about ownership and profit structures, necessitating discussions related to who is investing and who is benefiting • Many community connectivity projects led by local governments operate as non-profit organizations. • Small ISPs and other entities sometimes pursue community projects as a core aspect of their business.

A review of each of the structural variables for their relevance to community-led connectivity initiatives and for inclusion in produced three prototype models of community connectivity (see Figure 1). The three models identified share common structural values, with the exception of the action type, allowing for the student-led case studies to focus on the actions, while controlling for other parameters.

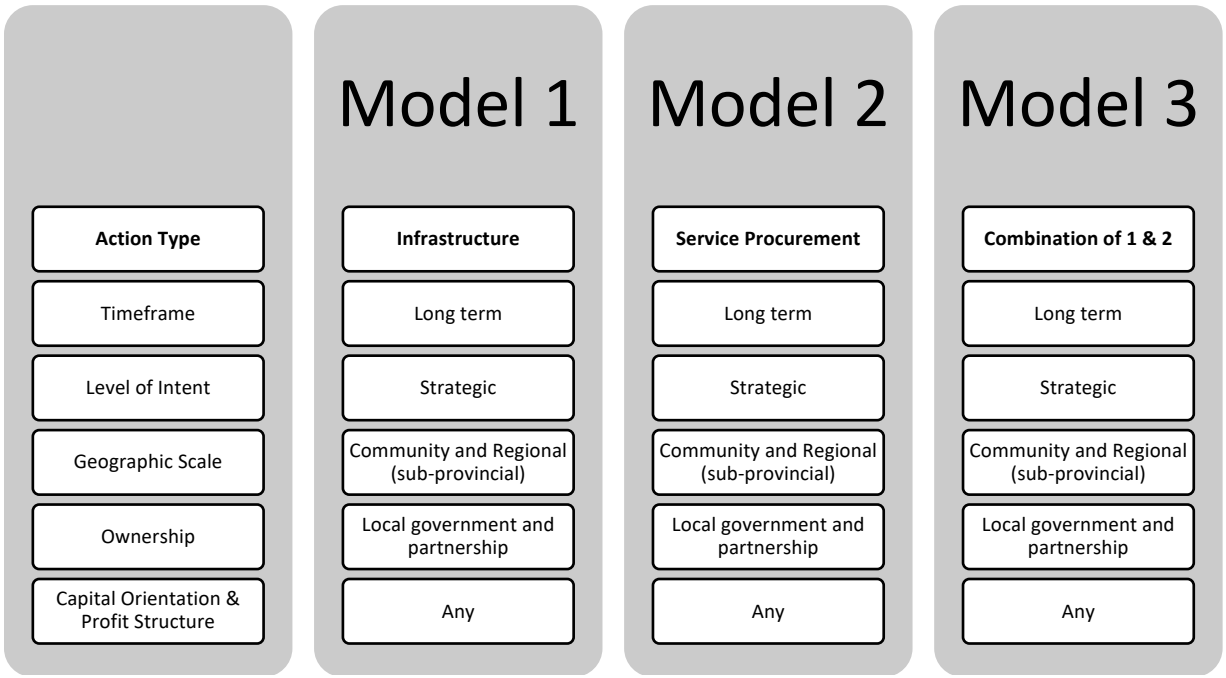

Figure 1: Initial Prototype Models of Community Connectivity (Authors, 2022)

Evolving the Models

The models identified in Figure 1 were then explored and refined. The two cases (City West and Kaslo infoNet) that were investigated by student researchers were both initially designated as Model Type 3. The detailed investigations of these cases identified several success factors common between these two community-led connectivity initiatives (Dubois et al., 2021; Nigam et al., 2021). The success factors generated through the case studies were combined with information gathered through a desktop inventory of other cases and layered over the structural variables (see Table 1 above) to produce insights about the connection between structural factors, indicators of success, and potential for replicability by other communities (see Table 2 below).

