Frozen Futures:

Exploring the potential of scenario planning techniques

for thinking and talking about digital divides in Arctic contexts

by

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Abstract

This capstone examines the use of scenario planning methodology as an alternative way for thinking and talking about Arctic digital divides, specifically in a Canadian telecommunications context. Despite an abundance of research into digital divides and decades of attempts to close the gap, the divide persists. Exploratory in nature, this study uses a mixed-methods approach combining content analysis methods within a future-focussed scenario planning framework. Computer-assisted content analysis was conducted on publicly-available transcripts from a CRTC hearing held in Whitehorse, Yukon, to create a dataset of trends and influences of key importance from the hearing. This dataset of "driving forces" was then run through a scenario planning exercise to see if anything can be deduced about the value of the methodology in the context of Arctic digital divides. Results identified that scenario planning was particularly adept at handling a range of complex ideas and uncertainty in a systematic way. However, blind spots were identified based on participants' own experiences and biases. This led to the recommendation that scenario planning should not be used in isolation, but that it could provide value as a secondary resource in decision making and policy guidance. This study walks the line between traditional and creative research approaches, highlighting the underestimated value of participants' lived realities, interpretations, and imaginations in problem solving complex issues.

Keywords: digital divide, connectivity, telecommunications, technology, ICT, service parity, Arctic, Canada, scenario planning, futurist methods.

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Introduction

Divisions and inequalities exist in every facet of social life, every era of human development, both between nations and within them. They have become a "normal" element of basic existence (Yu, 2006). Despite this, optimists and early adopters were hopeful that the rise of the internet and personal computers would bring forth a utopian digital society, equalizing citizens and breaking the bonds of old inequities. This optimism was keenly felt by Arctic residents who had long been isolated from the rest of the globe. But no sooner had the information age begun then the term "digital divide" entered the mainstream lexicon in the mid-1990s.

Since then, thousands of studies (Yu, 2006; Hongladarom, 2004) have been conducted on the topic of digital divides in an attempt to understand causes, consequences, and variables. While some divides are slowly closing (Tsatsou, 2011), others (such as exist in the Arctic) continue to grow. Theories have changed, technology has changed, the Arctic has changed – yet nearly 30 years later, the Far North still lags significantly behind its southern neighbours.

My interest in the topic of Arctic digital divides was driven by my personal experiences with ICTs in Canada's Far North as a long-time resident of the Yukon Territory and an employee of the Government of Yukon. The disparity in service delivery, quality, and reliability is real and significant. However, both government and corporate reports seemed to suggest that great strides were being made and the divide was closing. My lived reality was incongruous with these reports and I felt compelled to prove this. But the research body around digital divides was extensive. What could I possibly contribute to this topic that hadn't already been covered?

Cue the High North Dialogue. During the planning phase of this project, I had an opportunity to travel to Norway and attend the High North Dialogue (HND) Academy hosted by

Nord University, a leader in Arctic education and governance programs. I attended lectures and participated in workshops dedicated to the futurist methodology of scenario planning. Nord University is a major advocate of the methodology not only for its strength in capturing the complexity and uncertainty of Arctic contexts but also for its ability to encourage discussion and collective problem solving by breaking through traditional thought patterns and barriers.

I began to wonder if the reason that digital divides in the Arctic were persisting (despite all efforts to close them) was due to some subconscious trap in the way we collectively think and talk about them. Additionally, while in Norway, I experienced an Arctic that didn't suffer from digital divides in the same way that northern Canada did, spurring my belief that the issue was not just a nebulous, theoretical one, but a solvable one.

Upon returning to Canada, I learned that the Canadian Radio-television and Telecommunications Commission (CRTC) had recently held public hearings in my hometown of Whitehorse, Yukon, on the topic of improving connectivity and decreasing the digital divide between northern and southern Canada. These hearings became the core data source of this study.

I chose Arctic digital divides for this study because this issue matters to me personally. There is no doubt that this study is heavily influenced by me, researcher-as-participant. This is both a strength and a weakness for this study: on one hand I have a deep understanding of the complex dynamics at play, but on the other hand my emotions and personal experiences have deep grooves. But, just as scenario planning values its own subjectivity and the personal experiences of its participants, so too do I hope that this study has benefitted from my own.

The goal of this study was to determine if scenario planning could be helpful in shaking up the discussion around digital divides. It was exploratory in nature and involved experimenting

with two independent-yet-complimentary methodologies: content analysis and scenario planning. As such, the overarching research question (*Is scenario planning methodology a valuable tool for discussing and thinking about digital divides themes in Arctic contexts?*) was broken down into three sub-questions:

RQ1: What key themes/topics were trending at the CRTC public hearings on telecommunications service in Canada's Far North?

RQ2: When these themes/topics are run through scenario planning tools, what plausible futures can be imagined?

RQ3: What, if anything, can be deduced about the value of scenario planning tools when thinking and talking about digital divides in the Arctic?

This study begins with a literature review of the academic landscape of digital divide research. It then introduces the design and methodological approach of this study, including the participants, instruments, and frameworks used. Findings are then presented followed by a discussion of my own interpretations and a retrospective reflection on the experience of this project as a whole.

Chapter 1: Literature Review

In order to understand where we are and how we got here, this literature review seeks to examine the chronological timeline of digital divide research at both the macro (theoretical) and micro (Arctic-specific) levels through a comparative analysis of the dominant theories, frameworks, themes, and findings. It will map trends to generate a big-picture view of the subject area so as to inform my own research plans and capstone project.

The goal of this literature review is to understand how new studies have been built upon previous studies, how theories and frameworks have evolved and influenced public discourse, and how our modern understanding of technology, divides, and the Arctic has matured over time.

This literature review was guided by three key questions:

- What dominant themes/trends can be identified in digital divide literature?
- How have those themes/trends changed over time?
- How do those themes/trends influence current understandings of divides within Arctic contexts?

Findings will identify several noticeable shifts in digital divide research, as reflected in new themes and more advanced theories. Gaps, limitations, and next steps will also be covered.

Scoping

An initial scoping exercise was conducted to identify key databases, authors, search terms and influential articles. Prior to starting this exercise, I assumed that the topic of digital divides was a relatively niche one (even more so within the Arctic context), however, I was almost immediately overwhelmed by the amount of relevant literature, offshoot publications, and other various rabbit holes. To give a sense of the size of available literature, a bibliometric analysis

conducted on a single database (Web of Science) returned nearly 2,500 articles (Basit *et al.*, 2021). Using the same parameters identified by Basit *et al.*, a search of SCOPUS returned approximately 8,600 articles, while EBSCO (via the University of Alberta library) returned over 16,000 scholarly articles. As such, it is difficult to pinpoint the exact quantity of relevant material, but safe to say that it is extensive.

Since I was seeking both generalized studies, as well as location-specific studies, I split my scoping between two different sets of databases: general academic databases (Google Scholar and EBSCO), and Arctic-specific databases (Open Polar, ASTIS, and Arctic Portal). Additional literature was found in the reference sections of other studies. Not only did this identify niche articles of interest, but it also highlighted the most influential studies based on their recurrence in multiple articles.

Finally, in order to develop a well-rounded body of literature, I made a point of seeking out grey literature to offset the academic studies with practical experiences and policies. These sources were primarily identified on public archival websites such as the Arctic Council archives and the Government of Canada Bureau of Statistics.

Searching and Screening

To facilitate the searching process, a number of keywords were used in a variety of combinations with boolean expressions. For example, keywords such as *digital, connectivity, ICT, Arctic, equity,* and *circumpolar* could be combined to create the expressions “circumpolar telecommunications AND equity”, or “digital transformation OR digital modernisation”, or “ICT connectivity AND Arctic”. Initial searches were filtered by the date range of 2002-2022. While many seminal works predate this timeframe, many have become outdated by rapid technological

changes. In order to select more relevant literature, this date restriction was applied to coincide with the Web 2.0 movement. Articles were then selected based on their relevance in one of two categories: development of digital divide theories/frameworks, or digital divides in Arctic contexts. The latter were further prioritized if they focussed on at least one of the eight Arctic nations (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, or United States). Articles in the theory/framework category were considered from all localities to represent a generalized, global perspective.

The final corpus is composed of 70 articles, 40 of which come from academic, peer-reviewed journals and the remaining 30 come from alternative sources (see *Figure 1*). All articles were organized with the help of a cloud-based tool called Notion which allowed me to collect, annotate, tag, and filter literature sources in a consistent manner.

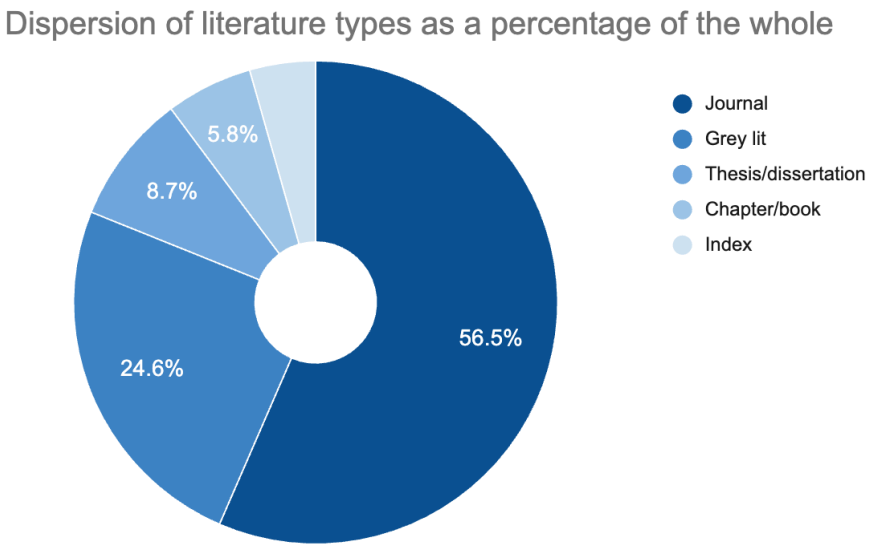


Figure 1. Dispersion of literature types as a percentage of the whole corpus.

Coding and Collating

At first, I didn't know how best to categorize or group the articles, so I began by identifying indicators that authors attributed to digital divides. Indicators were then organized by key themes (see *Table 1*).

Key themes	Indicators	Authors
Demographics	Socio-cultural background	Acharya (2017)
	Income	Billon (2009), Ferro (2011)
	Age & gender	Barzilai-Nahon (2006), Billon (2009), Ferro (2011)
Policy	Regulations	AEC (2021), AC (2017), Beck (2011), Delaunay (2020)
	Governance	Delaunay (2020), Heininen (2020)
	International collaboration	Abildgaard (2021), AC (2017), Hickel (2003)
	Strategy	Imaituk (2011), AEC (2016), Ferro (2011), Hatinen (2020), Heininen (2020), Kowalski (2015)
Economic drivers	Tax incentives	Imaituk (2011)
	Market dynamics	Imaituk (2011)
	Funding models	AEC (2021), AC (2017), Beck (2011), CCA (2021), Delaunay (2020)
	Competition	AEC (2021), Imaituk (2011), AC (2017), Billon (2009)
Localized contex	Indigenous knowledge	AEC (2021), AC (2017), CCA (2021), Dinero (2007), Fontaine (2014), Krone (2008)
	Community-based programs	Imaituk (2011)
	Needs-based approach	CCA (2021), Kozlov (2019)
	Self-determination	Abildgaard (2021), CCA (2021), AC (2017), Fontaine (2014), Johnson (2021)
Geography	Remote/isolation	Beck (2011), Delaunay (2020), Dinero (2007), Fontaine (2014)
	Climate change	Abildgaard (2021), AEC (2021), AC (2017), Didenko (2020), Exner-Pirot (2017)
	Geopolitics	Abildgaar (2021), Exner-Pirot (2017)
	Human capital	AEC (2016), Imaituk (2011), Kozlov (2019)

Table 1. Sample table setup to facilitate the grouping and coding of indicators into key themes

These indicators and themes were then placed on a timeline to determine if there were visibly-noticeable trends over time. In doing so, I was able to identify three distinct eras (or "waves"):

- Wave 1 – 2002-2008 – Early hype and the race to define
- Wave 2 – 2009-2015 – Rise of the Arctic and niched locales
- Wave 3 – 2016-2022 – Geopolitics and self-determination

It's important to note that ideologies and themes don't typically have exact start/stop dates. These dates are approximate, may overlap, and outliers may exist. However, the

classification of these waves is supported by a separate literature review wherein the author discovered that digital divide concepts have a tendency to evolve approximately every five years, "such as access divide during 1995-2000, skills divide during 2000-2005, and usage gap during 2005-2010" (Acharya, 2017). When grouped according to these three waves, we can see how generalized digital divide literature was significantly more popular around the start of the century and then plateaued over time, while Arctic-specific literature occurs in the reverse pattern (see *Figure 2*).

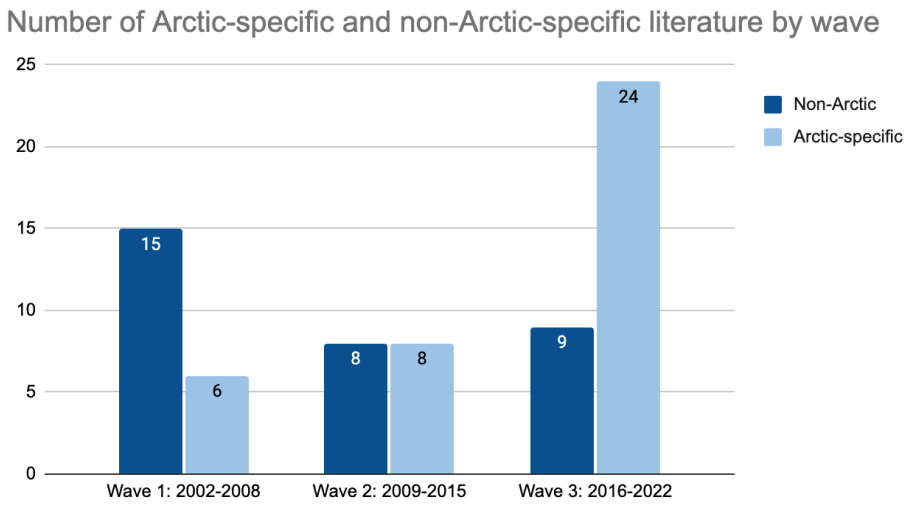


Figure 2. Dispersion of non-Arctic studies vs Arctic-specific studies across the three waves.

Potential Biases

Only English sources were selected for inclusion in this review which may aggravate the existing privilege of dominant Western ideologies in the ICT discipline (Delaunay & Landriault, 2020). Additionally, I am aware that my own biases may have inevitably crept in when selecting sources I deemed relevant. As a Northerner, I leaned on my personal experiences when coding and interpreting articles with an Arctic context. I consider this bias both a strength and a

weakness: a strength because I have a cultural awareness that Outside researchers may not; a weakness because the Arctic is a diverse space and my personal experiences are not universal to Arctic life. In an effort to mitigate these risks, I intentionally sought out articles that would reflect a wide range of perspectives from a wide range of nations. For example, I ensured that at least one article from each of the Arctic nations was included (see *Figure 3*).

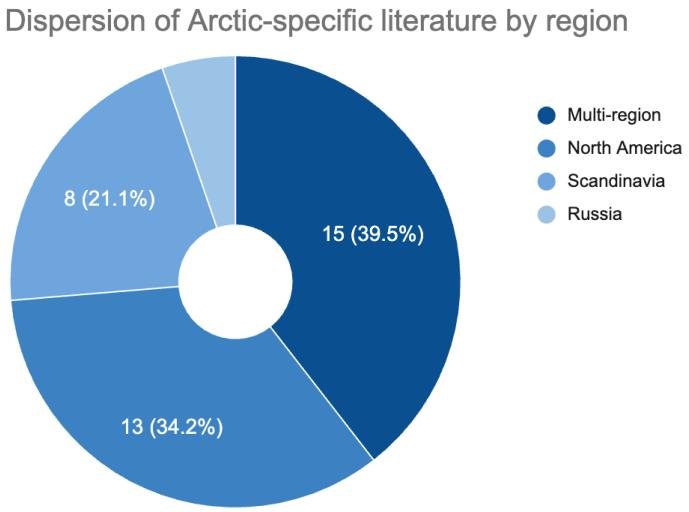


Figure 3. Dispersion of Arctic-specific literature by Arctic region.

