

Rajabiun, Reza

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The Rise of Broadband as an Essential Utility and Emergent Concepts in Universal Access in Advanced Economies: Perspectives from Canada

Reza Rajabiun*

Ted Rogers School of Information Technology Management
Ryerson University, Toronto, Canada
&
Algorithmic Media Observatory
Concordia University, Montreal, Canada

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Abstract

This article investigates how the transition of broadband Internet connectivity to an essential utility has influenced the development of universal access objectives and policies in Canada. In order to better understand the interplay between economic reality of broadband as an essential social and business input and the policymaking process, the article utilizes Natural Language Processing (NLP) tools to map conceptual emphasis in the content of submissions by stakeholders to the telecom regulator in proceedings to review Canada's universal access policy framework between 2009-2016. The analysis documents that increasing essentiality of broadband Internet access services as an enabler of social and economic activities makes their quality and affordability problems with general economic and policy relevance that cross the traditional conceptualization of universal access in terms of the rural-urban digital divide.

Contact address: reza.rajabiun@gmail.com; This research was undertaken, in part, thanks to funding from the Canada Research Chairs program and was supported by the Social Sciences and Humanities Research Council (Canada) and Ryerson University. Disclosure: I participated in the regulatory proceedings analyzed in this article as a consultant for Media Access Canada (MAC)/Access 2020 Coalition of Canadians with disabilities, as well as regional associations of rural municipalities from Ontario. Along with my colleagues David Ellis and Catherine Middleton, I was also engaged by the Canadian Radio-television and Telecommunications Commission (CRTC) to evaluate available policy options for addressing concerns about the affordability of basic communications services in Canada. The views expressed herein are the author's alone and should not be interpreted to reflect those of any organizations with which I am affiliated.

I. Introduction

Although the majority of the world's population still lacks access to the Internet¹, broadband connectivity has become an essential part of everyday life and work for a large majority of people in high-income countries. Starting from a luxury available to small networks of early adopters in the 1990s, broadband networks have become a necessity for individual social and economic participation in society, productivity growth in business, and delivery of public goods such as education and healthcare. As reliable and affordable broadband access is now an essential enabler of economic development and international competitiveness (Ayanso & Lertwachara, 2015; Lüdering, 2016), governments and policymakers are considering ways to ensure that broadband is available for all.

This article utilizes a novel methodology to evaluate how the rise of broadband as an essential utility has been conceptualized by stakeholders and influenced universal access policy formation in Canada. In addition to calls on policymakers to recognize broadband Internet access as a universal service and adopt policies for achieving some minimum standards of universal service availability, the rise of voice over Internet Protocol (VOIP) and mobile telephony make it increasingly inefficient to maintain regulatory obligations to deliver plain-old-telephone service (POTS) on old copper networks. The economic imperative to decommission old technologies and universal access obligations on POTS tend to complement growing impetus on telecom policymakers to recognize broadband as an essential utility and to implement policies that ensure access to some minimum level of service is universally available - regardless of where people live or their ability to pay for what has become a necessity for social and economic participation.² Evolving preferences regarding economic efficiency and the role of the government in promoting equality of opportunity are therefore be relevant in explaining and predicting observed universal access policies.

This article analyzes the content of stakeholder submissions to the Canadian Radio-television and Telecommunications Commission (CRTC, the Canadian telecommunications regulator) in a series of proceedings from the late 2000s to 2016 when the agency redefined high-speed Internet access as a "basic service".³ The methodology adopted here to study the Canadian policy formation process contributes to a growing body of research on the applications of natural language processing (NLP) and text mining to the analysis of policymaking (Ngai & Lee, 2016). The next section provides an overview of the universal access policymaking processes relevant for understanding stakeholder participation and the emergence of ideas they emphasized to policymakers. Section III describes the methodology and data. Section IV presents and analyzes the results. Section V discusses the relevance of employing content analytics for monitoring and developing effective strategies for influencing policymaking.

¹ Around 60% of the population according to World Bank (2016).

² e.g. In relatively high-cost rural areas where the business case for deploying broadband infrastructure is limited or with respect to relatively low-income vulnerable groups in environments with relatively high prices and limited price differentiation.

³ Telecom Regulatory Policy CRTC 2016-496.

II. Context: Multilevel governance and universal service standards

Under Canada's federalist arrangements, telecommunications regulation is under federal jurisdiction, but the provinces are responsible for delivering social and business infrastructure that supports economic growth and development (Rajabiun & Middleton, 2013). This has created relatively strong impetus for some provinces and lower levels of government to implement policies that aim to promote broadband infrastructure development and universal access to high-speed Internet connectivity. Provincial commitments and strategies to promoting universal access to high-speed access have varied; including investing directly in open access transport infrastructure (e.g. Alberta), trading procurement guarantees for the delivery of open access points of presence and higher speeds in rural communities with the incumbent operator (British Columbia), maintaining some measure of public control over incumbent copper network operators (Manitoba and Saskatchewan), and supporting regional public-private partnerships designed to expand access, improve speeds, and extend high-capacity fibre networks deeper into rural areas and small towns where the business case for operators to invest in broadband infrastructure is limited (Ontario).