Table 2: Insights on Connections between Structural Factors and Indicators of Success (Authors, 2022)

Related Goals/Metrics	Influencing Parameters / Decision Points	Key Success Factors
Timeframe		
• Community Impact • Community Digital Capacity • Infrastructure • Organization Capacity • Funding • Existing Government Activity • Community Investment	• Short-Term Project/Undertaking • Medium-Term Project/Undertaking • Long-Term Project/Undertaking	• Leadership • Partnerships • Funding & Access to Capital
Intent		
• Community Digital Capacity • Company Structure and Performance • Infrastructure • Funding • Organization Capacity	• Ad Hoc • Strategic	• Leadership • Expertise • Funding & Access to Capital
Model/Pathway		
• Community Digital Capacity • Community Impact • Community Investment • Community Needs & Customer Satisfaction • Competition & Price of All Available Internet Services • Existing Government Activity • Existing Service Quality, Technology Quality, and Types	• Informed Advocacy • Policy/Permitting • Infrastructure • Service Procurement • Service Delivery	• Expertise • Funding & Access to Capital

Related Goals/Metrics	**Influencing Parameters / Decision Points**	**Key Success Factors**
• Funding • Demographics		
Geographic Scale		
• Terrain & Landscape • Existing Government Activity • Funding • Infrastructure	• Community • Regional (sub-provincial) • Provincial • Regional (sub-national) • National • International	• Community Focus • Partnerships
Ownership		
• Model Profit • Community Investment • Funding • Competition & Price of All Available Internet Services • Existing Government Activity • Existing Service Quality, Technology Quality, and Types • Company Structure & Performance • Community Investment	• Civil Society • Private • Public • Partnership	• Community Focus • Relationships • Expertise • Funding & Access to Capital
Capital Orientation		
• Company Structure & Performance • Community Investment • Model Profit • Consumer Income Levels	• Shareholder Profit • Co-Operative Profit • Cost-Recovery/Non-Profit • Commons/Public Good	• Funding & Access to Capital • Community Focus
Profit Structure		
• Company Structure & Performance • Model Profit	• Non-Profit • For Profit	• Funding & Access to Capital • Community Focus

Based on the culmination of the above we refined the models, taking the three prototype models identified in Figure 1 and expanding them to five models (see Figure 2). Our refined conceptual models of community-led connectivity are listed along a spectrum: from working within the status quo to driving complete change in the way connectivity is planned, built, and governed. These models also represent a progressive spectrum from what is most likely to

occur (Model 1, which function primarily within the existing status quo) to what is least likely to occur (Models 5, which poses significant challenges to the perception that private-market delivery is the only mechanism for connecting Canadians). In between the two extremes are Models 2, 3, and 4 – where there is potential for community-led or community involved initiatives. Under the revised models, one of the case studies (Kaslo infoNet) is #3, while the other (City West) is #4.