Discussion and Analysis

This section will discuss the findings, working chronologically to review the literature within the context of each wave, as described above, to demonstrate how digital divide literature has shifted over time. This will be followed by an analysis of gaps in the literature, and next steps for the capstone project.

2002-2008: Early Hype and the Race to Define

Two Streams. Articles from the early 2000s read with a sense of urgency (Drori & Jang, 2003) as authors rush to define digital divides against the backdrop of a rapidly evolving technological ecosystem: "With great frequency, the Western media reports on new statistics regarding the internet penetration in society. Government, market and science have joined forces in a unique eagerness to 'keep the finger on the pulse'" (Steyaert, 2002, p. 2). During this time, researchers employed a plethora of tools and ideologies in an attempt to categorize and understand the phenomenon. These tools can be split into two streams: indices and frameworks. Both would have profound impacts on the next 20 years of digital divide research.

The first stream (indices) arose from the desire to quantify the complex phenomena of digital divides (Billon *et al.*, 2009). Early works from the 1990s typically focussed on increasing access to physical ICT infrastructure and, as such, were later criticized for oversimplifying the issue via the reliance on "single-factor, or monotopical, relations" (Barzilai-Nahon, 2006, p. 269). As a result, this wave experienced an explosion of indices, or compound indicators. Some examples include: the synthetic index of digitalization (Corrocher & Ordanini, 2002); SIBIS (University of Applied Sciences Solothurn Northwest Switzerland, 2003); DIDIX (Hüsing & Selhofer, 2003); United Nations' ICT Development Index (Hongladarom, 2004; Park *et al.*, 2015); United Nations' ICT Diffusion Index (United Nations, 2006); Network Readiness Index (Barzilai-Nahon, 2006); and Digital Access Index (Barzilai-Nahon, 2006). However, Barzilai-Nahon noted that most compound indices still don't portray comprehensive realities due to the isolated way that indicators are measured. She also noted that despite this evidence, the monotopical preference was still popular among politicians and policymakers as an easy way to promote agendas, measure benchmarks, and influence public opinion (Barzilai-Nahon, 2006).

Although indices have lost some popularity over the years, this monotopical focus continues to permeate current Arctic policy. For example, the national broadband strategies from each of the Arctic nations contain internet speed targets as a way to measure success (Arctic Economic Council, 2016) despite claims that speed is neither a representative indicator of network quality (Council of Canadian Academies, 2021) nor addresses deeper, underlying social, economic, or political issues. van Dijk argued that while indices can produce valuable statistics and correlations, they don't "bring forward the precise mechanisms explaining the appropriation and division of the technology concerned in everyday life" (van Dijk, 2006, p. 232). Both Bruno *et al.* (2011) and Vehovar *et al.* (2006) agreed with this sentiment calling indices an "oversimplification of complex interrelations" but acknowledging that they "can function as important eye openers outside of the scientific community" (Vehovar *et al.*, 2006, p. 284-285).

The second stream (frameworks) reflects a more theoretical approach by applying older conceptual frameworks to new systems and hypotheses. Some examples include: diffusion of innovations theory; knowledge gap theory; technology acceptance model; structuration theories (Mason & Hacker, 2003); development communications theories (Nulens, 2003); critical theories of power and control (Moss, 2002); the three levels of access, usage, and motivation (van Dijk & Hacker, 2003; van Dijk, 2006; Pick & Sarkar, 2016); information ethics (Hongladarom, 2004); and technocratic approaches (Sassi, 2005; Beck *et al.*, 2005). These theoretical approaches emphasize the entanglement of divides with other factors in a qualitative way. In fact, it is from this stream that we see overwhelming agreement among researchers that online divides can be directly attributed to offline inequalities stemming from existing socio-economic stratifications (Vehovar *et al.*, 2006; Barzilai-Nahon, 2006; Mason & Hacker, 2003; Moss, 2002; van Dijk, 2006; van Dijk & Hacker, 2003; Yu, 2006). Yu may have summarized it best:

> Information inequality, therefore, is neither new to the established power structure of society nor separate from it; it is in fact both determined by and contributes to the political and economic inequality already existent between classes and countries (Yu, 2006).

Attempts to disprove or negate digital divide theory typically come from proponents of the diffusion of innovations theory which suggests that any perceived gaps are temporary and will naturally resolve themselves over time. Technology adoption, it claims, can be envisioned on an S-curve, whereby some users gain access to the newest inventions early on, while others must wait for the technology to disperse through society before they eventually catch up. In defense of his own theory, van Dijk is highly critical of this approach, claiming "the so-called S-curve and the trickle-down principle of the adoption of innovations – from the higher to the lower social strata – pose serious problems, and they bear a determinist flavour" (van Dijk, 2006, p. 232). These two theories continue to battle it out on the Arctic stage today. Proponents of digital divide theory have claimed that intervention is required to close the Arctic gap (Yu, 2006; Hatinen, 2020; Hudson, 2017; Vassilakopoulou & Hustad, 2020), while proponents of diffusion theory have claimed that no action is necessary – only time. Yet, in the 20 years since these theories were formulated, the gap in the Arctic persists, potentially negating the applicability of diffusion theory in specific geographical contexts.

Binary. In early works, there is a discernible tendency to talk about divides in a binary or dichotomous manner: haves vs. have-nots; information rich vs. information poor; connected vs. unconnected. However, during this wave, researchers began to acknowledge that this classification is reductive and oversimplifies the complexity of divides (Vehovar *et al.*, 2006; Yu, 2006). Instead, newer studies indicate a preference for talking about connectivity and divides on

a spectrum or continuum (Yu, 2006), or multidimensional layers (van Dijk, 2006; van Dijk & Hacker, 2003). While this may seem like petty semantics, it speaks to the larger trend of adapting an entire discipline to more inclusive methodologies and ways of thinking.

Related to this shift away from binary terminology we see the introduction of new classifications. For example, during this wave van Dijk proposed a third category of users called "want-nots" (2006). He suggests that the divide can never be fully closed because there will always be a group of people who desire to *not* be connected. This is particularly problematic when we start to examine the attitudes of Arctic citizens and their views toward technology. Arctic people, especially Indigenous people, are accustomed to a certain amount of isolation. Many view technology and connection as a threat to their culture and way of life. It would be easy for Outsiders to misinterpret this attitude as "wanting-not". However, the Council of Canadian Academies (2021) points out that rejection in this case may not necessarily mean disinterest; rather it may actually be a symptom that the technology isn't meeting people's needs.

Summary. In summary, the advances in understanding divides during this time period were massive. Researchers laid the foundation for future studies and advocated for user needs by drawing attention to the complexities that contribute to divides and how these might be overcome. They set a tone of inclusion. Unfortunately for the Arctic, many of these ideas pigeon-holed it into a box within which it did not belong. In an attempt to define and categorize, these early researchers inadvertently didn't leave space for the geographic outliers that require different approaches. This leads us into the next era and the rise of niche divides.

2009-2015: Rise of the Arctic and Niche Locales

While many of the same conversations from the previous wave continue during this time period, there is a noticeable increase in niche studies "concerned with the multitudinous geographic dimensions of cyberspace" (Warf, 2011, p. 193). While some studies with an Arctic-specific context do pre-date this wave (notably Beck *et al.* (2005)), they are rare. It isn't until this second wave (roughly starting in 2009) that we begin to see a rising interest in the Arctic from a communications and technology perspective.

Unwanted Attention. There are a number of reasons that the Arctic increased in popularity amongst researchers during this time, such as increasing awareness of climate change (Heininen, 2020; Young, 2017). From a scientific perspective, the Arctic is an opportunistic petri dish of preserved and uncontaminated ecosystems for research and education networks (Kowalski, 2015; Arctic Council Task Force, 2017). From an economic perspective, it represents a wealth of untapped natural resources needed to feed a resource-hungry global population (Heininen, 2020; Plass *et al.*, 2015). From a political perspective, the opening of Arctic waters presents security and sovereignty concerns (Rossell, 2011; Ruiz, 2014; Imaituk Inc., 2011). All of these have contributed to a noticeable rise in Arctic-specific studies from a variety of disciplines.

In Canada in particular, 2009 was a pivotal year for Arctic telecommunications. Operation Nanook, a government-sponsored military exercise conducted in Iqaluit, exposed significant vulnerabilities to Canada's communications network when the influx of visitors caused the telecommunications infrastructure to fail in a very public way (Ruiz, 2014; Imaituk Inc., 2011; Kuersten, 2016). Prior to this event, Canada was largely in denial about the digital divide within its own borders. However, immediately after the event, the Government of Canada

commissioned an assessment of Arctic communications infrastructure (known as the ACIA report) which was completed in 2011 and provocatively-titled "A Matter of Survival" (Imaituk Inc., 2011).

Policy. Another significant shift during this time is the influential role of policy. Almost in unison, circumpolar nations began formalizing their strategic Arctic plans: Norway (ahead of its time) in 2006, Canada and Russia in 2009, Finland in 2010, Iceland, Denmark and Sweden in 2011, and the United States in 2013. Policies targeting broadband and national digitalization also begin to pop up during this time. But, despite the abundance of regional strategies, there is – noticeably – still no Arctic-wide strategy guiding international cooperation and governance. Several articles identify the need for such a strategy (Imaituk Inc., 2011; Arctic Economic Council, 2016; Kowalski, 2015), indicating a multi-national consensus that can be rare in politics. Even beyond the Arctic, place-based strategies start to gain popularity (Salemink *et al.*, 2017). For example, a study on the geographic proximity of digital divides highlighted that policies should "be tailored to the distinctive factors that apply for that nation's developed or developing region … [and] that use of spatial analysis can contribute to greater understanding and more accurate investigation of digital divides" (Pick & Nishida, 2015, p. 1). Similarly, Ferro *et al*. refer to digital divide policies as "a matter of strategic importance in a global race for competitiveness" (2011, p. 3), suggesting that a circumpolar policy could boost the Arctic's collective ability to compete in the global economy. As a result, the Arctic Council established an offshoot organization (the Arctic Economic Council) in 2014 which went on to establish the Telecommunications Infrastructure Working Group in 2016 with the specific goal "to draft, from a business perspective, a transnational broadband strategy for the Arctic" (Arctic Economic Council, 2016, p. 31). While many of these policies were in their infancy and have since been

replaced, the development of ideas during this wave and application of digital divide research into policy is a significant milestone.

Summary. While this wave was more subdued than the previous one, it set the stage for the transformational leap that was to come next. Vartanova & Gladkova summarized this wave well:

> In the last decades, policies and measures to prevent digital exclusion, such as improved technological infrastructures, cheap and easy access to technologies and digital literacy programmes to increase digital engagement, are considered to be key instruments in overcoming new forms of inequality across the world (2019, p. 210).

2016-2022: Geopolitics and Self-determination

Power. The third (and most current wave) is marked by a rise in frustration, sovereignty, independence, and self-determination. In particular, geopolitical tensions dominate the most recent literature. The resurgence of Russian aggression in Ukraine (first in 2014, then again in 2022), the growing economic and political interests from other non-Arctic actors such as China, and the arrival of SpaceX's Starlink (Cohen, 2022), have caused a surge of Arctic-specific studies (reflected in *Figure 3*). An issue paper prepared for the United States Congress went so far as to declare that the "renewal of great power competition" in the Arctic threatened to characterize the region "as it was during the Cold War" (Congressional Research Service, 2021).

Undoubtedly, this is unsettling to Northerners who – recent geopolitics aside – have a lengthy history with Western dominance, Outside influence, and colonial powers. With all of the attention and a renewed look at old forms of power, a significant number of studies in this wave have reflected specifically on Indigenous Arctic populations within these historical contexts. Some studies (Dinero *et al.*, 2007) use remote Indigenous villages to conduct experiments that

seem doomed to fail due to their lack of cultural awareness, while others (Beck *et al.*, 2005) present hypotheses that reduce the diversity and complexity of this massive region into a homogenous lump: “If we can serve Barrow, Toolik Lake, and the *Healy* with advanced information technology and infrastructure, the equipment and protocols will probably be suitable for most polar regions and perhaps other rural areas as well” (Beck *et al.*, 2005, p. 51). These studies paint Northerners as disadvantaged and weak compared to Western advancements and strength (Dinero *et al.*, 2007).

In recent years, researchers have begun pushing back against this “imposition of southern innovations” (Exner-Pirot *et al.*, 2017, p. 1), instead advocating on behalf of Indigenous communities and amplifying their voices (McMahon & Akçayır, 2022; Fontaine, 2017; Exner-Pirot *et al.*, 2017). Others examine ICTs as facilitators of identity reclamation, “rather than allowing technology to be one more force that assimilates them into that world” (Young, 2019, p. 3). Others, still, have found ways to incorporate Indigenous and local knowledge into the epistemological models such as the study into digital technology and reindeer husbandry of the Sami people of Norway, Sweden, Finland, and Russia. (Roturier & Beau, 2022). Some have even gone so far as to suggest that this pushback will be an important part of “economic reconciliation” with Indigenous communities (Council of Canadian Academies, 2021). As a result, themes of self-determination, independence, and resiliency are becoming more prevalent in digital divide literature. Two excellent examples include Johnson’s (2021) research article on how fibre optic cables have helped Iceland gain autonomy, and Wendt’s (2020) thesis on how the digitalization of Greenland promoted identity, self-determination, and independence from Denmark.

Economic drivers. The final significant shift seen in this third wave is the rise of new investment propositions, ownership models, and economic drivers. Up until this point, economic considerations of Arctic digital divides have fallen into two belief systems: let market logic sort itself out, or public subsidization is required to offset ROI losses. Digital divides are no longer seen as just a regulatory concern for nations – they are now an economic liability. As such, researchers begin proposing new and alternative economic models. Some examples include: "frugal" infrastructure development (Abildgaard *et al.*, 2021); the Arctic Connectivity Sustainability Matrix (Arctic Economic Council, 2018); public-private partnerships (Council of Canadian Academies, 2021); international investments (Delaunay & Landriault, 2020); piggybacking on industrial projects (Delaunay & Landriault, 2020); and community-owned networks (McMahon *et al.*, 2021; Council of Canadian Academies, 2021). These types of collaborative solutions may be exactly what the Arctic needs to overcome funding challenges impacting the regional divide.

Summary. During this wave, digital divide research came into its own, maturing and evolving under geopolitical tensions, reclamation and reconciliation efforts, and sought economic independence.

Gaps and Limitations

Due to the massive quantity of literature related to digital divides, with representatives from various countries, theories, ideologies, niches, and beyond, it's hard to imagine that any rock has been left unturned. And yet, the gap persists, which suggests that there is still more work to do. Due to the fact that this literature review was limited to English studies, I am curious to know if the same themes and indicators are found in other languages and cultures. For

example, there has been much discussion about incorporating Indigenous ways of knowing into our epistemological approaches (Roturier & Beau, 2022; Young, 2017), yet I did not discover any articles about divides written from the Indigenous perspective. Additionally, almost every Arctic-specific article discussed extreme weather as a contributing factor while simultaneously acknowledging the immense shifts caused by climate change. I suspect that the future research and policies of the "fourth wave" will be looking at a very different picture of the Arctic.

Summary

In the sections above I identified key indicators in digital divide literature from both a generalized (theoretical) perspective, and a niched (Arctic-specific) perspective. These indicators were grouped by themes, and then into three chronological waves to demonstrate how they have evolved and changed over time. In this way, we are able to see how newer ideas and our current understanding of digital divides in the Arctic have been built upon studies that came before. Unfortunately, these older works were not necessarily thinking about the Arctic when forming their frameworks and, as such, the models aren't always a perfect fit. But, the attention received by the Arctic region in recent years brings new opportunities, investments, and innovations – and a new generation to take up the torch.