In contrast to various European countries where municipal and regional governments have worked with private sector financial intermediaries to raise capital for so-called carrier-of-carrier strategies⁴, in Canada the scope for this approach has been historically limited as dominant financial institutions (banks and pension funds) also tend to be some of the largest institutional investors in the small number of large incumbents that dominate markets for fixed and mobile access (i.e. "the big three"). Large network infrastructure operators have also been very reluctant to engage in public-private partnerships in which the public sector retains some measure of control over essential network facilities, preferring direct subsidies to expand coverage and provision more network capacity to meet growing demand by users for network resources. The consequence has been that Canada has some of the highest public investment levels in telecommunications infrastructure in high-income countries.⁵

Much like many other advanced economies, universal access policies in Canada have traditionally focused on extending access to some form of connectivity in relatively higher cost and low revenue rural markets. While speeds and latency remain substantially lower in rural communities (the technical side of the universal access challenge), over the past decade it has become increasingly apparent that affordability and reliability of access to Internet connectivity (the economic side) is an issue in urban and rural areas. The fact that fixed and mobile broadband subscription and data prices in Canada tend to be some of the highest among advanced economies (CRTC, 2016a) makes affordability a barrier to network access and use by low-income vulnerable groups regardless of where they live.

⁴ e.g. One single ultra high-capacity fibre network or 4G+ mobile with over-the-top (OTT) service based competition.

⁵ According to relatively comparable international statistics from OECD, public telecommunications investment per total communication access paths in Canada was around \$163 annually (in USD, 2011-2013 average) in the period that preceded the CRTC basic service proceedings analyzed in this article. This is substantially higher than the OECD average for the same period of \$94; only Australia (\$201) and Switzerland (\$183) have higher public commitment levels than Canada; the U.S. rate is about the same at \$160 per access path. Source: OECD Digital Economy Outlook 2015. Table 2.30. Available at: <http://www.oecd.org/sti/ieconomy/deo2015data/2.30-InvestPath.xls>

Broader technological trends have also been reshaping what users expect in a “basic service”. Various classes of advanced ICT applications require reliable and increasingly symmetric connectivity to the “the cloud”, which can be challenging to deliver on older networks. Increasing interest by lower levels of government in building “smart cities” and “intelligent communities” enabled by ubiquitous fibre and advanced mobile networks also plays a part in shaping universal access policies that cross the traditional conceptualization of universal access policies in terms of the rural-urban digital divide. The confluence of technological change and universal access policies directs attention to key questions facing policymakers in Canada and other advanced economies.

While everybody agrees that universal access to the Internet is a desirable outcome, determining the standard of service that should be considered the basic minimum represents a critical source of contention in the design of universal service policies with respect to broadband: Universal access to what? Establishing national targets and standards that are congruent with the existing technological landscape would be relatively easy to achieve and perceived to be realistic. However, they are not necessarily efficiency enhancing in terms of economic policy and digital development as higher minimum standards of service may be desirable for incentivising private operators and “market forces” to decommission old broadband technologies and deploy new fibre access networks that can scale to growing demand for network resources, more symmetric bandwidth, and minimum service quality standards (e.g. warranty of an upper bound for connection latency).

Questions about standards of service for broadband, and about the role of the federal government in developing universal access policies are not new and can be traced back to the early 2000s when Canada’s Minister of Industry set up a National Broadband Task Force (NBTF, 2001).⁶ Led by a future Governor General of Canada, and including chief and other high-level executive management figures from large telecom operators and large institutional investors in them, equipment providers, representatives of educational institutions and others, this Task Force “concluded that a minimum two-way, or symmetrical, transmission speed of 1.5 Mbps per individual user is required...” to achieve a standard of service that would enable universal access to the range of emerging Internet applications and services available at that time.⁷ To reach this objective NBTF offered a set of recommendations, including to “maximize the role and risk taking of the private sector”, ensuring “competitive and technological neutrality” and “third-party open access”. In addition to public subsidies in transport facilities, the NBTF estimated that reaching the 1.5 Mbps symmetric minimum standard of universal service on legacy copper (i.e. DSL, cable), wireless, and satellites would require a public investment of about \$900 million to \$2 billion in access networks.

Although NBTF’s recommendations with respect to open access obligations on transport facilities, support for municipal and community driven initiatives, and minimum standard of service were not ultimately adopted, the strategy NBTF adopted in 2001 to “minimize deployment costs” by subsidizing upgrades to legacy copper networks serving rural communities (versus directing public subsidies to new fibre technologies) remains relevant for contextualizing ongoing debates about the design of universal access policies. Importantly, subsequent federal

⁶ See final report for details available at: <http://publications.gc.ca/collections/Collection/C2-574-2001E.pdf>

⁷⁷ Page 2, NBTF final report.

subsidy programs interpreted the 1.5 Mbps download speed the NBTF recommended as the minimum effective bandwidth that was required in 2001 as the minimum “best effort” speed for eligibility to receive public subsidies.⁸ Despite ongoing calls from rural communities, the CRTC continues to resist imposing third party open-access obligations on high capacity fibre transport facilities. It insists on identifying underserved communities based on speeds that operators claim are theoretically available within a particular area; versus minimum measured effective bandwidth and quality of service users experience.