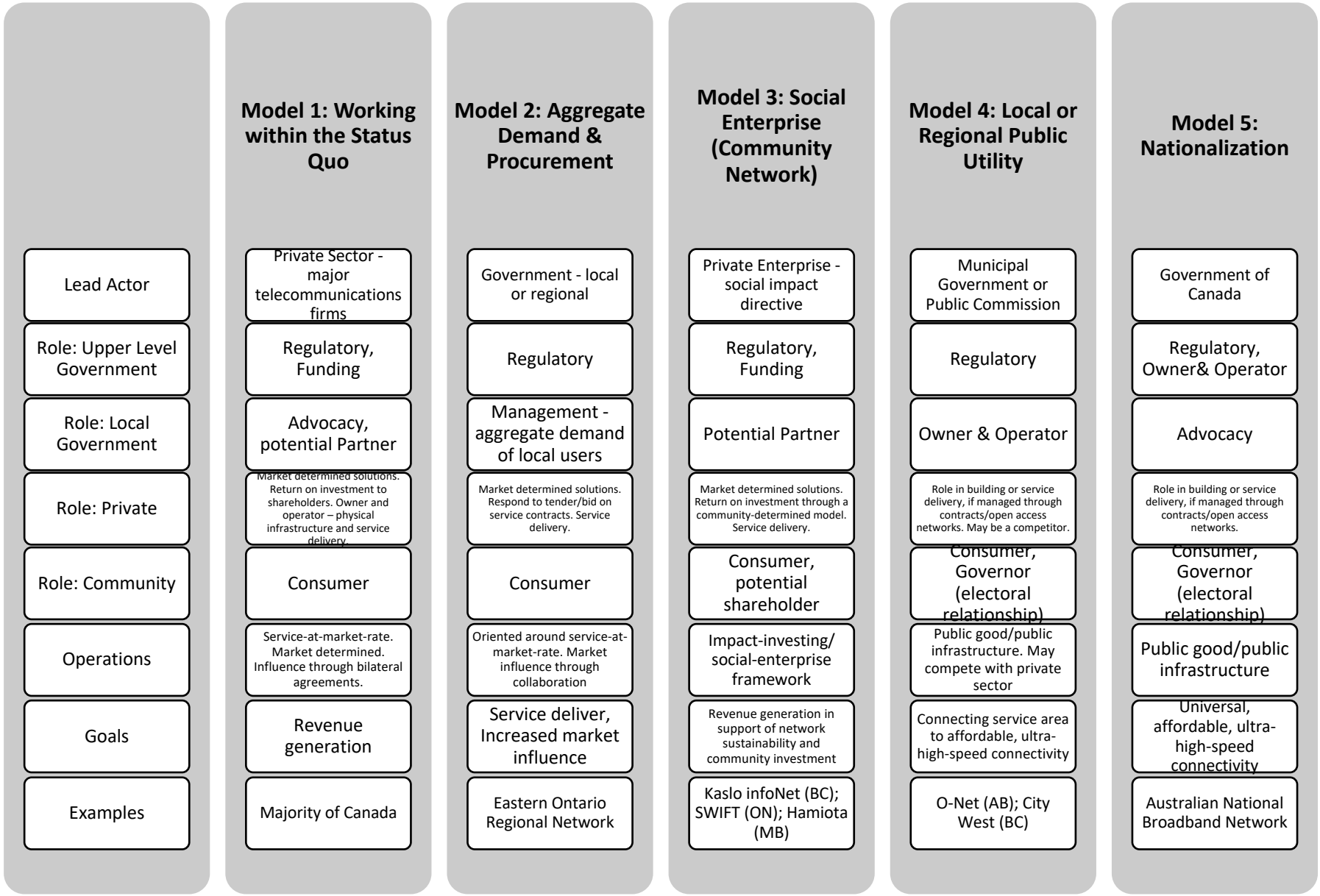

Figure 2: Refined Models of Community Connectivity (Authors, 2022)

Discussion

Informing Model Selection

The findings of this research indicate a range of critical roles for communities and governments in the advocacy for and rollout of rural broadband. These findings echo recent research from the United States, which found that county-level governments in Virginia have many ways in which they impact local broadband delivery (Ali et al., 2022). However, in the Canadian context, successful examples of individual successful community-led, rural connectivity projects represent outliers in the current rural policy and development landscape (Weeden & Kelly, 2021b). While further research could help clarify and challenge this, the limited existing studies indicate that success largely depends on unique combinations of place-specific factors, especially local capacity. The BC case studies substantiated this, identifying the critical importance of human capacity (leadership, expertise, experience) and other forms of capacity, culminating in the ability of individual actors or organizations leveraging both social and financial capital to address the lack of infrastructure or digital capital in their community or region (Dubois et al., 2021; Nigam et al., 2021).

Unsurprisingly, the type and amount of available funding and access to capital for connectivity projects is a significant factor in determining not only the success of a project, but its form and function. Funding determines the available time to complete all or part of a project, the type of project pursued, and, ultimately, the project's overall impact on the community. If funding comes directly from community actors, it serves as an anchor to the overall community focus of the project. Funding from governments (local, provincial, or federal) often comes with conditions about when and how it can be directed – influencing the timeframe, pathway, scale, and ownership of that community broadband project. Building physical digital infrastructure is capital intensive, and communities without sufficient funding or without appropriate partnerships with infrastructure-building actors may find themselves limited in the type of connectivity projects they can pursue. Finally, the stability and security of available funding influences the ability of a community to act proactively or strategically (versus reactively to funding announcements), the time horizon for projects, and the long-term sustainability of projects to continue work on network maintenance and expansion (if building physical infrastructure).