Chapter 2: Research Design and Methodology

As demonstrated in the previous chapter, both the Arctic and technology have changed. The way that we think and talk about digital divides has also changed. Yet despite this, divides in the Arctic persist. Typically, studies draw from past data to formulate theories and recommend policies. However, due to the ever-changing nature of the Arctic and tech, this data is almost immediately outdated. The goal of this study was to determine if an alternative, future-focussed methodology – scenario planning – can be helpful in shaking up the discussion around Arctic digital divides and generating new ways of thinking.

For the purposes of this study, data was limited to Canada's Far North (generally considered to be 60 degrees latitude and higher). Despite this narrow focus, many Arctic states (especially Alaska, Russia, and Greenland) experience dynamics similar to those in Canada, and digital divide theory can apply to different regions and countries. As such, my hope is that this study will be of interest to Arctic citizens more broadly, not just Canadians.

The overarching question for this study (*Is scenario planning methodology a valuable tool for discussing and thinking about digital divides themes in Arctic contexts?*) was broken down into three sub-questions:

RQ1: What key themes/topics were trending at the CRTC public hearings on telecommunications service in Canada's Far North?

RQ2: When these themes/topics are run through scenario planning tools, what plausible futures can be imagined?

RQ3: What, if anything, can be deduced about the value of scenario planning tools when thinking and talking about digital divides in the Arctic?

This research was exploratory in nature. It involved experimenting with and combining two independent-yet-complimentary methodologies: content analysis and scenario planning. This chapter begins with some context to explain how this combination of methodologies came about. It will then break down the design of the study, including the tools used for data collection and the processes applied to analyze the results. It will conclude with a discussion of limitations and ethical considerations.

Context: April 17-21, 2023

Every year, the High North Center for Business and Governance – an international research centre for development in the Arctic based at Nord University in Norway – holds the High North Dialogue (HND), a week-long academy and conference. In 2023, I attended the HND in Bodø, Norway to learn scenario planning methodology from leaders in the field. Throughout the week, 22 students from nine countries participated in workshops and lectures, developing their own scenarios for 'the Arctic in 2050'. These scenarios were then presented to, and judged by, a panel of experts from Norway, Canada, and the United States.

Upon returning to Canada, I searched for a relevant research context to which I could apply the tools I had learned in Norway. It just so happened that during the same week as the HND, the Canadian Radio-television and Telecommunications Commission (CRTC) had held public hearings in my hometown of Whitehorse, Yukon, on the topic of improving connectivity and decreasing the digital divide between northern and southern Canada. These hearings were part of a broad consultation on telecommunications in the Far North (CRTC 2020-367; CRTC 2022-147). The CRTC is an "administrative tribunal that regulates and supervises broadcasting and telecommunications in the public interest" (Government of Canada, 2023). However, its role

in the North is unique in that it is also responsible for overseeing Northwestel, a private company that operates as a regulated monopoly over telecommunications services in the region. The public hearings were in part a review of Northwestel's regulatory framework. During the hearings, a total of 21 presentations from a variety of stakeholders were made to the commission throughout the week.

I was drawn to the CRTC hearings for this study in part because of my personal connection to these issues. I have lived and worked in the Yukon for the past 15 years. Throughout this time, I have heard corporations like Northwestel argue that telecommunications infrastructure and service delivery are at the mercy of unique social and environmental conditions in the North – that Northern residents cannot expect reliable and affordable connectivity because of the "northern-ness" of the region. I have lived with the consequences of past Northwestel behaviour and CRTC decisions as both a public sector employee advocating for improved services, and a private citizen lamenting the lack of change. But my experiences in Norway directly challenged those arguments by showing me how telecommunications *could* work in Arctic regions, and how collaborative approaches can break traditional thought barriers.

I chose this issue because it mattered to me personally. There is no doubt that this study is heavily influenced by me, researcher-as-participant. The choice to include computerized tools in the design of this study (discussed later in this chapter) was a deliberate attempt to offset my own bias. While these tools cannot eliminate researcher intervention, they do add an important layer of detached objectivity. But, just as scenario planning values its own subjectivity and the personal experiences of its participants, so too do I hope that this study has benefitted from my own. Therefore I am up-front and transparent about these issues.

Design of This Study

The design of this study can be broken down into two parts.

- Part 1: Conduct content analysis of the transcripts from the CRTC public hearings to produce a dataset of key topics, trends, and opinions that could be used as raw inputs in Part 2.
- Part 2: Analyze the dataset collected from Part 1 through the lens of a scenario planning exercise to assess the methodology's value for discussing the topic of telecommunications in the North (specifically) and Arctic digital divides (generally).

I will start with an overview of the two methodologies to understand their individual strengths and weaknesses, and then explain how they will be used together in a mixed-methods approach.

Content Analysis

Qualitative computer-assisted content analysis (CACA) was deemed the most appropriate method for extracting data from the transcripts for a number of reasons.

First, I needed a process that would add reliability and validity to counterbalance the highly subjective nature of scenario planning. CACA is a widely recognized, extensively employed, empirical method for systematically analyzing textual data (Zhang & Wildemuth, 2009; Hsieh & Shannon, 2005; Lindgren & Bandhold, 2009; Krippendorff, 2004). Advocates tout its "ability to improve methodological rigor, consistency and analytical transparency" (Kaefer *et al.,* 2015) in a logical and replicable process (Denscombe, 2010). While this

methodology is not without its limitations (more on this later in the chapter), its value-add to this study is the strength of its reputation as a trustworthy, scientific research method.

Second, the CRTC transcripts were rich with nuance requiring an understanding of northern Canadian contexts. While the software used in CACA cannot intuitively decipher these meanings, it can do some heavy lifting to reduce the complexity by providing a tool to help apply metatags, codify content, and generate frequency reports or correlational graphs. After this preliminary work, researchers can take over to manually analyze the data, its subtexts and latent meanings, and draw connections. In this way, content analysis is considered to be a "context sensitive" method that allows researchers to process "significant, meaningful, informative, and even representational" texts (Krippendorff, 2004, p. 41).

Third, with a total of 21 transcripts containing an average of 2,200 words each, I needed a process that would be efficient when analyzing this large dataset. One of the strengths of CACA is its ability to process batches of text quickly while applying coding parameters and/or algorithms consistently and unbiasedly across all texts.

Other methodologies (such as ethnographic research, focus groups, or interviews) that collect primary data (rather than analyzing secondary data drawn from a different context) may have generated richer data through the natural flow of conversation and real-world interactions between the researcher and participants. However, the likelihood of being able to gather a wide-enough range of experts together for the purposes of this capstone was low. Due to the unobtrusive nature of content analysis, I was able to include publicly-available data from organizations and individuals who might not have otherwise participated in such a study.

Scenario Planning

Scenario planning is a futurist methodology that combines a systematic analysis of trends and influences (or "driving forces") around a particular topic with the creation of multiple, imaginary futures as a way to map causal events and potential decision points. These futures (or "scenarios") are typically presented in a narrative format that delivers findings in "analytically coherent and imaginatively engaging" ways (Bishop *et al.*, 2007, p. 5). Scenario planning is often confused with forecasting but differs in the range of outcomes produced. While forecasting aims to predict the single most *probable* future, scenario planning explores a multitude of *plausible* futures, or "a set of possible ways forward while retaining uncertainty" (Sardesai *et al.*, 2021, p. 36). While forecasting emphasizes answers as outcomes, scenario planning emphasizes the process of thinking about a problem and asking the right questions (Sharma & Yang, 2015).

The methodology first emerged in the 1960s for planning military exercises and researching new weapons technology (Chermack & Lynham, 2002). Since then it has grown and adapted to the "bewildering number" of tools and techniques available to researchers today (Mineev *et al*., 2023, p. 3) while retaining its initial purpose of:

- stimulating dialogue to challenge assumptions, overcome thinking limitations, and encourage innovation;
- creating a systematic format for talking about complex topics and uncertainty; and
- amalgamating a wide range of issues, perspectives, and opinions to produce a holistic understanding of an issue.

Scenario planning declined in popularity from the 1980s onward but has seen a resurgence in recent years due to its ability to accommodate uncertainty and complexity during times of rapid innovation and change (Amer *et al.*, 2013; Sardesai *et al.*, 2021). This dynamic is

particularly relevant in the Arctic which is experiencing change (on all fronts) at a faster rate than non-Arctic nations (a socioeconomic variation of polar amplification). For this reason, scenario planning may prove to be a useful methodology for Arctic-specific projects.

A major criticism of scenario planning is rooted in the inherently subjective nature of its narrative output – the scenarios themselves. Scenarios are essentially stories about what *could* happen, not necessarily what *will* happen or *should* happen (Kahane, 2012). They are typically presented in a short creative fiction format, sometimes including theatrical, audio, or visual elements. It can be tempting to dismiss the methodology purely on this creative component alone. However, such thinking undermines the researcher's responsibility to ensure that findings are not just accurate, but understood. These narratives are "the heart of effective scenario presentation; … the 'aah' that grabs the consciousness as it experiences the feel of life in another world" (O'Brien, 2004, p. 718). Scenarios rely on rhetorical devices such as framing, word choice, intended audience, and mode of delivery to help readers visualize unrecognizable futures and motivate them to consider the implications. Thus "the issue of how scenarios are presented is central to their use" (O'Brien, 2004, p. 718). Scenarios are constructed following the development of a scenario planning matrix, which will be outlined in the following sections.

Mixing Methods

Since I was unable to attend the CRTC hearings in person and assemble a team for a scenario planning workshop, I relied on the hearing transcripts as stand-ins for real participants. Before the scenario planning exercise could begin, I first had to conduct content analysis of the transcripts to produce a dataset of variables that could be used as inputs in the scenario planning process. Content analysis is not normally a part of scenario planning. The two methodologies were mixed for the purposes of this study to compensate for the absence of "live" participants.

Part 1 of this study employed Denscombe's six-step framework for qualitative coding (Denscombe, 2010). However, working through this framework required pre-planning to ensure that the outputs would be appropriate for the scenario planning process. During the HND, participants were provided with a "quick and dirty" framework which was effective within the time restraints of a 5-day workshop but restrictive within the larger scope of this study. As such, I used the eight-step framework for scenario planning outlined by Frances O'Brien, a researcher and associate professor at the University of Warwick, as an overarching guideline (O'Brien, 2004). *Figure 4* shows how content analysis and scenario planning overlap and influence each other at various points throughout the study. A detailed breakdown of these specific steps will be covered later in this chapter.

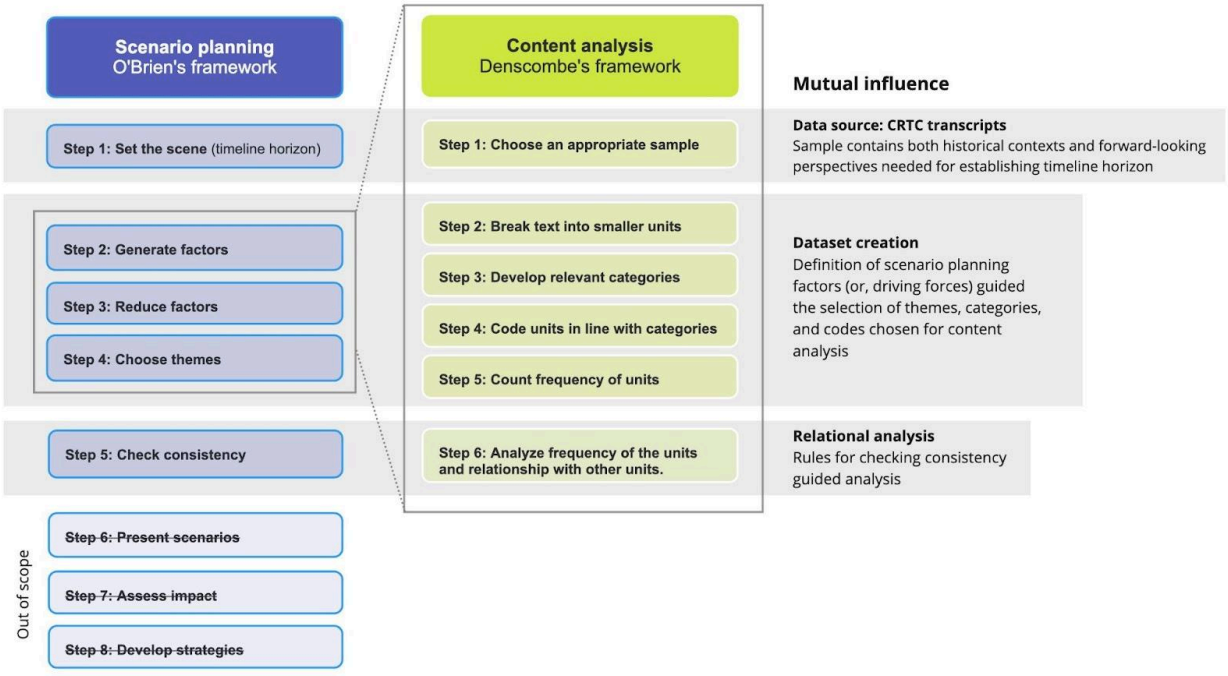


Figure 4. A structured view of the two frameworks employed in this study and their various overlaps and influences.

Participants and Setting

Scenario planning is typically conducted as a group exercise where experts and stakeholders from various fields participate in a workshop to identify driving forces (trends, influence, actors) expected to be the most relevant in the future. These driving forces can be considered variables in the scenarios that come out of this exercise. Rather than conducting a focus group in the design of this study, the transcripts from Part 1 were used to represent the positions of different stakeholders/rightsholders. Going forward, the word "participants" will be used to mean the presenters of the transcripts.

The transcripts were collected from the Government of Canada's website and split into two parts: a presentation, and a question and answer period. A decision was made to exclude the question and answer part of the transcripts to preserve the voice of the speaker and their intended message. Since each participant was asked similar follow-up questions by CRTC staff, there was a risk that those repeated words or phrases would be falsely weighted higher during content analysis because of their frequency. I wanted to ensure that the data collected accurately reflected the participants and their words, and was not skewed by the CRTC-guided questions, or the commissioners themselves. While this isn't ideal (since the transcripts are essentially monologues that lack the natural flow of conversation and debate), the diversity of participants ensures that this data source is a well-rounded alternative representing a "strategic microcosm of the system as a whole" (Kahane, 2012, p. 20). *Figure 5* shows how participant group representation was split across the 21 transcripts.

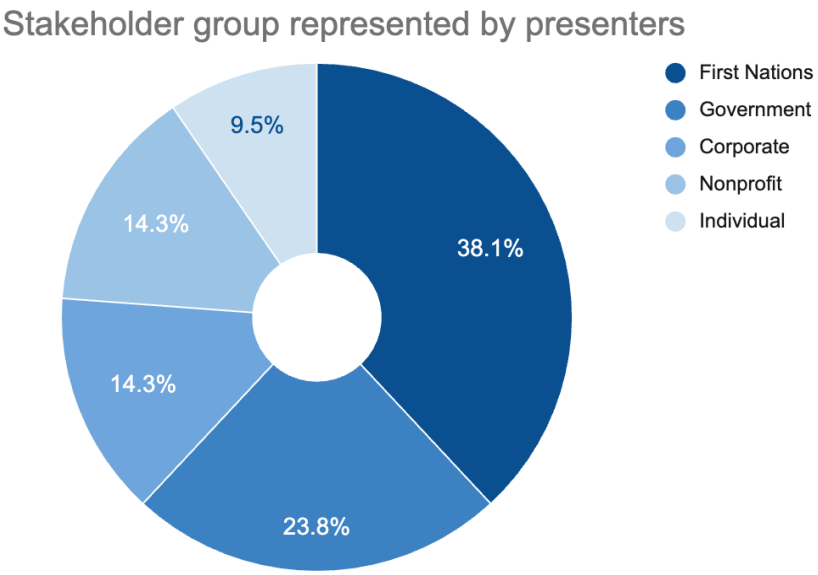


Figure 5. Participant group representation culminated as a percentage of all presentations. See Appendix A for data source.