In the subsequent years, significant investments in upgrades to cable TV networks to deliver higher speed Internet connectivity provided a basis for rapid growth in penetration rates of broadband connectivity in Canada’s urban centres. For this reason, in the early to mid 2000s Canada was generally viewed as a success story in terms of broadband development (Frieden, 2005). This early lead by cable companies in upgrading their networks (at a time when competing incumbent DSL operators chose to adopt a “sweat the copper” strategy rather than deploying fibre-to-the-premises (FTTP) to compete with higher speeds of cable), explains why fixed broadband uptake rates on cable networks were among the highest in the world.⁹ Enabling the delivery of faster Internet connectivity and bundled telecom and media services, users with a preferences for higher speed broadband increasingly migrated to cable providers, a trend broadly similar to the U.S. market in this period.¹⁰

Despite the apparent success, by the mid 2000s it was increasingly apparent that private sector incentives to extend and/or upgrade faster cable and fibre transport/middle mile facilities in rural communities were not adequate and a rural-urban broadband divide was rapidly expanding. In contrast to the industry-dominated National Broadband Task Force, in 2005 the federal government responded to these concerns by establishing a three-member Telecommunications Policy Review Panel (TPRP) supported with professional staff and tasked them with conducting public consultations and offering their policy recommendations.¹¹ In other words, the federal government essentially bypassed the agency mandated by the Parliament to develop and implement policies based on a specific set of economic and social policy objectives under Section 7 of the *Telecommunications Act*.

In addition to receiving written submissions, the TPRP held a variety of informal consultations with industry, consumer groups, and lower levels of government. As such, it may have appeared to be more inclusive than the earlier NBTF approach. Recognizing that Canada was already

⁸ The federal government and the CRTC essentially ignored NBTF recommendation about 1.5 Mbps upload speeds, which remain technically challenging to deliver even today on long loop DSL plants. In areas without upgraded cable DOCSIS plants, users requiring this minimal level of upstream capacity remain unserved under the 2001 minimum service standards agreed upon by members of a Task Force dominated by chief executive and investors in large incumbent operators that continue to dominate the provision of fixed and mobile network infrastructure in Canada.

⁹ By 2011 residential Internet access market shares of cable carriers in terms of revenues was at 55% of the total, whereas incumbent telco’s had 38%. Although market share of telco’s has remained steady since, there was a marginal increase in competition from other service providers (i.e. non-facilities based resellers) and market share of cable companies declined to about 50% by 2015. CRTC Communications Monitoring Report (2016). Figure 5.3.1.

¹⁰ Note that in the U.S. FTTP penetration rates are nearly twice that of Canada, reflective of the fact that some incumbent DSL providers choose to deploy FTTP in certain urban centres (e.g. Verizon).

¹¹ TPRP’s 2006 final report available at: [https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/tprp-final-report-2006.pdf/\\$FILE/tprp-final-report-2006.pdf](https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/tprp-final-report-2006.pdf/$FILE/tprp-final-report-2006.pdf)

beginning to fall behind leading countries in Asia and Europe in terms of FTTP deployment, it recommended a long list of policy recommendations. These included a call on the government to “immediately commence a program to ensure that affordable and reliable broadband services are available in all regions of Canada, including urban, rural and remote areas, by 2010 at the latest”.¹² The primary vehicle for achieving this objective recommended by the TPRP was a proposed Ubiquitous Canadian Access Network/Ubiquité Canada or U-CAN program to subsidize expanding access to transport facilities in areas where the private sector business case for doing so was limited.¹³ It also recommended keeping the “basic service” obligation to serve telephone services, but did not explore the statutory responsibility of the CRTC to expand universal access obligations to high-speed Internet access as a basic service, suggesting market forces and targeted transport subsidies would be sufficient to achieve ubiquitous access to broadband connectivity by 2010.

While most of its recommendations were not adopted as the federal government had changed by the time TPRP’s final report was submitted, one of its key recommendations is notable for understanding the evolution of semantics in subsequent CRTC basic service proceedings we analyze in this paper. One of the many recommendations of the TPRP was to alter statutory objectives under S.7 of the *Telecommunications Act*. Section 7.b of the Act required telecommunications policy to render “reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada.” The TPRP recommended this be changed to “promote affordable access to advanced telecommunications services in all regions of Canada, including urban, rural and remote areas”.¹⁴ Reliability and quality of service considerations were therefore deemphasized in this proposed construction relative to the more economic approach specified by the Parliament in the 1993 Act (requiring policymakers to consider both *quality* and *affordability* parameters of access to communication services considered basic in their decisions). Even though this early attempt at constraining the statutory authority of the independent regulatory agency with respect to standard setting was not successful, it represents an early manifestation of a strategy, promoted by operators, that remains relevant today.¹⁵

Following the delivery of the TPRP report in 2006, the new Minister of Industry issued a directive to the CRTC ordering it to: “i) rely on market forces to the maximum extent feasible as the means of achieving the telecommunications policy objectives, and, (ii) when relying on regulation, use measures that are efficient and proportionate to their purpose and that interfere with the operation of competitive market forces to the minimum extent necessary to meet the policy objectives”.¹⁶ This conceptualization of “market forces” and public regulation as a competing, rather than complementary, institutional mechanism relative to markets continues to cast a long shadow in shaping subsequent regulatory policy formation processes across a wide

¹² Recommendation 8-1-b

¹³ TPRP further recommended as a condition for receiving the subsidy, operators should be required to provide third party access to these facilities at a discount that reflects the public subsidies.

¹⁴ Recommendation 2-2.

¹⁵ The current government has called for a review of the *Telecom Act*, which makes this point particularly relevant as potential changes along these lines are likely to be proposed by dominant infrastructure operators accustomed to “best effort” services and non-binding aspirational speed targets versus minimum speed/service quality universal access standards.