Variation in the goals, constraints, and opportunities facing each community means guiding them through a simple decision tree or flowchart on community broadband projects is difficult. However, the information within the proposed models does lend itself to supporting communities in taking inventory of their assets, limitations, opportunities, and challenges. How, then, are communities to determine which model will work for them? Recognizing that communities are often faced with the uncertainty of where to start or how to proceed to develop local broadband, we developed a non-exhaustive set of questions to guide how a community might begin. The focus of these guiding questions is to complete an inventory of the structural variables relevant when approaching connectivity initiatives and how that inventory should be considered and weighted based on their existing capacity to change existing conditions/contexts to advance specific goals based on existing assets, limitations, challenges, and opportunities (see Table 4). This set of guiding

questions has the potential to build local understanding and capacity regarding community broadband initiatives and align potential paths with the individual realities for each community.

Table 4: Guiding Questions for Model Selection (Authors, 2022)

Structural Variable	Guiding Questions	Example of Responses and Related Model
Timeframe	How much time do you have? Are there timing constraints to available funding?	Limited timeframes and short-term funding windows could consider pursuing partnerships under Model 1.
Level of Intent	How much capacity do you have? Do you have sufficient expertise? Can you add that expertise? Is this a long-term project that requires planning or an immediate, stop-gap solution?	High levels of local capital and expertise could consider Models 3 or 4.
Action Type	How much capacity do you have? What is the existing market dynamic? How much funding do you have?	Communities with low risk tolerance should maintain Model 1.
Geographic Scale	What are your boundaries? Are you working with other governments (peers/partners or other orders; is there a hierarchy?) What are your limits?	Strong local and regional collaboration could result in Model 2.
Ownership	Who is the lead actor? Who will own this? What are the lines of accountability? How much capacity do you have? Do you have sufficient expertise?	Strong desire for community driven assets and existing leadership could consider Models 2, 3, 4.
Capital Orientation	How is the project funded? What are the conditions of that funding? Who has a stake – and what do they need in return?	Existing and accessible funding supports Models 2, 3, 4.
Profit Structure	Will profits be reinvested in the network/project or distributed to shareholders? Is the goal revenue generation or public good?	Strong local need for direct local investment and social return on investment could consider Models 3 and 4.

Communities unable to make it through guiding questions without substantive responses will likely remain within the status quo (Model 1). Currently, Canada's existing telecommunications regulatory context and rural capacity limitations indicate that most rural communities will find themselves limited to Model 1 – perhaps to their frustration. Without concerted effort from other orders of government to reconfigure the macro-landscape of Canada's intergovernmental relationships, broadly, and the telecommunications industry structure (e.g., enabling Models 2, 3, 4 or shifting to Model 5), specifically, communities without available resources, technical expertise, and capacity to change their local market dynamics will find themselves challenged to advance another model beyond the status quo. This challenge invites reconsideration of the governance relationship between the orders of government in

Canada, in general, with particular attention to whether, how, and why federal and/or provincial policies might be approached and developed specifically for community-level use. The risk of endeavouring to 'go it alone' without considering the tangible steps required to address these contextual constraints wastes already limited financial and political capital. This guide and process offer a realistic view of communities' challenges in seeking locally-led solutions to connectivity issues rather than discouraging such efforts.

The Value of Conceptual Models

This project aimed to identify and present models of community-led approaches to rural connectivity, providing guidance to communities and challenging other researchers to explore the merit and application of these and other such models. We also question whether the complexity of options, combined with differing contextual and jurisdictional factors, can be modelled in a way that adds value and is transferable. Based on our findings, the response is: not easy or clean, owing to the number of structural variables, but also the surrounding landscape. Models aim to simplify complex situations and options. In this respect, our proposed five models join others in providing a simplified perspective of options and activities (see Figure 3).