The high representation of First Nations in the public hearings reflects not only the greater presence of this demographic across Canada's three northern territories, but also the amount of public interest around Indigenous reconciliation (one of the topics highlighted by the CRTC in their original notice of consultation (Government of Canada, 2022).

Instruments and Tools

As mentioned previously, I intended to offset my personal influence in this study by using CACA to analyze the transcript data. I downloaded and tested a handful of tools and found the majority to be difficult to use as a first-time analyzer. I wanted something free, intuitive, and – most importantly – respected by the research community. I eventually selected TAMS Analyzer, an open source markup system originally designed for ethnographic research and discourse analysis (Weinstein, 2002). TAMS was first published in 2002 and has been identified as "a low

barrier to entry tool" (Rath, 2016) and a "powerful and flexible program" (Warters, 2005) for qualitative coding. Additionally, it is listed on a multitude of post-secondary websites for students seeking research tools. For these reasons, I felt confident that the research community had validated it as a trustworthy instrument.

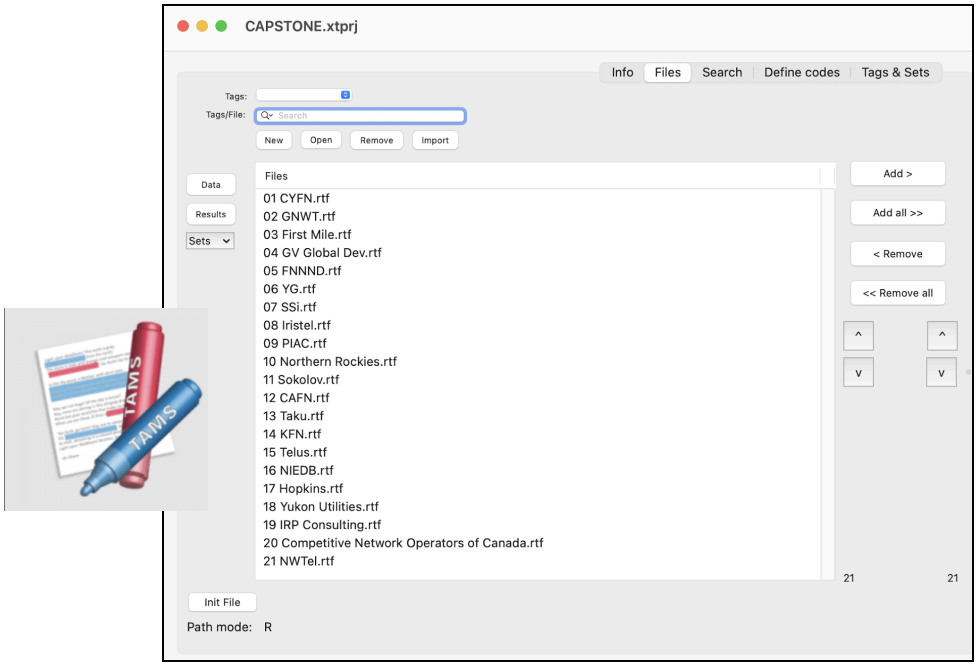


Figure 6. The TAMS interface is fairly simple. Here, the 21 transcripts have been imported into the software. Using the tabs at the top, researchers can switch quickly between adding/deleting files, conducting searches, defining codes, and creating tags.

I was also curious to see what computer-assisted tools were available for scenario planning. I discovered a program called ScenarioWizard, first developed in 2001 for conducting cross-impact balance analyses and which continues to be maintained by the Research Center for Interdisciplinary Risk and Innovation Studies at the University of Stuttgart as a method for analyzing impact networks. This tool could be leveraged to "check for consistency" (Step 5 of

O'Brien's framework) by facilitating the "systemic synthesis of isolated information to an overall picture in the context of scenario analysis" (Weimer-Jehle, 2021, p. 5).

I quickly realized that the tool was far too complex for me as a first-time analyzer, and beyond the scope of this study. (This tool deserves a dedicated study of its own!) Nonetheless, reviewing the software's manual influenced my approach to analyzing the data produced by content analysis by providing a structured way of identifying and measuring variants. This will be expanded upon in the following section.

Data Collection and Analysis

This section walks through how each of the six steps of Denscombe's framework were implemented. Each step also includes a description of how O'Brien's scenario planning framework influenced decisions and processes within content analysis.

Step 1: Choose an Appropriate Sample

When constructing scenarios, a timeline must be determined to constrain the scope of the exercise. The timeline should be far enough in the future to allow for change but close enough to the present so as to still be concrete and relevant. In the absence of a discussion with participants to workshop these parameters, the sample selected for content analysis should therefore reflect both the historical context of the situation as well as forward-looking perspectives. A number of participants at the CRTC hearings expressed frustration at having made nearly identical speeches to the commission 10 years prior and still not seeing change. Other participants shared their visions for the future, or made recommendations for next steps when moving forward. In this way, the transcripts can be considered conducive for scenario planning timeline setting.

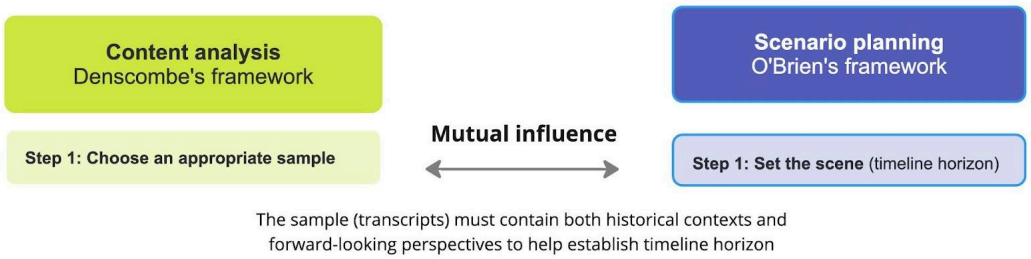


Figure 7. Mutual influence between the frameworks in this step. Sample selection required thinking about timeline horizon needs of scenario planning.

The transcripts were collected from the Government of Canada's website and split into two parts: a presentation, and a question and answer period. As mentioned previously, the question and answer period was omitted to preserve the voice of the speaker and their intended message. The final corpus contained 21 transcripts with an average length of approximately 2,200 words each (see Appendix A for list).

Step 2: Break the Text into Smaller Units

It was decided that transcripts should be analyzed at the paragraph level (rather than the word or sentence level). During a preliminary reading to familiarize myself with the texts, I noticed that presenters typically relied on multiple sentences to articulate an idea, build an argument, or provide examples. What I wanted to capture was the essence of their argument, not the specific words used. Conveniently, paragraphs had already been delineated and numbered by the original transcriber, so this seemed to be the most efficient choice.

Step 3: Develop Relevant Categories.

Two rounds of coding were applied to the transcripts. The first was to identify driving forces, and the second was to determine consensus across variants.

Driving Forces. The inputs in scenario planning are called "driving forces" so I needed to ensure that the data produced by content analysis was appropriate for its intended use in scenario development. (Note: O'Brien uses the word "factors" while others use phrases like "key influences" or "drivers". I will use the term "driving forces" throughout this study for consistency's sake.)

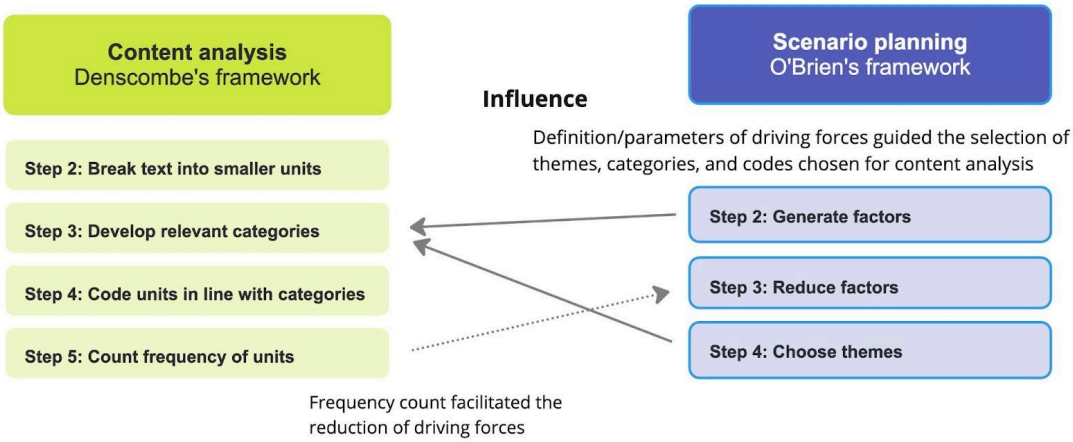


Figure 8. Inter-framework influence in the creation of codes, categories, themes and driving forces.

Driving forces can be broadly interpreted as "underlying issues, events, processes, or trends with a high level of probability to 'drive' future development" (Petrov *et al.*, 2021). They can be internal (endogenous) or external (exogenous); hard (tangible) or soft (intangible); predetermined (known) or uncertain. They can be things we can influence, or things that influence us. The only rule is that driving forces "be expressed as a noun to discourage … making pronouncements on how that [force] might appear in the future" (O'Brien, 2004, p. 716).

Driving forces typically fall into one of three categories:

- Assumptions: predictable; predetermined; generally accepted into societal consensus; “grounded in basic assumptions about the world” (Mineev *et al.*, 2023, p. 4).
- Uncertainties: factors that are beyond our control; decisive for future outcomes; “could easily tip developments one way or the other” (Mineev *et al.*, 2023, p. 4).
- Wild cards: low-probability, high-impact events that break the logic and invalidate scenarios. “Wild card events divide history into a ‘before’ and an ‘after’.” (Mineev *et al.*, 2023, p. 23)

During my preliminary reading of the transcripts, I made note of recurring topics, opinions, ideas, etc. that could be defined as driving forces. I then began grouping these into related categories, whittling out duplicates, and defining parameters. I was worried that my personal interpretations and biases would cause me to overlook a particular topic, so I took O’Brien’s suggestion to use PEST (Political, Economic, Social, Technological) themes as a general guide to ensure that I captured a holistic range of issues. After this initial grouping attempt, I had 30 codes in 12 categories across 5 themes. I then conducted a more thorough reading of the transcripts to test these codes and categories. Most remained unchanged, though some required moderate refining. For example: the category of “affordability” was defined too narrowly as “cost to consumer” and didn’t allow for consideration of how the cost to provider influenced affordability systemically. Subsequently, the category was split into separate codes (one for consumer costs and one for provider costs). The final list of 27 codes (or driving forces) in 11 categories under 5 themes can be found in Appendix B with complete definitions and in-text examples.

Consensus Across Variants. In scenario planning, any number of scenarios can be conceived. However, the most popular method is a 2x2 matrix that generates four mutually-exclusive scenarios. The x- and y-axes of the matrix represent two driving forces that participants perceive to be the most volatile, or uncertain. “The four cells represent alternatively the four combinations of the poles of the two uncertainties, each of which contains a kernel or logic of a plausible future” (Bishop *et al.*, 2007, p. 14).

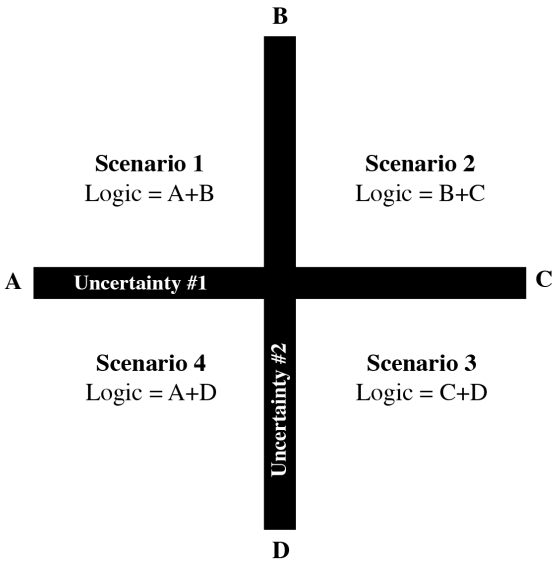


Figure 9. A sample 2x2 matrix demonstrating how the four scenarios are mapped against uncertainties, and the internal logic that guides them.

Therefore, it was not enough to simply identify the driving forces – it was also necessary to determine their level of uncertainty.

To achieve this, I modified an approach described in the ScenarioWizard manual for identifying and measuring variants of each driving force. Variants are described as “a set of qualitative alternatives that characterise the possible states of descriptors” (Weimer-Jehle, 2021,

p. 6). Researchers then make a judgment about the impact of the variant and express that judgment on a qualitative scale.

To implement this, each code was assigned three variants: one positive, one negative, and one neutral. The terms “positive” and “negative” were not used to imply that variants were inherently good or bad, favourable or unfavourable, but rather to represent opposite poles on a continuum. For example, the code “2.3.1 Monopoly” was assigned these three variants:

Positive	+	Increase exclusivity (double down on monopoly to provide stability)
Neutral	=	Maintain status quo (no action needed; competition trickling in)
Negative	-	Eliminate exclusivity (disrupt monopoly with free market)

After all codes were tagged in TAMS Analyzer, each instance was re-evaluated (again, at the paragraph level) and assigned to a variant based on its underlying sentiment or nuance.

Continuing with the example of code 2.3.1 Monopoly, here are three specific instances categorized by variant:

+	“The most practical, cost-efficient and reliable option to bring terrestrial broadband service to Atlin is to transfer incumbency to Northwestel.”
=	“Northwestel points to the introduction of competitive transport facilities in the north as a reason why the Commission should disregard all the evidence that parties have provided concerning the ILEC's dominant position over terrestrial facilities…”
-	“...we need to disrupt the monopoly. Like, I just don't know any other way through it. It's not working here.”

The selection of variants was highly subjective and felt, at times, arbitrary (see Appendix C for complete list). The purpose of this exercise was not to determine consensus on “the” truth,

but rather to determine consensus on "a" truth that could be quantified for further use. While this choice arguably reduces the validity of the study, it is still entirely within the subjective reality of the scenario planning methodology. These limitations will be discussed later in the chapter.

Step 4: Code the Units in Line with the Categories

Now with a concrete coding scheme, I returned to TAMS and tagged the transcripts at the pre-determined paragraph level. TAMS handles this by using a colour-coded, curly-bracket markup system (*Figure 10*).

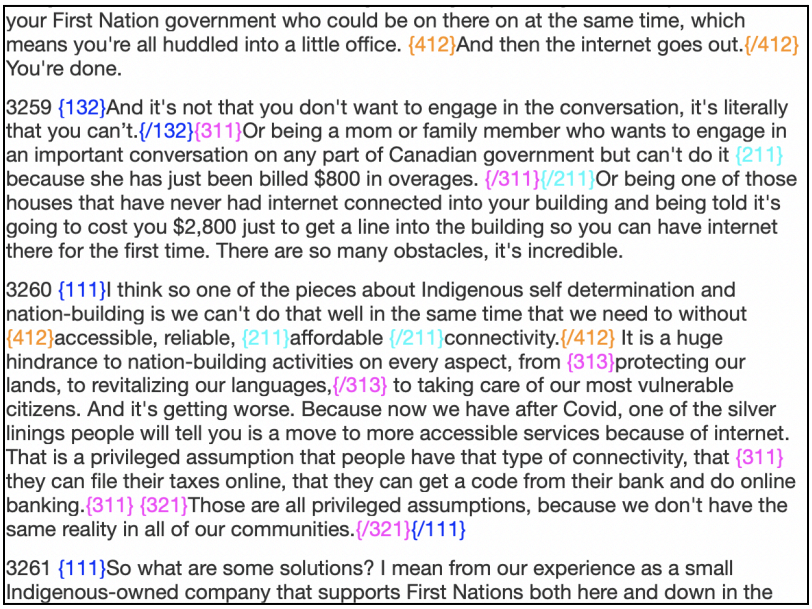


Figure 10. Screenshot of TAMS' colour-coded, curly bracket in-line coding scheme. Codes have been applied at the paragraph level.