¹⁶ Order Issuing a Direction to the CRTC on Implementing the Canadian Telecommunications Policy Objectives. SOR/2006-355. Available at: <http://laws.justice.gc.ca/eng/regulations/SOR-2006-355/page-1.html>

variety of subject areas at the CRTC in the subsequent decade, including wholesale/essential facilities obligations to fibre transport and access facilities, mandated Mobile Virtual Network Operators (MVNOs), consumer protection, and universal access to broadband as a “basic service”.

The 2006 Policy Direction (aka “The Bernier Directive” per the minister that issued it)¹⁷ can be viewed as the start of a decade long policymaking process that ultimately resulted in the CRTC recognizing “high-speed” Internet access as a basic service in 2016. Pursuant to the political directive to minimize regulation with the hope that it would maximize market forces, large incumbents subject to existing obligations to serve used the opportunity to convince the CRTC to remove existing universal service obligations. The CRTC 2009-575 Notice of Consultation initiated the multi-stage CRTC “basic service” proceedings analyzed in the subsequent sections in this article:

“In Telecom Decisions 2007-51 and 2008-34, the Commission established action plans to review existing regulatory measures pursuant to the Governor in Council's Policy Direction. The action plans identified the obligation to provide telephone service (obligation to serve) and the local service subsidy regime as matters to be reviewed; however, in the proceedings that led to the development of the plans, parties provided little or no reasons for reviewing these particular measures. While neither plan mentioned the basic service objective for review, the Commission considers that this measure is associated with both the obligation to serve and the local service subsidy regime, and that these three measures are interrelated.” (para. 1).

Based on public feedback to this Notice, the Commission determined that it would be appropriate to start a more comprehensive review of the basic service framework as it related to both existing and potentially new basic service policies relating to broadband Internet connectivity. In Telecom Notice of Consultation 2010-43, the CRTC explicitly opened the door to incorporating high-speed Internet access into the basic service framework and adopting some minimum standards of service quality that operators should make universally available:

“Is the basic service objective still necessary and, if so, what should it comprise? Specify the services/obligations as well as the appropriate technical specifications (e.g. high-speed Internet access at a minimum speed of 1 megabit per second) to be included in the basic service objective.” (para. 14).

Although these questions were opened and brought within the purview of consideration in the first of the two proceedings analyzed here in order to capture the evolution of the debate, in the CRTC 2011-291 decision that followed the agency did not reclassify high-speed access as a basic service or decommission universal access obligations relating to legacy telephone and low-speed data. Instead, it adopted aspirational broadband speed targets of 5 Mbps downstream and 1 Mbps upstream, which it considered should be available to all Canadians by 2015 when it planned to review the effectiveness of its basic service policies.¹⁸ In the subsequent review

¹⁷ It is noteworthy that the former minister has been more recently calling for the abolition of the CRTC. See: <http://www.cbc.ca/news/business/maxime-bernier-telecom-1.3620155>

¹⁸ The extent to which the 2011 aspiration targets achieved their objective was extensively debated at the CRTC 201-134 hearing, with the federal regulatory agency and network operators claiming that they were (based on data

(CRTC 2015-134 Notice of Consultation), the CRTC did not adopt binding universal access obligations for broadband access, but declared broadband as a basic service and has started to decommission the old subsidy regime for the provision of universal access to legacy telephone services (CRTC 2016-496 decision).

Practical implications of the new policy direction are not yet known and are beyond the scope of this article to analyze. What is relevant from the brief overview above is the broad alignment of regulatory conceptualization of broadband and the economic reality that access to reliable and affordable connectivity has become essential for social and economic participation of individuals, business productivity growth, and delivery of other public goods such as education and healthcare.

In CRTC 2016-496 the agency also increased its aspirational speed targets from 5/1 to 50/10 Mbps, instituted an industry funded cross-subsidy mechanism to improve fixed and mobile connectivity in underserved communities to these standards, and set up a working group to study the development of minimum Quality of Service (QoS, e.g. latency) standard in the future. Implementation of these policies is currently underway. This rest of this article focuses on the evolution of stakeholder perspectives that led to these policy outcomes in order to better understand the interplay between market forces that have made broadband Internet access an essential utility and state institutions designed to promote universal access to reliable and affordable basic communications services.

III. Methodology and data

A simple explanation for the observed shift in the position of the regulatory agency with respect to the formal classification of high-speed connectivity between the late 2000s and 2016 is the growing essentiality of fixed and mobile connectivity during this period. Over this period, a larger proportion of the population became more reliant on access to multipurpose fixed and mobile networks. This may have made it increasingly costly for policymakers to avoid recognizing that high-speed Internet connectivity has in fact become the most basic of communications services on top of which all others applications and services are delivered. In parallel to this trend, with the diffusion of IP-based infrastructure it has also become increasingly costly for operators to maintain old copper-based telephone systems and decommissioning them can generate substantive cost savings to incumbent operators who are subject to existing universal access obligations on telephone and “low-speed” data access on legacy platforms. Growing costs of regulatory obligations to maintain aging copper POTS infrastructure over this period may have also contributed to explaining the 2016 policy outcomes outlined above.