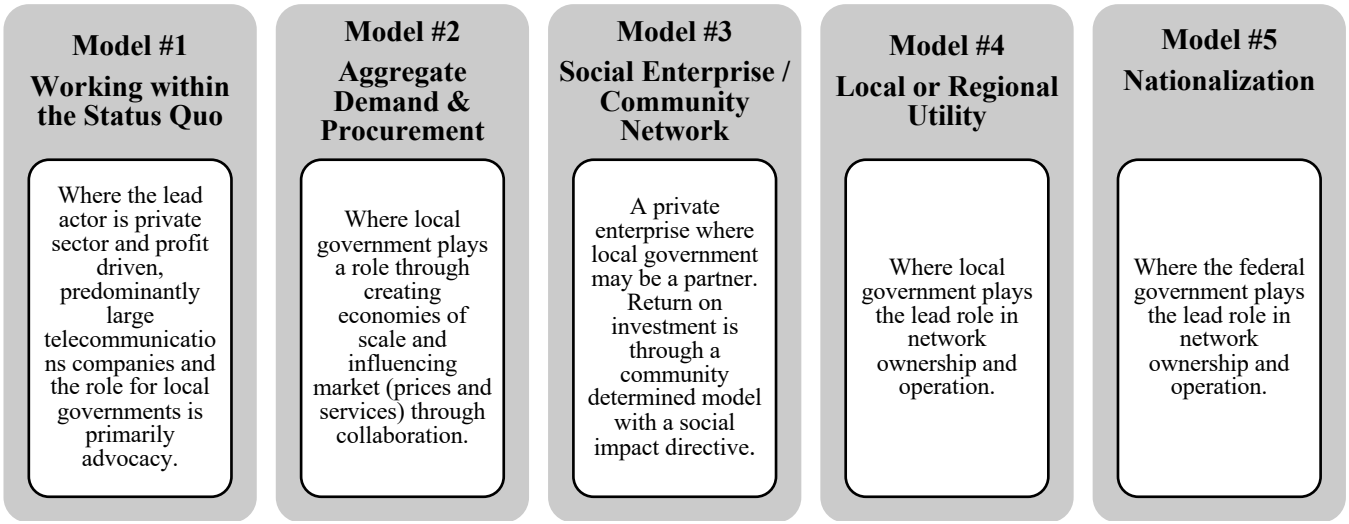

Figure 3: Summary of Refined Models of Community Connectivity (Authors, 2022)

As with other attempts, our proposed models recognize various potential activities, from the status quo (letting the market operate on it's own) to advocacy to a municipally owned network. Similarly, our proposed models acknowledge the range of infrastructure and service construction, operation, and ownership**.** The models presented in Figure 3 have the potential to evolve and expand both conversations, identifying and clarifying potential roles for both local government and the community at large, as well as essential identification of the success factors required to support the more active community models (i.e., models 2, 3, 4).

However, as identified by the two case studies, the critical aspect of capacity limits the potential merit and transferability of the models. Counterintuitively, the successes of these case study communities represent a critical failure of the policy environment. These communities have

undertaken significant work, and it is vital to acknowledge it. Indeed, known community or regional success stories are not driven primarily by effective overarching federal or provincial policies, but rather each community or regional network had to develop strategies– in which the goals and drivers work to circumnavigate the federal and/or provincial policy and regulatory landscape in reaction to a specific local goal or pressure. The above makes modelling difficult, because these existing examples studied as case studies are, to a large extent, working outside the system we were trying to model.

Further, most of the toolkits and models that are currently available to rural communities have been developed by non-government entities, lobbying groups, or researchers – with little pragmatic literature or modelling originating within governments (of any order), creating even more distance between community-oriented advice or programming and the broader policy environment in which those initiatives must occur.

The models presented above are simplified perspectives and generalizations. While these can help inform and assist communities in their decision-making, in one respect it is challenging to create a clear and logical decision tree because of the complexity of factors in terms of number and combination. The guiding questions we have proposed for communities to self-assess what models may be accessible to them could also be seen as exceptionally simple as the barriers to entry within the connectivity space are sufficiently high that most rural communities have little choice but to work within the status quo. Any model beyond advocacy – including partnership with a major telecommunications company - requires the presence and alignment of multiple key success factors. The current landscape is not conducive for facilitating the average rural community to establish durable digital infrastructural change.