If at any point I was unsure about which code to apply, I referred to the carefully-worded coding definitions that I had created in Step 3 (see Appendix B).

Step 5: Count the Frequency of Units

Once all transcripts had been coded, I ran a frequency report to count the number of times a code recurred within each transcript, as well as the total number of instances across all transcripts. TAMS output this report as a tabulated spreadsheet (see Appendix D).

A second report was run to drill down into these numbers and separate them based on the frequency of each variant (see Appendix E).

Step 6: Analyze the Frequency of the Units and their Relationship with Other Units

One of the reasons I chose content analysis as a methodology was for its ability to analyze qualitative data quantitatively. By looking at the number of times a particular code recurred across all transcripts, I could determine which codes (or driving forces) had the greatest significance across all presentations at the CRTC hearings. Based on the frequency report, driving forces could be ranked and ordered, then filtered down to a reasonable number for scenario planning. In her framework, O'Brien recommends reducing the total list of driving forces to 12 – a number that had "been set somewhat arbitrarily, but in practice proved to be a sensible number since it allowed participants to capture both the breadth of issues across categories and some depth within categories" (O'Brien, 2004, p. 711).

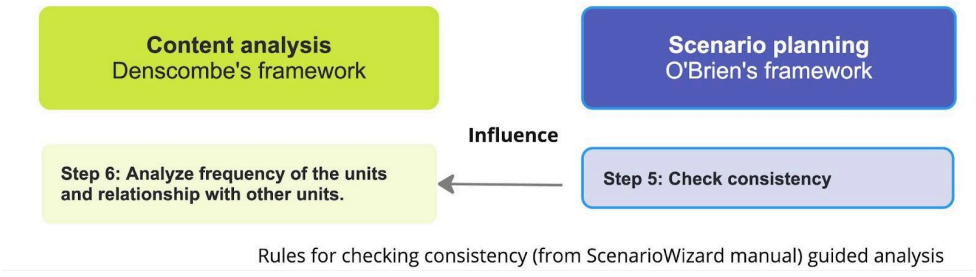


Figure 11. Scenario planning's influence on the final step of content analysis.

As for the variants, their frequency was used to determine uncertainty. By measuring the standard deviation across variants I was able to determine which codes had generally achieved consensus and which had not. Codes with greater deviation could be deemed consensual since the frequency swung heavily towards one particular variant. Codes with less deviation could be deemed uncertain, since frequency was more evenly split across all variants, representing a lack of consensus. This list (see Appendix E) was also ranked from most uncertain to most consensual.

Thus, the two datasets can now be used as inputs in scenario planning development:

- 12 driving forces for inclusion in the scenarios as variables; and
- 2 highest-ranked uncertainties to form the x- and y-axes of the 2x2 matrix for determining scenario logic.

The findings from these datasets will be explored thoroughly in the following chapter.

Limitations and Considerations

The purpose of this study was to examine an alternative methodology, not necessarily the most rigorous methodology. Specific limitations of the design of this study have been covered throughout this chapter. Of key importance has been maintaining objectivity despite my personal history with the topic, and with my role as researcher-as-participant. In response, I have highlighted where digital tools helped to create some separation between myself and the data through systematic validation techniques. However, it should also be evident by now that scenario planning is inherently subjective and values the interpretations and influences of its participants. The practice of scenario planning as a group exercise helps balance individual subjectivity through the process of debating and achieving consensus.

Initially, I assumed that with enough rigor and strategic planning, I would be able to achieve this same outcome purely from the transcripts. However, there were still many instances when a decision was required (such as which variant to apply to a specific code). Therefore, it's important to keep in mind that the datasets and outputs of this study represent only one possible outcome. Ironically, this limitation fits perfectly within scenario planning's structure of producing multiple *plausible* futures over a single *probable* one.

As a methodology, scenario planning teeters between the scientific and creative, the known and the unknowable, tapping into "the remarkable capacity of humans to both imagine and to learn from what is imagined" (Chermack & Lynham, 2002, p. 371). Readers are asked to keep this dichotomy in mind in the following chapter, where I will present the results of this study against the backdrop of scenario planning and digital divides more broadly.

Summary

This chapter outlined the design of this study, its methods, frameworks, participants, and various instruments with consideration for limitations along the way. I will now present the findings of this study and discuss potential implications and thoughts for future research.

Chapter 3: Findings

The HND Academy encouraged students to imagine a future (or futures) for the Arctic by guiding them through a scenario planning exercise designed to explore alternative ways of thinking about complex issues. My experience with that process led to the development of the overarching research question which guided this study: *Is scenario planning methodology a valuable tool for discussing and thinking about digital divides themes in Arctic contexts?*

To answer this question I tested the scenario planning methodology using 21 publicly-available transcripts from a CRTC public hearing held in Whitehorse, Yukon. As discussed in the previous chapter, this dataset was part of a broad consultation on telecommunications in the Far North. These transcripts were codified via content analysis processes to produce two datasets of driving forces (and their variants) which could be used as inputs in the scenario planning exercise.

This chapter begins by presenting the findings of the content analysis (datasets 1 and 2) and how they resulted in the creation of the final list of driving forces. Next, I present these results within a scenario planning context by plotting them on a 2x2 matrix (sometimes referred to as the double uncertainty approach) which has been called the "gold standard of corporate scenario generation" (Millett, 2003, p. 18). Finally, I suggest how the scenarios could be developed into comprehensive narratives by summarizing the logic of each matrix quadrant.

Dataset 1: Driving Forces and Importance

The first step in the study was to use content analysis to produce a dataset of driving forces based on the CRTC transcripts. This resulted in a total of 27 driving forces across 11 categories and 5 themes were identified from the CRTC transcripts (see Appendix B for

complete list). Based on the frequency report generated by TAMS Analyzer, the results were ranked, reordered, and filtered.

As shown in *Figure 12*, the number one driving force was code 2.1.1 (Affordability – Cost to consumers). This code was counted 163 times across the 21 transcripts identifying it as a significant issue to participants. The second highest-ranked driving force was code 4.1.2 (Technology – Service delivery) with a count of 128 instances, and the third was code 1.2.1 (Policy/legislation – Government intervention) with a count of 99 instances. The ranking of these results is deemed to represent a driving force's level of "importance".

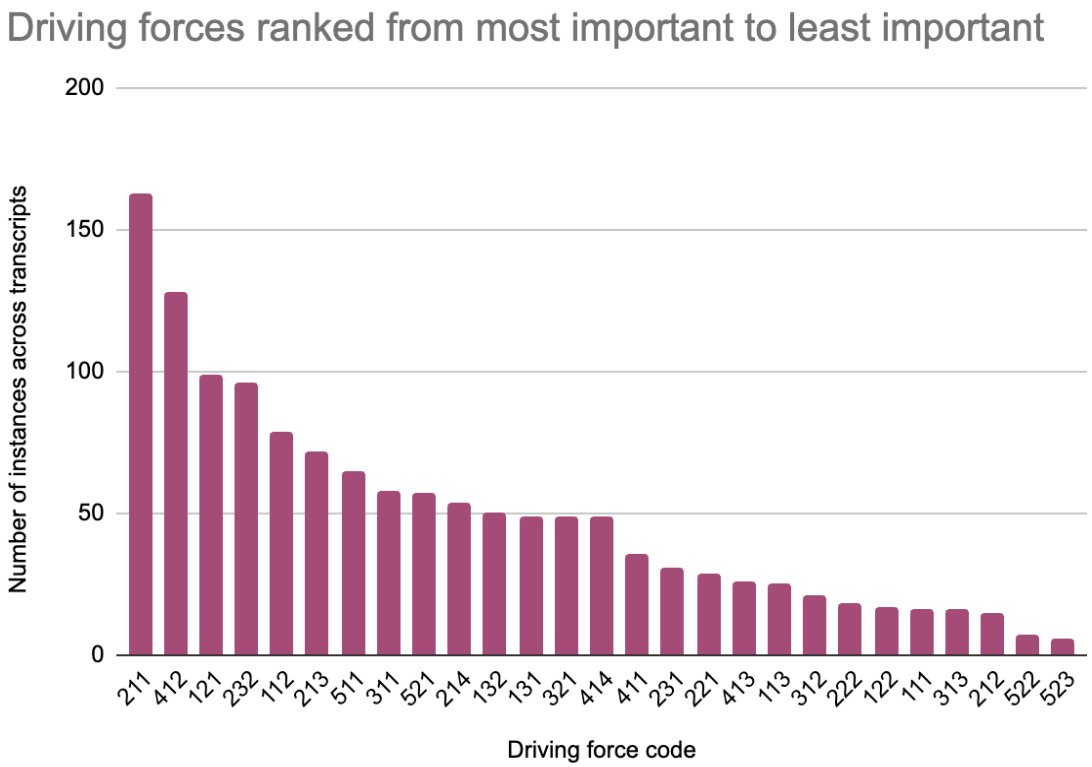


Figure 12. Using the frequency reports produced by TAMS Analyzer, driving forces were ranked and ordered based on the number of instances across all transcripts to determine their level of importance for scenario development.

Twenty-seven driving forces is generally considered to be too unwieldy for scenario planning exercises. Indeed, O'Brien recommends reducing the total to "a manageable number" of 12 driving forces (2004). Since two of my driving forces (1.1.2 - Economic reconciliation and 4.1.2 - Service delivery) would eventually be used for the x- and y-axes of the 2x2 matrix, I filtered the dataset to the top 14, resulting in this final list of driving forces:

Theme	Category	Code	Code count	Theme count
Economic forces	Affordability	**2.1.1. Cost to consumer**	**163**	385
		2.1.3. Subsidies/funding	**72**	
		2.1.4. Wholesale access	**54**	
	Market forces	**2.3.2. Competition**	**96**	
Governance forces	Policy/legislation	**1.2.1. Government intervention**	**99**	278
	First Nations relations	**1.1.2. Economic reconciliation**	**79**	
	Transparency	**1.3.1 Statistics**	**49**	
		1.3.2. Collab/consultation	**50**	
Technological forces	Technology	**4.1.2. Service delivery**	**128**	177
		4.1.4 Innovation	**49**	
Geographic forces	Digital divide	**5.1.1. Digital divide**	**65**	122
	Geolocational isolation	**5.2.1. Rural/remote**	**57**	
Social forces	Participation in society	**3.1.1. Interdependencies**	**58**	107
	Injustice	**3.2.1. Disproportionality**	**49**	

Table 2. The top 14 codes based on frequency count.

None of the driving forces on this list are surprising and could have been easily predicted during the preliminary reading of the transcripts. What is interesting to note, however, is that the list is fairly balanced across all five themes and multiple categories. I had expected to see one

category or theme rise above the others more significantly but this did not happen. This points to one of scenario planning's strengths: its ability to present "complex elements together into a coherent, systematic, comprehensive and plausible manner" (Amer, 2013, p. 24), thereby capturing a microcosmic view of reality. Diversity and contrast among these elements benefit scenario planning by "allowing several ways for the development of the future and of enabling the inclusion of complete future developments that result from different trends and perspectives" (Sardesai, 2021, p. 37). If the top 14 driving forces leaned heavily in one direction (e.g. primarily economic-focussed), it would be more difficult to produce four distinct scenarios since the x- and y-axes would be too similar, thematically speaking. The overall effectiveness of the exercise would be lost. Therefore, the diverse range of driving forces seen in *Table 2* validates the selection of transcripts for this study as robust, rich, and balanced, representing a holistic approach to the underlying topic (telecommunications in the North).

However, despite this range, many driving forces that I personally thought would (or should) be important did not make the top 14 while others were completely non-existent in the transcripts. For example, climate change is a well-documented concern in the North. In their development of scenarios for 'international cooperation in the Arctic in 2035', Mineev *et al.* called climate change "a fundamental uncertainty" (2023, p. 10), even using it as one of the key axes in their 2x2 matrix. Despite being captured in content analysis as code 5.2.2, climate-related forces ranked second-to-last in importance, with only seven instances across all transcripts. Similarly, Arctic fibre projects, Russian tensions with the Arctic Council, and Canadian Arctic sovereignty are all contributors to the broader geopolitical landscape affecting telecommunications in the North. However, these topics were never discussed in any of the

transcripts. For the purposes of this capstone, I consider these forces to be “blind spots” in the current policy discourse around digital divides in Canada’ Far North.

Whether the absence of these forces should be considered a strength or a weakness in the findings is debatable. On one hand, the top 14 reflect elements perceived as most important to the participants. Knowing that First Nations groups made up the majority of participants, it then makes sense that a number of the top 14 carry significant weight in Indigenous realities: economic reconciliation, collaboration (duty to consult), service delivery in rural and remote communities, and the cost to consumers who disproportionately fall into low-income brackets. In this way, the methodology can be seen as functioning exactly as intended – valuing the personal experiences and interests of participants. This suggests that different participants would potentially put forward different perspectives. For example, had the majority of representation at the hearings been environmental agencies, we can assume that climate change would have made the list of top 14 forces while economic reconciliation may have been less prevalent.

On the other hand, the lack of such issues in a holistic policy analysis raises important questions. How can the issue of telecommunications service delivery (for example) be addressed if we aren’t also talking about the logistics of getting personnel and equipment to remote locations? How can the issue of cost to consumers be discussed if “monopoly” didn’t make the top 14? As such, it is important to keep in mind that the methodology may create or perpetuate blind spots since it is organized around pre-existing perspectives expressed by participants. Therefore scenario planning in general might be improved by integrating a step dedicated to the discussion of potential blind spots amongst participants to ensure a holistic policy analysis.

Dataset 2: Variants and Uncertainty

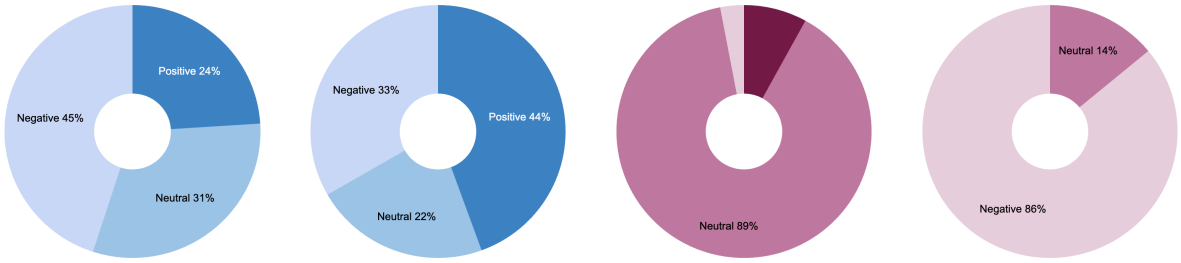
The next step in the study was to determine and rank each driving forces' degree of uncertainty. Scenario planning is a futurist methodology that seeks "to capture the range of uncertainty" between stakeholder positions about a given driving force (O'Brien, 2004, p.709). Uncertainty increases as we move away from the present. Itmis both a reason for conducting scenario planning, as well as a character in its own development.

To determine degrees of uncertainty, variants for each code were identified (see Appendix C for complete list) and counted by TAMS Analyzer in the same way that driving forces were. The frequency count was then represented as a percentage which could be used to measure standard deviation consistently across all codes. Standard deviation was measured using the following formula:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}.$$

Driving forces with a high deviation score were considered more "consensual" than driving forces with a low deviation score. This is because the high deviation represents a significant swing toward one particular variant. Lower deviation scores, on the other hand, indicated that the variance was closer to the mean – or, the count was spread more evenly across all variants. In this circumstance, the driving force was deemed to be less consensual and therefore more uncertain.

It may be easier to understand this by looking at pie graphs to visualize how the split across variants affected uncertainty. *Figure 13* shows an example using four codes.



1.3.1 Statistics | 4.1.1 Phys. infrastructure | 5.1.1 Digital divides | 3.1.2 Safety

Figure 13. Visualization of how the split across variants was used to determine uncertainty. The two blue (left) graphs represent code 1.3.1 and 4.1.1 – the two highest ranked uncertainties. By comparison, the two pink (right) graphs represent codes 5.1.1 and 3.1.2 which were deemed to have achieved consensus and were thus considered less uncertain.