Although this simple economic framework for explaining regulatory persistence and change might be relevant to examine long term trends in the interplay between state and market mechanisms, it is too deterministic to be plausible for understanding short to medium term trends in universal access policymaking. This is because policy outcomes that capture regulatory bargains among competing interests tend to be shaped by the design of the policymaking process in the first place, as well as collective action and agency by stakeholders potentially impacted by

on advertised speeds), while stakeholders from rural and remote communities demonstrating that actual speeds providers deliver to them can fall substantially below these aspirational targets.

the particular public policy or regulation under consideration. The rest of this article explores this collective action process by analyzing the content of the submissions to the CRTC basic service proceeding between the late 2000s and 2016. The content and concept centric methodology adopted here aims to offer a richer account of the universal access policymaking process than the simple deterministic economic model of institutional change/persistence noted above.

Procedural design: In contrast to federal government attempts to develop a universal service strategy for broadband in the early to mid 2000s (NBTF, 2001; TPRP, 2006), the origins of the 2009-2011 CRTC proceedings were a product of attempts by large incumbent operators to remove old universal access obligations to serve high-cost areas and cross-subsidize other service providers that service rural and remote communities. The design of the regulatory process for the earlier 2009-2011 proceeding was relatively ad hoc, consisting of a number of sub-proceedings in which different groups of operators and other stakeholders participated. For the second proceeding pursuant to which the agency declared broadband as a “basic service”, the 2015-134 Notice of Consultation adopted a more methodical approach, setting out a clear schedule for a multi-phase process of public consultation process that ultimately took nearly two years to complete. Even though long and cumbersome to follow, the procedural design enabled parties to the proceeding to question each other on the public record and provided the opportunity for a large number of submissions from individual consumers, consumer and rural advocacy organizations, and lower level of government.¹⁹

With the notable exception of incumbent telecom operators and large cable companies, most of the submissions supported the threshold legal issues of redefining broadband access as a basic service and adopting binding universal service obligations. This suggests another simple explanation of the eventual policy outcomes as evidence of CRTC’s responsiveness to popular demand for aligning public regulation with economic reality. However, in opening relatively transparent communication channels with the “public”, the agency could have predicted that this would happen. It would be therefore reasonable to suspect that policymakers could have predicted that by opening these input channels they would generate public support for redefining broadband as a basic service and execute a Solomonic bargain to achieve competing objectives: To redefine broadband as a basic service, but not to impose binding universal access obligations and minimum service quality standards that would threaten the interests of large industrial interests with the capacity to push back against egalitarian public policies they believe would harm their private interests.²⁰

Methodology: To explore the complexity of the policymaking process, while minimizing the potential for biases to impact our retrospective analysis through automation, we utilize a general purpose content/text analysis software tool to extract and map emergent concepts and their

¹⁹ Around 50,000 individual submissions. The vast majority of these were in the form a petition letter and individual comments collected by the consumer advocacy organization OpenMedia and submitted to CRTC on behalf of the parties. Given the similar language in this class of submissions, they are excluded from the quantitative linguistic analysis that follows in order to reduce “noise” that might bias the results and make it difficult to identify more nuanced “signals” from stakeholder submissions.

²⁰ Earlier calls for statutory reform by the TPRP (2006) and ongoing ones to review the 1993 statutory framework that delegates wholesale and retail regulatory authority primarily to the CRTC should be viewed in this context.

evolution between the 2009 and 2016 CRTC proceedings.²¹ We evaluate and contrast different corpuses of written and oral submissions (described in detail below) to the CRTC over the two proceedings using a two-stage analytical methodology: First, we extract the content of the submissions and generate quantitative indicators of frequencies by which the words co-occur relative to each other (i.e. co-occurrence frequency matrix). This allows for constructing concrete quantitative indicators of the relevance of words and identifying “concepts” as they arise organically in the textual input from the parties trying to influence the policymaking process in terms of their co-occurrence relative to all other words and emergent concepts.²² The Appendix provides a list of emergent concepts in the transcripts of the two proceedings we analyze in this article, as well as a standardized quantitative indicator of their statistical relevance and visual depictions of their evolving relevance between 2010 and 2016 proceedings.

To explore underlying relationships among discovered concepts, we use iterative clustering algorithms in our textual analysis software designed for identifying groupings of concepts, or higher level “themes”.²³ For the purposes of this paper we present intuitive visual depictions of the results built on co-occurrence frequency matrices of particular corpuses and clustering algorithms for exploring their interconnectedness. In order to capture relevance of concepts and themes compared to each other, the visualizations are “heat-mapped” and situated in the content maps in relation to each other (i.e. concepts/objects placed near each other are more closely associated compared to those further apart).²⁴ Lines between concepts in the “network trees” depicted in the visualization of content data represent those with the highest statistical relevance pursuant to the application of particular clustering algorithms that enable identification of emergent concepts, themes, and connection paths among them.

While much of this analysis is automated and our software has very valuable algorithms for merging word variants, subsequent to quantitative content extraction and creating the organic co-occurrence frequency matrices, we engage in some degree of human supervision to merge word variants that stemming algorithms in our software cannot identify and further filter out other uninformative/noisy concepts from the analysis (e.g. names of persons/organizations, repeated words such as “page” and “paragraph”, standardized procedural jargon, etc.).

Data and sampling: Our primary source of data is the content of the written submissions and oral hearing transcripts from the two CRTC proceedings, the first one in 2009-2011 and the second in 2015-2016. For the purpose of this paper, we ignore “meta-data” of the submissions

²¹ See: <https://info.leximancer.com/> ; for a discussion of quantitative concept extraction and clustering algorithms underlying Leximancer system, see: Smith & Humphreys (2006). For a review of diverse applications of content analysis/NLP to policymaking see: Ngai & Lee (2016)

²² As such, this approach is more systematic and robust to discovering key ideas compared to the simple counting of words and ranking them by their absolute frequencies of appearance.