A community broadband approach may facilitate the goal of durable digital infrastructure change by providing high-speed Internet access to underserved or remote areas where commercial providers might not have a presence. This participatory approach aligns with the core principles of community informatics, which emphasize involving community members in decision-making processes related to technology deployment. The guide and process align with the holistic approach of community informatics, which seeks to create enduring solutions that adapt to changing circumstances. A well-designed broadband approach considers the long-term viability of the infrastructure, as well as the social and economic benefits it brings to the community. Developing an approach for setting up community broadband can contribute to community informatics by promoting digital inclusion, fostering local empowerment, encouraging collaboration and skill development, facilitating knowledge sharing, enabling data-driven decision-making, and promoting sustainability and resilience within the community.

Conclusion

The realities of Canada's approach to telecommunications legislation/governance and how ISPs have evolved to navigate that territory make proposing clear and discrete connectivity models challenging. The difficulty of modelling community approaches to connectivity in Canada is an important reflection of the complexity of the problem at hand. It and underscores the challenges

of engaging in effective interventions without requiring changes to the overall telecommunications industry. The way the proposed models evolved throughout our work underscores the iterative, complex realities of developing an inventory of crucial factors/decision-points for local actors interested in pursuing connectivity initiatives and inform where communities may find themselves. The guiding questions provide a tool and starting point for community leaders to review and reflect on the criteria for building local broadband initiatives. Once information is collected, placed in context, and weighed based on the most pressing conditions, challenges, and opportunities facing proposed projects in the community, would-be leaders of connectivity initiatives can gauge where they might locate themselves along a spectrum of the models below and choose their next steps based on both their realities and their aspirations.

Guidance and funding could be developed to support communities to replicate anomalous success stories. However, in the absence of system change, the benefit and pragmatism of doing so is uncertain, particularly in light of the financial and capacity cost to communities. Change is needed in how we consider community involvement in connectivity, however this must be accompanied by change in the surrounding policy and regulatory landscape, to address the digital divides. It is our hope that the models we have proposed provide opportunities for local, provincial, and federal policymakers to consider better approaches to developing meaningful broadband policy. Our proposed modelling shines a light on the critical schism between what is supposedly the goal of broadband policy versus the realities of achieving that goal across a multi-scalar web of policies given Canada's composition as a federation. As such, our proposed models may offer the most utility as a tool that supports policymakers in finding inroads for addressing policy incoherence. The models suggest the beginnings of an outcome-based lens for bottom-up or community-up approaches that encourage all orders of government to ensure that broadband policy interventions by different orders of government work in concert through greater intergovernmental coordination.

The models described above need further research, investigation, and applied testing by different orders of government. Even if they are confirmed, they should not be seen as forgone conclusions, particularly within a shifting landscape. Should the federal or provincial orders of government choose to reconfigure the way telecommunications is regulated, new opportunities for supporting community-led connectivity initiatives will emerge. Further research can and should focus on regional, provincial, national, and international models as separate-yet-parallel/complementary models for delivering Internet services. The guiding questions should also be further researched and tested with communities to determine their appropriateness and effectiveness in helping communities navigate criteria for local broadband. It is also important to note that the models proposed in this paper were developed at the same time as new literature on community broadband networks that has been emerging from the United States, providing opportunities for future cross-jurisdictional comparative analysis.

To this end, and as part of this discussion, it is also essential to return to the surrounding policy and legislative context. Within an unchanged telecommunications landscape, rural communities in Canada are likely to face one of three possible scenarios. First is the failure to launch. Many community connectivity projects have yet to be initiated or have fizzled out due

to a lack of local expertise, funding, capacity, support, or another gap in the foundational characteristics essential to success. The second scenario is corporate capture, wherein the large-scale corporate capture of Canada's digital infrastructure and service delivery impedes policy change and efforts to close connectivity gaps. Furthermore, the third is the cycle of pushing against the existing landscape to varying degrees of success, or the 'Sisyphus' network'. As exemplified by the current successful outliers, it takes immense effort and capital to participate in the connectivity space and this work takes place in a broader policy environment that simultaneously celebrates the resilience of community networks while underfunding their work and reinforcing the primacy of market-determined service delivery.

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