Once all driving forces had been assigned a standard deviation, they were ranked from most uncertain / lowest consensus (lowest standard deviation) to least uncertain / highest consensus (highest standard deviation). The highest ranked uncertainty (ie. lowest consensus among participants) was code 1.3.1 (Transparency – Statistics). The three variants for this code focussed on statistical data regarding service delivery, demographics, customer satisfaction, and prices. 31% of instances reflected a belief that data was available and actively informing telecommunications policy. 24% believed that data was available but shrouded in secrecy or not publicly available. 45% reflected a belief that data was insufficient, incorrect, or unavailable.

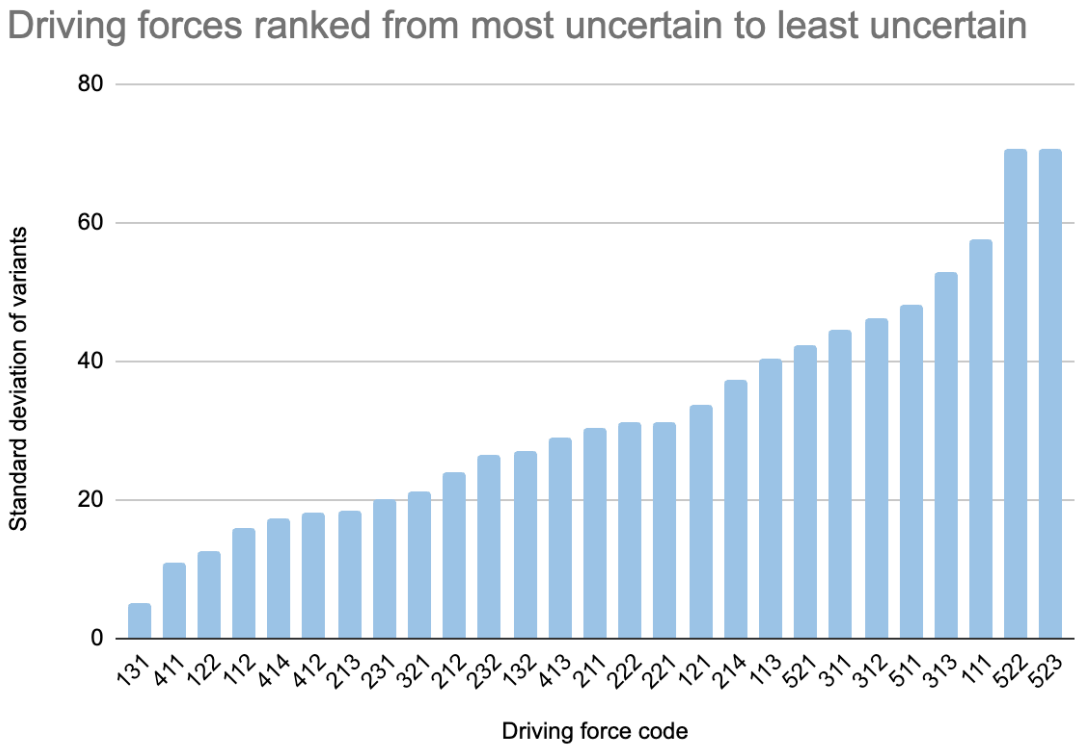


Figure 14. Driving forces ranked by uncertainty based on their deviation score. Complete list of scores available in Appendix E.

The second highest ranked uncertainty was code 4.1.1 (Technology – Physical Infrastructure). In this case, the analysis resulted in a split of 44% of instances of infrastructure described as degrading/unsatisfactory, 22% that implied that infrastructure was being upgraded but keeping pace with the digital divide, and 33% that reflected a belief that physical infrastructure was being significantly improved.

The third highest ranked uncertainty, 1.2.2 (Policy/Legislation – Human Rights), had only two variants. 41% of instances reflected that connectivity-as-a-human-right was a low priority (or long-term policy matter) while 59% indicated that connectivity was a critical utility that should be prioritized on par with electricity and shelter.

The axes

With the content analysis portion of the study complete, I now turned to applying the results to scenario planning. As discussed in the previous chapter, the x- and y-axes of the 2x2 matrix represent the two driving forces that are deemed to be the most important and the most uncertain. To identify which two codes should be used as the axes, the bar graphs from *Figure 12* and *Figure 14* were combined to see how a driving force's importance compared to its uncertainty.

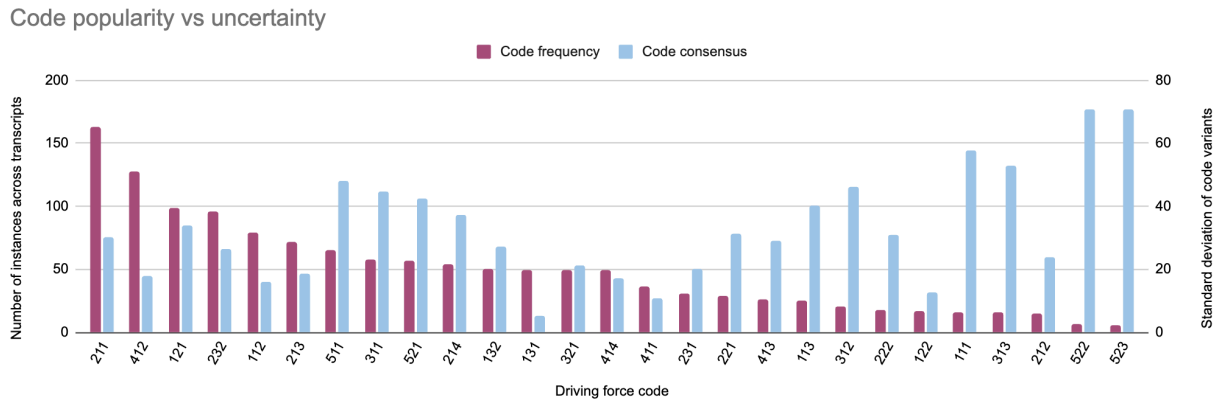


Figure 15. The two bar graphs from Figures 12 and 14 are combined to see how importance and uncertainty compare for each code.

The visible correlation between the overlapped graphs was, once again, not surprising. When a topic or driving force is contentious, we would expect to see more instances across the transcripts as participants argue or debate the variants. Therefore, topics with more instances (deemed to be high importance) had a tendency to also be more uncertain. Likewise, driving forces that were less uncertain (i.e. more consensual) were discussed less as they are considered to be generally-accepted assumptions about reality not requiring debate. For example, two lowest ranked (i.e. least important) forces were 5.2.2 (climate change) and 5.2.3 (logistics) with only 7

instances and 6 instances respectively. Both codes also achieved 100% consensus. All participants agreed that the effects of climate change were detrimental, and all agreed that logistical matters (e.g. transportation, accommodation, and supply chains) were challenging.

In *Figure 15*, no two codes stick out significantly above the others. Therefore, I examined the four highest ranked codes based on their overlap (see *Table 3*).

Category	Code	Importance ranking	Uncertainty ranking
Technology	**4.1.2 Service delivery**	2nd	6th
First Nation relations	**1.1.2 Economic reconciliation**	5th	4th
Affordability	**2.1.3 Subsidies/funding**	6th	7th
Transparency	**1.3.1 Statistics**	12th	1st

Table 3. The top 4 uncertainties determined by their combined importance ranking and uncertainty ranking.

For scenario planning, any two of the driving forces presented in the table (in a total of six possible combinations) would be adequate for representing the x- and y-axes in our 2x2 matrix. However, I decided that I didn't want to use 1.1.2 (economic reconciliation) and 2.1.3 (subsidies/funding) together because they both have a heavy economic focus. As mentioned earlier, the goal of the scenario planning methodology is to use two uncertainties that generate diverse and contrasting scenarios. Therefore I replaced 2.1.3 with 1.1.2, the higher ranked uncertainty. Secondly, I felt that 1.3.1 (statistics) would not generate interesting-enough results, since it is generally agreed within governments that informed decision-making based on more data leads to better results (and vice versa). Therefore, I chose to use economic reconciliation

and service delivery as my matrix axes, with their variants on either end of the spectrum. Variants for economic reconciliation are "opportunity-focussed" vs "injustice-focussed". Variants for service delivery are "improving" vs "failing". *Figure 16* visualizes this layout.

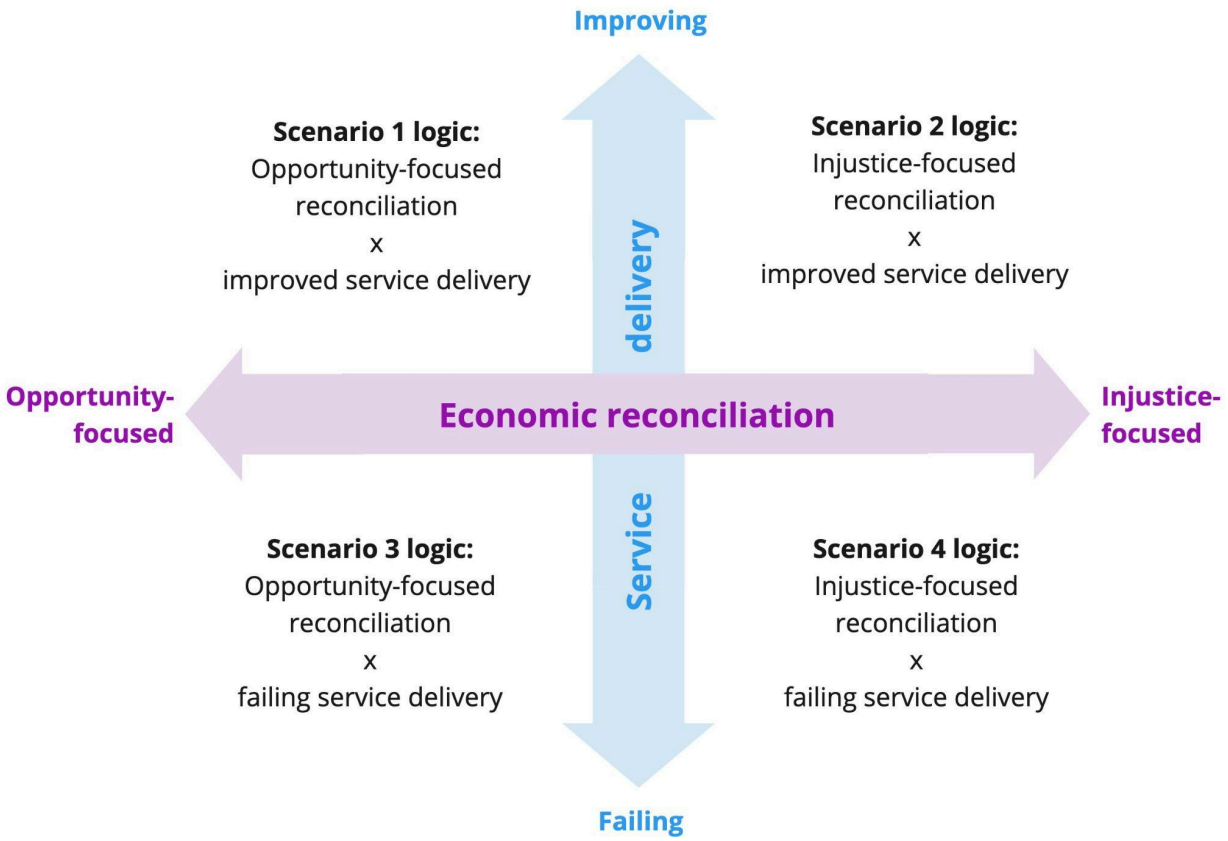


Figure 16. The top two uncertainties form the matrix axes with their variants on either pole. The intersection of these uncertainties form the scenario logic in each quadrant.

The 2x2 Matrix

The next step was to plot the remaining 12 driving forces on the matrix. Traditionally, deciding where to place each driving force would be a group exercise. Participants would debate and rationalize their ideas of where driving forces should live on the matrix and their anticipated influence in each quadrant. Consensus and compromise would be achieved through discussion

amongst the group. As a sole researcher, I relied on my own interpretations, experiences, and deductive reasoning to go through this process. Therefore, the placement of driving forces on the matrix should be considered as one possible outcome of this exercise – not the only outcome. The results of this process are represented as sticky notes in *Figure 17*.

As an example, I will describe how I chose the placement of one of the driving forces: 1.2.1 (government intervention). According to Scenario 1 logic, service delivery is functioning well and economic opportunities are available based on reconciliation efforts. In this reality, we expect that government intervention would be decreased since customers are happy and the economy is flourishing. This resulted in placing 1.2.1 (with variant "decreasing") in the top left corner of the matrix. In contrast, according to Scenario 4 logic, service delivery is failing and a sense of social injustice prevails. Therefore, we would expect to see a sharp rise in government intervention through policy, monitoring, and regulatory efforts. This resulted in placing 1.2.1 (with variant "increasing") in the bottom-centre of the matrix. This variant is placed more centrally on the economic reconciliation spectrum than its counterpart since when services are failing, government intervention is likely to increase regardless of economic reconciliation forces.

Some driving forces appear multiple times in the matrix (e.g. "digital divide" appears as both "closing" and "widening") while others only appear once. This is because not all variants were relevant to all quadrants.

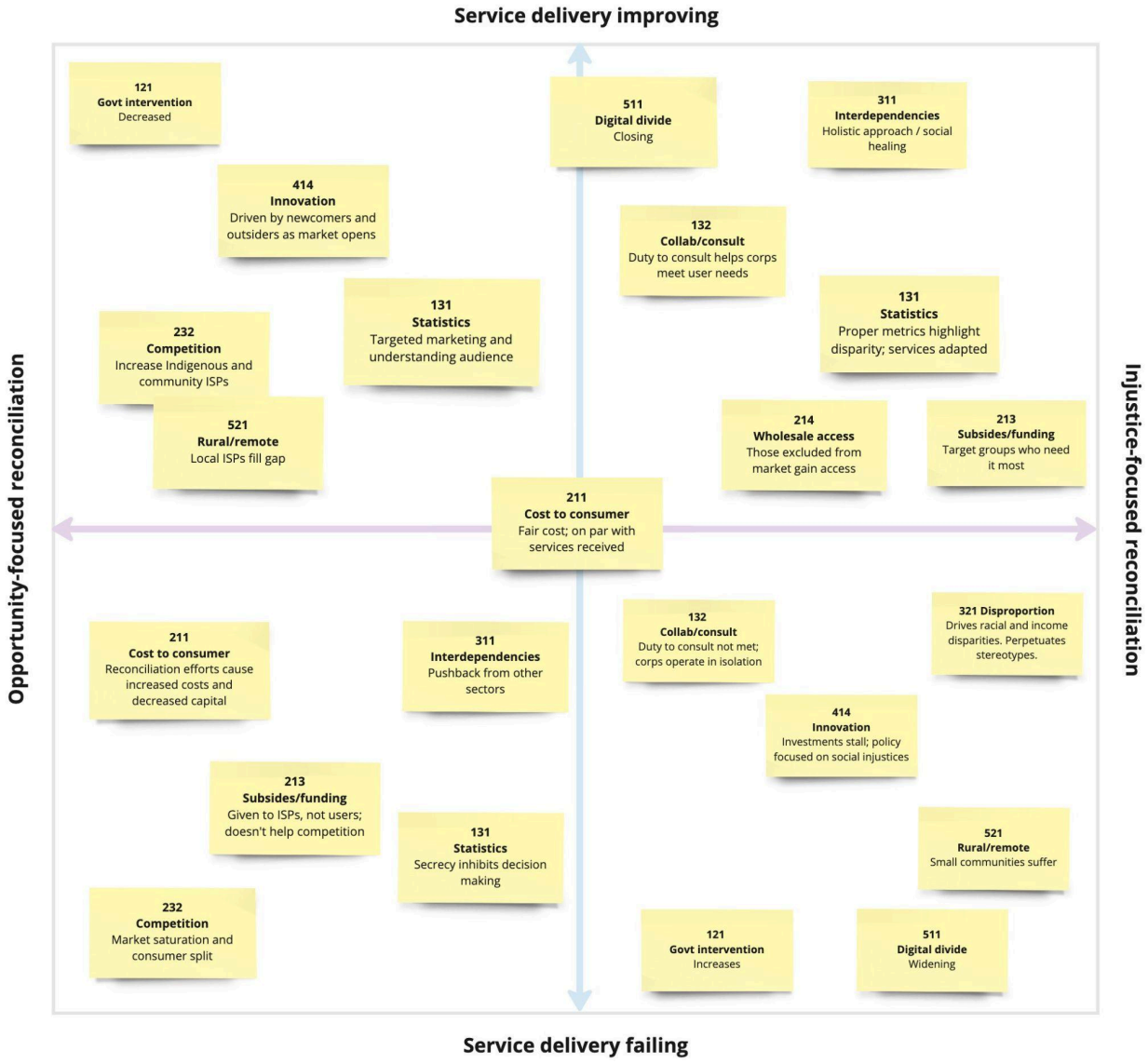


Figure 17. Driving forces (sticky notes) plotted on the spectrum of each axis and within the logic of each quadrant.