²³ It is relevant to note that clustering algorithms for discovering “themes” in Leximancer are stochastic, and therefore their results cannot be exactly replicated. Some measure of cleaning up the sample from uninformative and noisy words, as well as experimentation and clustering optimization with human supervision is therefore required and has been exercised.

²⁴ Depending on the clustering algorithm we are using. The “social network” algorithm tends to emphasize the interconnectedness among discovered concepts, while the “topical” algorithm puts a greater weight on their distinctiveness. We also use special learning processes in Leximancer for segmenting emergent concepts across different bodies of public submissions to the agency over time and across stakeholders trying to shape its regulatory policy direction in this matter.

(e.g. identity of sender, size or other high-level features of their submissions to the agency) in order to abstract away from the semantics of individual participants and focus on emergent ideas as they evolved over time and among diverse groups of stakeholders in the development of broadband infrastructure. To evaluate semantic variation among different groups of operators and stakeholders in the 2016 process, stratified purposeful sampling of the submissions is used to segment stakeholders into 6 groups and analyze the diversity of their input into the policy formation process at the CRTC, but do not identify the parties in each group individually.²⁵

Both proceedings consisted of a series of stages, including the opportunity for the parties to ask questions, provide written replies, appear before the Commission at the public hearing, and offer final comments. Some parties participated in all phases of the two proceedings, submitting lengthy documents, with some including multiple attached legal opinions and economic studies to support their positions. These parties include large network operators with substantive resources devoted to shaping public policy in their private interests. Consumer advocacy organizations, non-profit organizations, and lower levels of government that participated were generally not as engaged as large operators along the various stages of the multistage processes and provided relatively shorter submissions. For the purpose of this article, we exclude appended studies, interrogatories, reply comments, French language submissions, and the large numbers of short submissions by individual consumers from the analysis.²⁶ Instead, we focus on the analysis of substantive comments (more than 5-10 pages) and oral transcripts of hearings because they tend to offer a more diverse and consistent basis for extracting key emergent concepts and tracking them over the two proceedings. Focusing on this subset of substantive interventions further helps mitigate against the potential for biases that can arise from wide disparities in the quantity of noise some resourceful parties tend to produce with lengthy submissions; which overload policymakers with “noise”, making it harder for policymakers to observe relevant “signals”, and help shape eventual policy outcomes in an effective manner. We analyze the submissions to the basic service policymaking process at the CRTC between 2009 and 2016 in three steps:

- Analysis of an aggregated corpus from both proceedings to identify key emergent concepts and their evolution over time.
- Stepwise analysis of the evolution of the debate in the 2015-2016 proceedings from the first submissions, to hearing transcripts, and the final submissions.
- Deconstruction and mapping of conceptual emphasis by different groups of participants in their final submissions to the 2015-2016 proceeding.

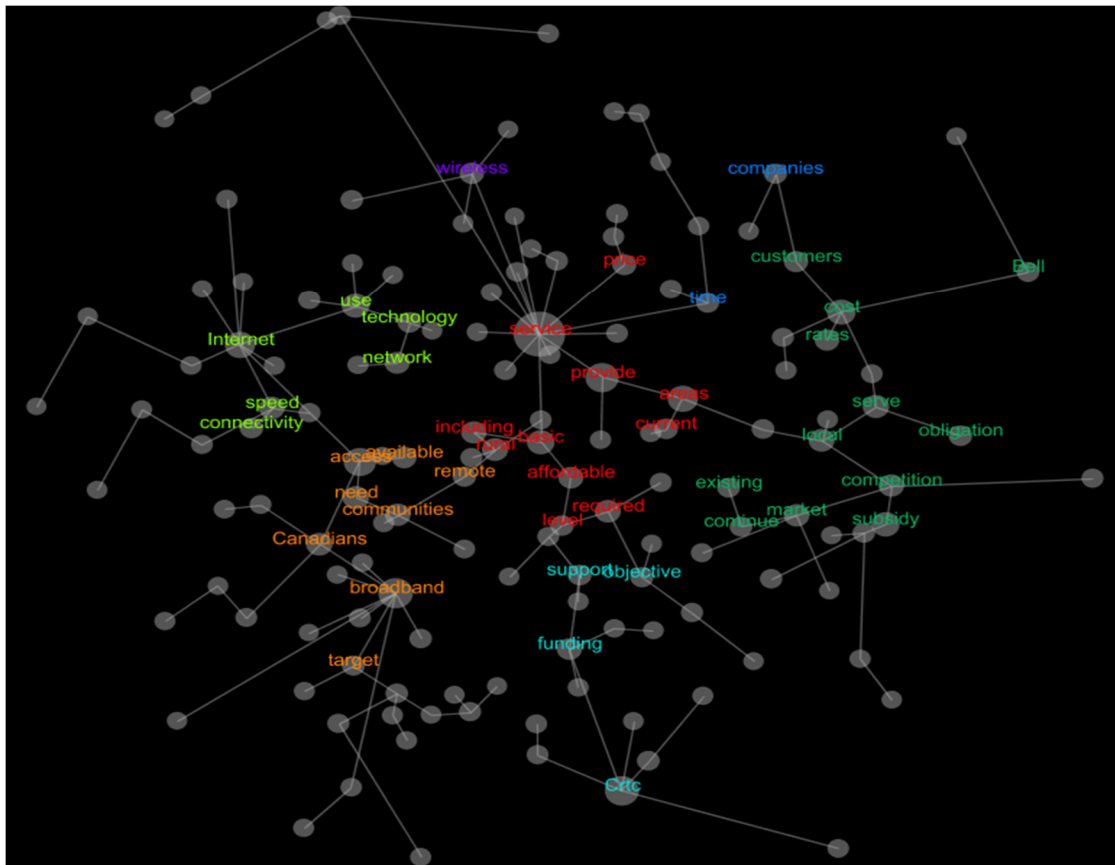
IV. Content analysis of submissions to CRTC

²⁵ Actual submissions are publicly available from the CRTC website for readers interested in exploring positions of particular parties further.

²⁶ Most of the 50,000 individual submissions represent a standardized petition, while other short comments prompted by questions from the regulator or public interest advocacy organizations that were encouraging public participation in the process tend to have limited linguistic diversity. Including them in the analysis in the future might be informative, but would introduce significant noise into the analysis and obfuscate relevant signals. The same logic applies to responses to questions by the parties to those from the CRTC, other parties, and reply comments in the middle of the proceedings (between first and final written submissions).

A. Emergent core concepts: 2010-2016

Figures 1 and 2 present complementary perspectives on submissions to the CRTC that help identify core concepts and how they evolved based on the text of the transcripts of the CRTC basic service hearings held nearly five years apart.²⁷ Figure 1 provides a content map of the most prominent concepts (in terms of their co-occurrence frequencies relative to all other words) discovered from the corpus that includes transcripts of both hearings. Emergent clusters of concepts are heat mapped based on intensity along the stemming tree of all other key concepts.²⁸ The most prominent concept cluster at the centre captures the relevance of “affordability” and concerns about “rural” communities to the debate (in red, per standard coloring scheme of heatmaps). Other statistically significant concept clusters relate to “Canadians” “need” for “broadband” “access” in “remote” “communities” (in orange); importance of “Internet” “connectivity” “speeds” for the ability of people to “use” “technology” (bright green on the left side); the role of “market” “competition” and “subsidies”, and the “costs” of the “obligation” to “serve” for large Bell, the largest operator in the Canadian market (darker green).

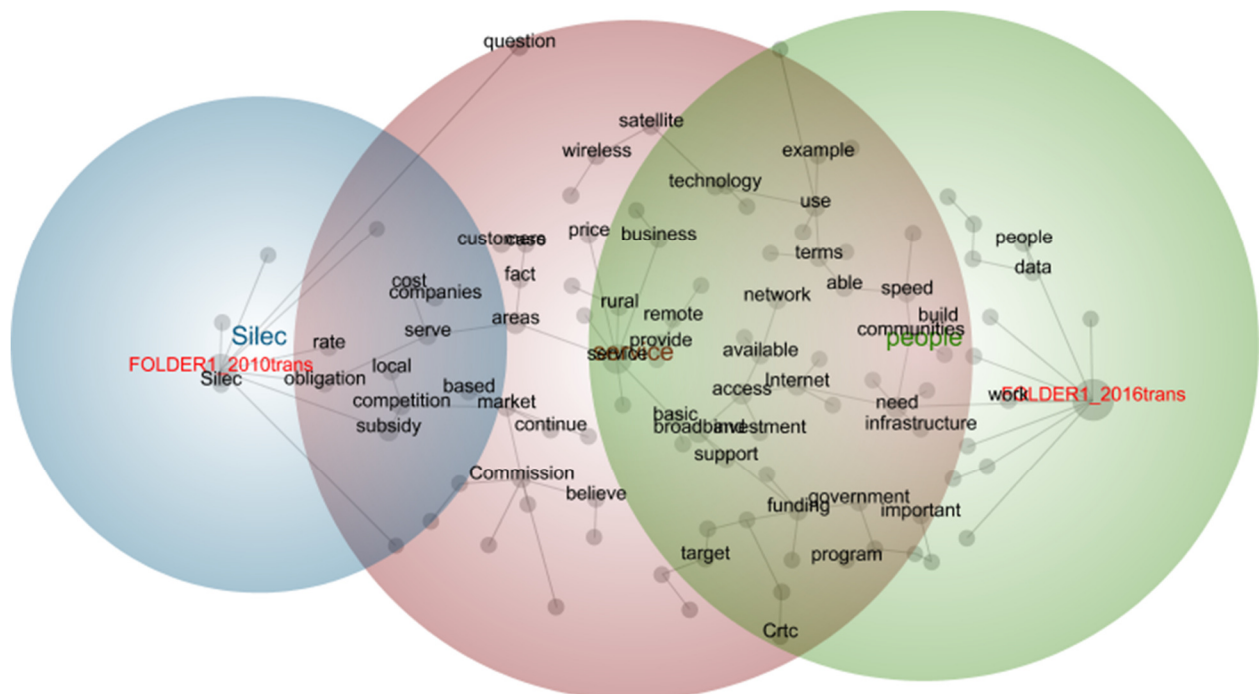


²⁷ The transcripts include an oral comment, as well as the opportunity for questions from the Commission and responses by the parties. Consequently, they reflect both the perspective of the intervener and capture which aspects of their comments the CRTC found sufficiently relevant to explore further.