Looking at *Figure 17*, it is interesting to note that "cost to consumer" fell in the centre of the matrix, since it was rated the most important driving force following the content analysis. Something that was identified in the transcripts and captured in the variants for this code was that improving the cost of telecommunications does not necessarily result in lower-cost services. Many participants acknowledged that costs were higher in the North and those costs would

naturally be reflected in the prices paid by consumers. The cost itself was not the issue – it was the service received for the price paid. Therefore, most participants indicated that they were willing to pay higher rates, as long as the cost was fair and on par with service quality. With this in mind, it felt right to place "cost to consumer" in a central, balanced location on the matrix.

The Scenarios

The final step: putting all of this analysis together in narrative form. Using the plotted driving forces, the uncertainties, and the scenario logic of each quadrant, participants in a scenario-planning exercise would construct and present the future scenarios. While this step largely falls outside the scope of this study, I did create a brief summary for each quadrant (see *Figure 18*). These are presented as an example of what these narrative scenarios *might* look like.

The narratives generated by this exercise are typically much longer and may include theatrical presentations, visuals, or other forms of representation and narrative. For example, in one study, O'Brien highlighted one particular example of participants from the BBC opting to present their scenarios verbally as radio broadcasts, consistent with the oral tradition of the medium (2004, p. 718). Scenario narratives rely on creativity and imagination to stretch the boundaries of traditional thinking. Ideally, they should be an *experience*, not just exposition. "A good scenario grabs us by the collar and says, 'Take a good look at this future. This could be your future. Are you going to be ready?' (Bishop *et al.*, 2007, p. 5).

Figure 18. Summaries of four possible scenarios that could be built out by participants. These are provided as an example to demonstrate how the findings come together in scenario planning. They should be considered one possible outcome, not the only outcome. For easier reading, full text is available in Appendix F.

As indicated in the previous chapter, there are several additional steps in O'Brien's framework for scenario planning that are out of scope for this study. These include presenting the scenarios to stakeholders in memorable ways; assessing the impact by analyzing the discussions

generated following the presentations; and developing strategies (e.g. modifying corporate strategic plan to accommodate newly-discovered potential risks). These steps could form a separate study and are offered to the reader for further consideration.

Summary

The findings laid out in this chapter have answered two of the research sub-questions. RQ1 (*What key themes/topics were trending at the CRTC public hearings on telecommunications service in Canada's Far North?)* has been answered through the ranked list of driving forces produced by the content analysis of the transcripts. RQ2 (*When these themes/topics are run through scenario planning tools, what plausible futures can be imagined?)* has been answered by working through the scenario planning exercise of selecting axes, plotting driving forces, and summarizing the matrix quadrants. I will now take a step back to discuss my own interpretations of the results in an attempt to answer the final sub-question *(RQ3: What, if anything, can be deduced about the value of scenario planning tools when thinking and talking about digital divides in the Arctic?).*

Chapter 4: Discussion and Retrospective

In Chapter 1, I highlighted a noticeable shift in digital divide research by delineating three specific "waves". Newer studies began to demonstrate a preference for talking about connectivity and divides on a spectrum, continuum, or multidimensional layers (Yu, 2006; van Dijk, 2006; van Dijk & Hacker, 2003). This marked a maturation in theory, as previous classifications and definitions were considered reductive or oversimplified. It could be argued, then, that scenario planning is perfectly positioned to become the methodology of the "fourth wave". As we move away from the present with increasing uncertainty towards more complex understandings and holistic approaches, we need new ways of thinking and talking about these topics. I believe that this study has demonstrated how scenario planning has the potential to fill this gap when talking about digital divides in Canada's Far North. However, many nuances of the methodology exist and will need to be carefully evaluated prior to its use in other studies.

Reliability and Applicability of Results

So many of scenario planning's strengths are considered weaknesses by traditional quantitative social science research standards. These include factors such as the heavy emphasis on subjectivity, lack of replicability, and the transformation of results into fictional narratives. This belief is rooted in the assumption that the outputs (the scenarios themselves) are the primary source of value from a research perspective. However, these outputs are only one part of the answer. In scenario planning, value is also derived through process – by the very act of participating in discussions, challenging assumptions, working through thought traps, and facing uncertainty. Participants aren't just actors in a process – they are also the beneficiaries.

Therefore, a secondary output of scenario planning is a group of informed individuals who feel empowered to work toward alternative solutions.

For this reason, my recommendation is that when used to discuss Arctic digital divides, scenario planning should not be conducted in isolation but combined with other methods. Its potential as a thought experiment cannot be understated, but it should not be used as the sole determinant for strategic policy initiatives or other targeted actions. It may be appropriate to treat a scenario planning workshop in the same way that public surveys or "what we heard" documents are used to inform decision-making, without directly controlling it. Put differently, scenario planning may be treated as one among several inputs into policy-making.

Scoping for the Arctic

When scenario planning is used to guide corporate strategic thinking, the scope of the exercise is constrained by the boundaries of the company. This helps to clearly define which driving forces are included or excluded. However, when the topic is as broad as "Arctic digital divides", the specifics become lost in favour of the bigger picture. Additionally, a corporation would likely limit its participants to employees and people who know the business well, whereas diverse actors in Arctic issues can range from Indigenous groups, federal policymakers, corporations, and international interveners, all with divergent interests.

While plotting the 2x2 matrix, I felt that many of the driving forces expressed by participants in the transcripts were too broad and lacked the specificity needed to generate unique and/or useful scenarios. I also identified several blind spots that should be considered to ensure a holistic policy planning process.

How can scenario planners leverage the differences between contrasting groups (such as consumers and providers) without pitting them against each other? How can results be presented in a way that is memorable when the intended audiences (recipients of the scenarios) all have different needs and perspectives?

In the context of Arctic digital divides, it may be more effective to break the discussion into more narrow areas of focus. For example, participants could be tasked with discussing Northwestel's incumbency across Canada's three territories, or the technological innovation of Indigenous ISPs. This would enable groups to be more targeted in the selection of driving forces and in any scenarios and/or recommendations produced as a result of the exercise.

Additionally, an invite-only selection of participants would be ideal, so that researchers can ensure that a diverse yet appropriate range of experiences and knowledge are accounted for.

Other potential areas for study could be to conduct scenario planning workshops in specific groups and examine the differences between presented scenarios. For example, how do the scenarios compare/contrast if they are produced by Indigenous groups vs corporate groups vs climate scientists. The fluidity of scenario planning makes it an attractive option for researchers requiring flexible approaches to complex topics.

Subjectivity and Lived Experiences

When I think about what can be deduced about this methodology in the context of Arctic digital divides, I stress that the scenarios generated by the findings are not the main area of focus. Rather, I look at the opportunities this methodology creates for debate, discussion, learning, growth, and imagination. Every time I was required to make a decision in isolation as a sole

researcher, rather than in a workshop setting with invested participants, this opportunity to engage with others in the decision-making process was lost.

Scenario planning is very much a lived experience. It emphasizes the experiences and knowledge of experts, stakeholders, and citizens through a collaborative blend of disciplines and realities. In this way, it is an ideal methodology for Arctic citizens to talk about Arctic futures because they are the ones who will have to live with the potential consequences they foresee.

Perhaps my biggest recommendation for other researchers considering scenario planning is to take the extra steps required to conduct an in-person group exercise. Participants' subjectivity should be considered an invaluable resource in this type of study.

Summary

Scenario planning is complex, nuanced, flexible, and allows for a range of ideas and their variants to find a place within the spectrum of uncertainty. It does not apply judgment on which driving forces are positive or negative but instead creates a space for all variants to safely explore potential outcomes. I believe that this study has demonstrated how scenario planning – despite its shortcomings – has the potential to be an incredibly valuable tool when thinking and talking about digital divides in Canada's Far North.

Conclusion

Considering scenario planning's value of personal experiences, it seems fitting to conclude with some of my own.

This study was researched and written through a myriad of connectivity struggles and disruptions such as being regularly off-grid or unable to find stable connections in Yukon's rural communities. Fibre cuts would result in a complete telecommunications blackout no less than six times (October 2023, November 2023, March 2024, May 2024, July 2024, August 2024) as the Dempster Fibre Line redundancy project continued to limp along . The July 2024 outage lasted nearly 24 hours and disrupted 911 services. Ambulances were positioned at key intersections around town, emergency communications were relayed to citizens over the radio, and crowds gathered at the few locations with publicly-available Starlink access. In August 2024, the Yukon's Premier blasted Bell Mobility, Northwestel, and the CRTC over social media for their "embarrassing" cell phone coverage and telecommunications service in the downtown core of Yukon's capital city (Chishti, 2024). All of this to say that digital divides in Canada's North are very real, and are actively disrupting life in significant ways for Northerners. These are neither rare occurrences nor historical references. This is today and now.

When I first began thinking about this study, I was driven by a desire to know how the telecommunications situation in Canada's Far North had become what it is today. I wanted to understand how different groups/stakeholders could have such significantly different perspectives and interpretations on the success or failure of the system. I wanted to prove that, contrary to corporate messaging, Northerners shouldn't have to just accept poor connectivity as a consequence of where they live.

This study has not conclusively answered any of these questions. But by analyzing the CRTC transcripts, learning from colleagues in Norway, and examining scenario planning methodologies, I feel a sense of optimism that I didn't feel before. Participants in the CRTC hearings were passionate and informed advocates for the North. The HND highlighted the collaborative problem solving that is already happening amongst Arctic nations and being shared with students globally. Scenario planning techniques offered me the freedom to explore and experiment with a topic that mattered to me personally.

As citizens of the Arctic we have a voice in shaping its future. We have the right to expect that our experiences and needs are considered by decision makers in policy implementation. We do not have to accept any future just because it seems most likely. Most importantly, we are responsible for participating in the discussion, learning from each other, getting our hands dirty, and facing uncertainty head-on.

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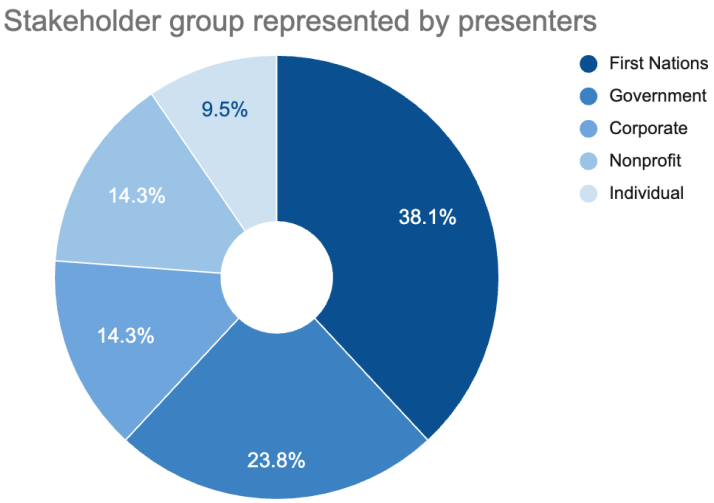
Appendix A: Sector representation across transcripts

Table showing how sector representation was assigned to each transcript. This is the source data used in *Figure 5*.

Transcript	Organization	Participant group
1	Council of Yukon First Nations	First Nations
2	Government of Northwest Territories	Government
3	First Mile Connectivity Consortium	First Nations
4	G&V Global Development	Corporate
5	First Nation of Na-Cho Nyäk Dun	First Nations
6	Government of Yukon	Government
7	SSi Canada	Corporate
8	Iristel	Corporate
9	Public Interest Advocacy Centre	Nonprofit
10	Northern Rockies Regional Municipality	Government
11	Sokolov	Individual
12	Champagne and Aishihik First Nations	First Nations
13	Taku River Tlingit First Nation	First Nations
14	Kluane First Nation	First Nations
15	TELUS Communications Inc.	Corporate
16	National Indigenous Economic Development Board	First Nations
17	Hopkins	Individual
18	Yukon Utilities Consumers' Group	Nonprofit
19	IRP Consulting	First Nations
20	Competitive Network Operators of Canada	Nonprofit
21	Northwestel Inc.	Corporate

Sector represented	Count
First Nations	8
Government	5
Corporate	3
Nonprofit	3
Individual	2
	21



Appendix B: Coding Structure, Definitions, and Examples

Structure of coding scheme by category and theme. Definitions and examples follow.

Theme	Category	Code
1.Governance forces	1.1 First Nation relations	1.1.1 Self governance 1.1.2 Economic reconciliation 1.1.3 Treaties / agreements
	1.2 Policy / legislation	1.2.1 Govt intervention 1.2.2 Human rights
	1.3 Transparency	1.3.1 Statistics 1.3.2 Collaboration / consultation
2. Economic forces	2.1 Affordability	2.1.1 Cost to consumers 2.1.2 Cost to providers 2.1.3 Subsidies / funding 2.1.4 Wholesale
	2.2 Investments	2.2.1 Economic growth 2.2.2 Partnerships
	2.3 Market forces	2.3.1. Monopoly 2.3.2 Competition
3. Social forces	3.1 Participation in society	3.1.1 Interdependencies 3.1.2 Safety 3.1.3 Cultural connectivity
	3.2 Injustice	3.2.1 Disproportionality
4. Technological forces	4.1 Technology	4.1.1 Physical infrastructure 4.1.2 Service delivery 4.1.3 Operators/providers 4.1.4 Innovation
5. Geographical forces	5.1 Digital divide	5.1.1 Digital divide
	5.2 Geolocational factors	5.2.1 Rural/remote 5.2.2 Climate 5.2.4 Logistics

Coding definitions with examples from transcripts.

Code	Definition	Examples from transcripts
1.1.1 Self governance	First Nation governments; independent constitution and legislation	- "we make laws on behalf of our own citizens" - "self-government powers, including law-making, taxation" - "sovereignty over connectivity"
1.1.2 Economic reconciliation	Economic participation opportunities; jobs/ contracts; FN ownership; decolonization of economic streams	- "lack of opportunity for economic participation " - "Cree intern training program" - "average prices and homogenous consumers and users erases the socioeconomic and historical repression"
1.1.3 Treaties / agreements	Land claims; settlement agreements; treaty obligations; Indigenous rights-holders	- "land claim obligations and rights " - "Champagne and Aishihik is a rights-holder, it's not a stakeholder" - "The final agreement is constitutionally protected"
1.2.1 Govt intervention	CRTC powers to intervene; mandated oversight; policy implementation; red-tape; bureaucracy; territorial/ federal legislation	- "apply national policies and standards in the north" - "the competitor quality of service regime" - "immediate need for the CRTC to mandate bandwidth rates" - "Red tape and bloated government bodies are a major inhibitor"
1.2.2 Human rights	Internet as critical utility like electricity; basic human need for survival; international policies like UNDRIP	- "connectivity has come to be a basic need, on the level of other utilities" - "our role and responsibilities in alignment with 94 Calls to Action, UNDRIP, and 231 calls for justice" - "seen as a human right in exactly the same way in which food and shelter are human rights"
1.3.1 Statistics	Accurate data used to inform decision making; collection and reporting on key metrics; open data and transparency; audit trails and accountability.	- "improve the collection of data in rural, remote and Indigenous communities" - "national indicators or targets to evaluate whether its affordability outcomes were being achieved". - "ensure that regulatory decisions are transparent, evidence-based"

1.3.2 Collaboration / consultation	Collaborative decision-making with stakeholders and experts; duty to consult; establish a dedicated "northern" unit in the CRTC	- "obtain their free, prior, and informed consent before adopting and implementing legislation" - "a dedicated Indigenous unit within the CRTC" - "Encourage collaboration and knowledge-sharing to foster a spirit of cooperation and mutual growth"
2.1.1 Cost to consumers	Packages, rates, and overage charges; pricing structures; affordability standards and averages	- "Some people get their service cut off because they can't pay large overage charges" - "elimination of overage fees to improve affordability" - "prices were 37 percent higher in Yellowknife"
2.1.2 Cost to providers	Feasibility of business models in this market; corporate expenses are passed to consumers;	- "capital costs and lower ongoing operational costs" - "Investing in resiliency does not bring added revenue" - "the problem is, no secret, it's very expensive to build infrastructure here"
2.1.3 Subsidies / funding	Subsidization with public money; socialized low-income programs such as Connecting Families; federal or territorial grants	- "inclusion in social programs for low-income broadband users" - "eligible households have access to the discounted internet services available" - "covered currently by ISED funding agreements at $2.1 million per year"
2.1.4 Wholesale	Wholesale access to third-parties and independent ISPs; wholesale pricing and competition	- "implementation of a wholesale access regulatory regime in the three territories" - "mandating wholesale access is at best unnecessary and at worst destructive" - "We rely on Northwestel's Wholesale Connect as a primary transport solution"
2.2.1 Economic growth	Investment opportunities and development projects; participation in the digital economy; business and industry growth.	- "needed by northern Canadians to participate in the digital economy" - "Our business model provides vital local jobs" - "growth and acquisition to include over 3,500 internet subscribers"
2.2.2 Partnerships	Corporate-to-government or business-to-business partnership on projects; economic collaboration and co-investment	- "GNWT partnered with Ledcor and Northwestel to design, finance, build and operate" - "we are prioritizing Indigenous initiatives that are led or partnered with Indigenous communities"

2.3.1 Monopoly	Incumbency; market dominance; control over infrastructure; anti-competitive behaviour	- "ILEC's dominant position over terrestrial facilities and the impact of that dominance on downstream" - "We have to compete with well-financed incumbents who have received government subsidies" - "an abuse of special market power"
2.3.2 Competition	Availability (or lack) of consumer choice; global market influences and threats; diversity of providers	- "competitive ISPs can provide solutions" - "households can decide whether to spend it with Northwestel or maybe with a wireless plan if that meets their needs" - "the market entry of Starlink"
3.1.1 Interdepend-encies	Internet required for participation in society in 21st century; affects other facets of life such as work, education, healthcare, finance, etc.; interwoven	- "Nursing stations and other public services in the communities have told us that the C band connections are not adequate for their needs" - "a vital link for Yukoners to connect with government services, including emergency services" - "I guess our citizens can't join those Zoom meetings, I guess our citizens can't file their taxes"
3.1.2 Safety	Emergency comms such as 911 and accessing evacuation alerts; life-threatening circumstances dependent on connectivity.	- "if there was an emergency, no one would have known" - It's a safety issue in the communities when there are women who are trying to escape violence" - "We cannot call for emergency services when we are faced with life-and-death situations"
3.1.3 Cultural connectivity	Local knowledge; traditional practices (hunting/trapping); the spread of language and culture; elements of First Nations and Northern ways of living	- "contributes to the preservation and dissemination of Inuit culture by improving access to affordable, reliable and high-quality internet services" - "we are very much tied to our land, our traditional territory, and the people and the ancestors” - "how we used to live and operate that's important for our identity and for our ongoing survival"
3.2.1 Disprop-ortionality	Disparity and inequality issues that affect needs and/or service delivery; systemic issues independent of telecoms; fairness.	- "low internet take-up rate of only 63 percent compared to 94 percent for other households" - "exacerbating our existing income inequality" - "Telecommunications can erase the disadvantages of distance and remoteness" - "broadband and connectivity as an equity issue"

4.1.1 Physical infrastructure	The equip/facilities needed to deliver or access service: fibre, satelite, backbone, redundancy; upgrading or future-proofing equip	- "a single vulnerable fibre connection running down the Alaska Highway" - "community-based servers particularly designed for satellite environments" - "current delivery is also reliant on end-of-life copper infrastructure"
4.1.2 Service delivery	Deliverable received by consumer: speed, quality, reliability, latency; customer service; 50/10 standards; disruptions/outages	- "lack of service and quality and reliability" - "the Commission's universal service objective, defined as 50/10 unlimited internet" - "more comprehensive approach to addressing network outages" - "Northwestel's customer service must be improved"
4.1.3 Operators/ providers	Human capital such as technicians, independent operators, community or Indigenous ISPs	- "First Nation internet service providers known as community regional intermediary organizations" - "which has, in turn, cost the North 40 full-time jobs within our company alone" - "dependent on Northwestel's technicians"
5.1.1 Digital divide	Divide in physical access, connectivity, delivery, digital literacy, skills, and consumer experience (North vs South, FN vs non-FN, etc.)	- "northerners are substantially challenged compared to the citizens of southern Canada" - "four times the price of comparable performing services in southern Canada" - "they are now connected by the same leading technology that powers Canada's largest cities"
5.2.1 Rural/ remote	Distance from urban centres; off-grid; isolation; small communities with few customers	- "Internet infrastructure is often the only alternative to a 400-kilometre drive to Whitehorse" - "our most remote communities, many of which are only accessible by plane" - "off-grid residents, plus or minus 100 homes, which is roughly about 30, 40 kms outside Yellowknife"
5.2.2 Climate	Extreme weather/ temperature considerations; permafrost	- "when it's -40 plus, the system freezes for days" - "because the conditions are harsh, roads have to be resurfaced and rebuilt" - "storms" - "under threat of various climate impacts"
5.2.3 Logistics	Supply chain, availability of personnel or skill, accommodation, transportation, etc.	- "technicians who can take days to arrive" - "it takes her three months to get somebody out there" - "availability of charter flights and accommodation" - "availability of equipment"

Appendix C: Code Variants

Code	Variant
1.1.1 Self governance	More independence, isolation from federal Balance of power and responsibilities; stability Less independence, more federal involvement
1.1.2 Economic reconciliation	Opportunity focused "Art on the walls" Injustice focused
1.1.3 Treaties / agreements	Obligations met Implementation in progress Obligations not met
1.2.1 Govt intervention	More govt intervention requested Status quo Less govt intervention requested
1.2.2 Human rights	Low priority (policy matter) High priority (critical utility)
1.3.1 Statistics	Data available but secret (not transparent) Data available and informs decision making No data, or incorrect data
1.3.2 Collaboration / consultation	Poor engagement; insufficient or nonexistent Medium engagement; discussions but no action Good engagement; tangible actions (co-dev)
2.1.1 Cost to consumers	Driven by systemic issues (income inequity) On par with costs in the north (distances, density) Driven by industry
2.1.2 Cost to providers	Rooted in tangibles: infrastructure Rooted in intangibles: Service delivery, politics

2.1.3 Subsidies / funding	Positive economic effect Effect unclear Negative economic effect
2.1.4 Wholesale	Positive solution No effect or effect unknown Negative solution
2.2.1 Economic growth	Policy helps economic dev Policy needed/missing Policy hinders economic dev
2.2.2 Partnerships	Partnership happening Partnership lacking
2.3.1 Monopoly	Increase exclusivity (stability) Maintain status quo (trickle in competition) Dismantle monopoly (disruption)
2.3.2 Competition	Open competition to all Mandated/moderated competition Close competition
3.1.1 Interdependencies	Critical overlap Medium overlap Minor overlap
3.1.2 Safety	Meets/exceeds modern safety standards Neutral Doesn't meet safety standards
3.1.3 Cultural connectivity	Traditional values, practices, knowledge Modern values, practices, knowledge
3.2.1 Disproportionality	Systemic roots: social/racial; income Nonsystemic roots: industry/corporate decisions
4.1.1 Physical infrastructure	Degrading / unsatisfactory / not keeping up

	Stagnation / status quo Upgrading / improving / advancing
4.1.2 Service delivery	Improvements in progress Functional, but needs improvement Broken, critical action needed
4.1.3 Operators/ providers	Community-based solutions No solution available Corporate or outsourced solutions
4.1.4 Innovation	Progressing Advocacy, but little action Stifled
5.1.1 Digital divide	Growing Exists; stagnate; keeps pace with progress Shrinking
5.2.1 Rural/remote	Ruralness impacts service delivery Neutral Ruralness not a factor in service delivery
5.2.2 Climate	Favourable Detrimental
5.2.3 Logistics	Simplified Challenging

Appendix D: Results of code frequency count

Code count results generated by TAMS Analyzer frequency report.

	Transcript #																					
Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	9	20	21	**Total**
111	0	0	0	0	7	0	0	0	0	0	0	0	0	3	1	0	0	0	5	0	0	16
112	3	2	6	0	6	4	3	0	4	0	0	6	8	7	5	6	2	1	12	2	2	79
113	2	0	1	0	7	1	0	0	0	0	0	9	0	4	0	1	0	0	0	0	0	25
121	5	4	4	3	1	9	8	8	8	4	1	4	5	4	1	1	3	4	2	13	7	99
122	2	0	0	0	2	0	0	0	3	1	0	1	1	1	1	3	0	0	1	1	0	17
131	0	12	8	1	0	1	0	1	8	1	2	5	1	0	1	4	1	2	0	0	1	49
132	2	3	4	0	5	3	0	1	0	0	0	10	2	0	7	7	0	0	3	0	3	50
211	11	14	18	5	0	12	4	6	22	7	16	3	2	3	3	4	4	14	5	5	5	163
212	0	1	1	0	0	0	1	2	2	1	1	0	0	0	2	1	0	0	0	0	3	15
213	1	8	7	3	0	5	1	5	10	4	2	1	0	0	9	0	4	4	2	2	4	72
214	2	5	1	1	0	2	13	2	5	3	0	0	0	0	0	0	0	2	0	16	2	54
221	2	2	0	0	3	3	4	3	1	0	0	1	1	1	0	4	1	0	0	1	2	29
222	0	1	1	0	1	1	2	0	0	0	2	0	1	0	2	0	0	0	3	0	4	18
231	0	0	1	1	1	0	5	4	0	3	5	0	0	0	2	0	2	4	1	2	0	31
232	4	5	6	2	0	4	12	6	4	5	7	0	0	4	6	0	9	5	1	10	6	96
311	2	1	8	0	4	4	0	0	1	1	3	0	2	7	0	7	1	1	16	0	0	58
312	0	1	2	0	3	2	1	0	0	1	0	0	6	1	0	3	1	0	0	0	0	21
313	0	1	4	1	4	0	2	0	0	0	0	0	1	2	0	0	0	0	1	0	0	16
321	2	5	2	0	1	3	1	1	5	6	2	0	2	2	3	7	2	2	1	0	2	49
411	3	1	6	2	0	0	4	2	0	4	5	0	2	1	1	0	1	0	0	1	3	36
412	9	11	23	2	1	10	4	7	2	8	1	3	5	12	6	2	6	2	4	4	6	128
413	0	0	12	2	0	0	6	0	0	0	0	0	0	0	1	0	0	0	3	0	2	26
414	0	3	5	0	0	4	12	5	1	0	0	0	0	2	3	2	3	2	3	0	4	49
511	6	6	2	2	2	6	1	4	1	3	0	0	3	9	1	2	0	3	8	3	3	65
521	4	7	13	2	4	3	3	2	0	2	1	0	1	0	1	3	1	3	1	0	6	57
522	0	1	1	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	7
523	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	1	6

Appendix E: Results of variance frequency count

Results of variant count (per code), represented as a percentage. Standard deviation measured using the formula:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}.$$

Code	Code freq count	Variant	Variant freq count	% of total	Standard deviation
111	16	+	0	0%	47.14
		=	16	100%	
		-	0	0%	
112	79	+	23	29%	13.02
		=	40	51%	
		-	16	20%	
113	25	+	2	8%	33.03
		=	20	80%	
		-	3	12%	
121	99	+	71	72%	27.64
		=	19	19%	
		-	9	9%	
122	17	+	7	41%	9
		-	10	59%	
131	49	+	12	24%	8.73
		=	15	31%	
		-	22	45%	
132	50	+	31	62%	22.17
		=	15	30%	
		-	4	8%	
211	163	+	40	25%	24.79
		=	13	8%	

		-	110	67%	
212	15	+	10	67%	17
		-	5	33%	
213	72	+	39	54%	15.17
		=	20	28%	
		-	13	18%	
214	54	+	41	76%	30.44
		=	4	7%	
		-	9	17%	
221	29	+	20	69%	25.61
		=	6	21%	
		-	3	10%	
222	18	+	13	72%	22
		-	5	28%	
231	31	+	3	10%	16.49
		=	14	45%	
		-	14	45%	
232	96	+	43	45%	21.63
		=	50	52%	
		-	3	3%	
311	58	+	49	84%	36.41
		=	9	16%	
		-	0	0%	
312	21	+	0	0%	37.67
		=	3	14%	
		-	18	86%	
313	16	+	14	88%	38
		-	2	13%	
321	49	+	32	65%	15
		-	17	35%	
411	36	+	16	44%	8.98
		=	8	22%	

		-	12	33%	
412	128	+	18	14%	14.81
		=	64	50%	
		-	46	36%	
413	26	+	17	65%	23.69
		=	2	8%	
		-	7	27%	
414	49	+	23	47%	14.05
		=	19	39%	
		-	7	14%	
511	65	+	5	8%	39.41
		=	58	89%	
		-	2	3%	
521	57	+	47	82%	34.65
		=	8	14%	
		-	2	4%	
522	7	+	0	0%	50
		-	7	100%	
523	6	+	0	0%	50
		-	6	100%	

Appendix F: Scenario Summaries From Figure 18

Scenario 1: Open Market

NWTel is still the incumbent but new opportunities fuelled by reconciliation efforts lead to increase in Indigenous and community-based ISPs to fill gaps. This drives local competition and innovation which forces NWTel to upgrade infrastructure. Accurate statistics are used by corporations to develop targeted marketing campaigns, monetizing audience sectors. While NWTel is still regulated, CRTC complaints have significantly decreased and government intervention eases. Inequities persist, but this is the closest version of "open market" achieved to date.

Scenario 2: Socialist Telecoms

A blitz on righting past wrongs leads to a wave of targeted subsidies, funding programs, and policy changes to expedite reconciliation efforts. Focus on leveling disparities and increasing collaboration makes telecoms a social issue, ignoring economic and technological needs. Innovation and investment stall as profits are minimal, however the holistic/healing approach leads to better representation and understanding of needs which is reflected in services that are appropriately adapted. Success may be short-lived unless economics match progress.

Scenario 3: The Pendulum Swing

Reconciliation efforts implemented too swiftly and poorly. Subsidy funding made available but put in corporate hands rather than consumers. Training programs for Indigenous staff are expensive and burdensome. Corps see decreased capital that stalls upgrades. Opening competition to other ISPs leads to market saturation and consumer split since there is very

limited # of customers. In an effort to gain a foothold, corporations act in secrecy. Interdependent sectors (health, education, banking) begin to suffer and telecoms becomes scapegoat for all problems.

Scenario 4: Rising Tensions

Hyperfocus on correcting disproportionality causes system imbalance. Stereotypes and racial tensions rise as metrics used for segregation rather than integration. Duty to consult not met, fracturing relations between First Nations and corporations. Federal government steps in with a heavy hand in an attempt to regain control. Innovation sees a short, optimistic spike as entrepreneurs attempt to find solutions, but this peters out due to instability deterring investors. Rural communities continue to suffer more than others and the digital divide grows as service delivery seems to move in reverse.