²⁸ Please note that there are trade-offs in using different stochastic clustering models (e.g., linear, Gaussian) and this approach to extracting higher level themes from concepts is not always stable. To the extent possible we have tried to check for the stability of the results presented here and evaluate their robustness to different algorithms for discovering interconnectedness of concepts in the texts.

Figure 2 decomposes this high-level picture by applying a nested learning procedure to the transcripts of each hearing and allowing us to identify distinctive concepts emphasized in them relative to each other. This allows us to generate an intuitive overview of the regulatory history outlined in the previous sections in a relatively automated manner and helps outline the evolution of emergent concepts between the 2010 and 2016 proceedings. Each circle in the figure represents a cluster of statistically related concepts, or an emergent “theme”. A statistical concept cluster/theme (in larger letters) is named after the most prominent concept within that particular cluster.

Moving from left to right in Figure 2, the most distinctive central emerging concept in the earlier 2009-2011 proceeding (relative to the subsequent 2015-2016 proceeding) is “SILECS” (Small Incumbent Local Exchange Carriers). These entities tend to serve small rural communities that large operators are not very keen to serve due to their relatively higher costs and low expected return. This class of providers tend to rely on cross-subsidies associated with universal access obligations relating to telephone service. The emergence of this grouping of operators as the most distinctive concept in the earlier proceeding captures their efforts to counteract attempts by larger incumbent operators (who tend to cross-subsidize smaller rural ones) pursuant to the 2006 Policy Direction to remove/reduce existing regulatory obligations to maintain costly legacy systems in low return areas (in blue). The cluster in the middle captures shared conceptual emphasis between the two proceedings, including some the core concepts already identified above in Figure 1 based on the aggregated corpus of transcripts and without nested learning (with the provision of access in rural and remote communities at the centre of content map/debate). Questions about access to the Internet, speeds, and “government” “funding” become more central to the debate over time. The most prominent concept (i.e. “theme”) in the cluster on the right-hand side of Figure 2 (situated closer to the “tag” for the transcripts of the 2016 hearing, in green) is “people”; in relation to their the need for high “speed” “infrastructure” and the importance of the “communities” in which they live and “work”.

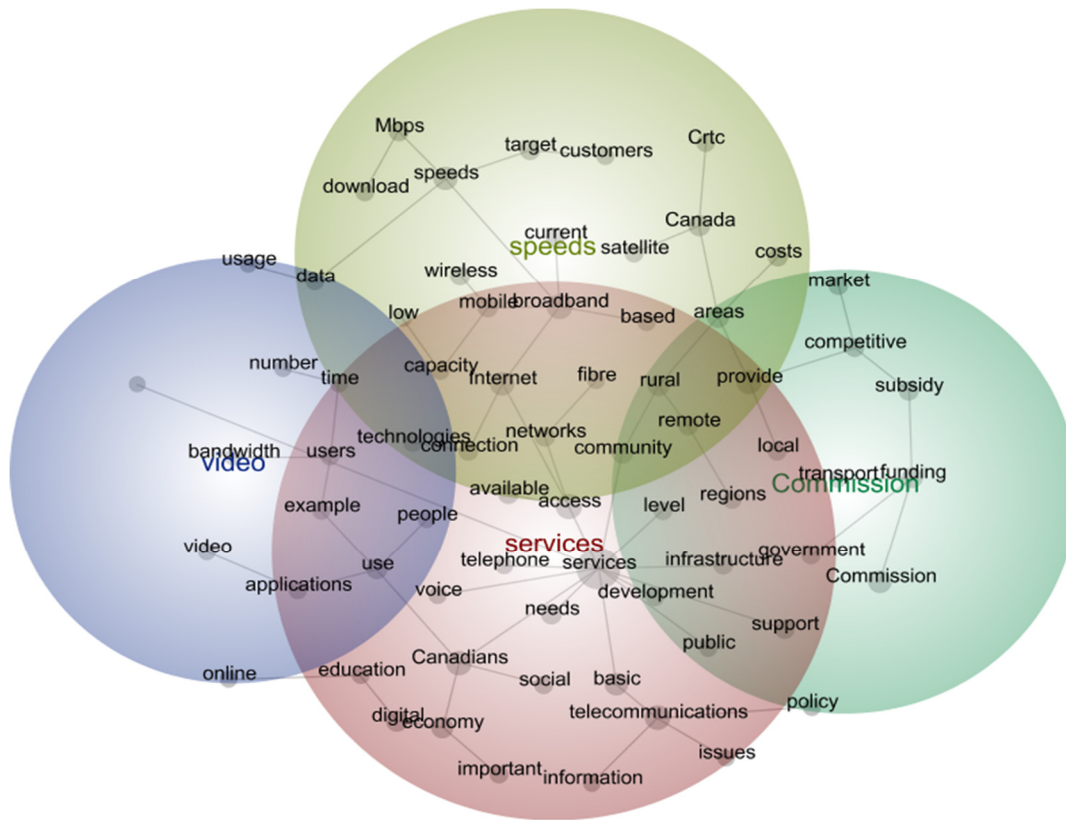


These simple visualizations of the evolution of the policymaking process are based on a relatively automated content analytic methodology, but offer a picture of the evolution of the debate that is consistent with the traditional historical overview detailed earlier in this article. Starting from a rent-seeking contest in which large operators tried to relive themselves of the burden of maintaining costly legacy telephone infrastructure in the late 2000s, the needs of “people” for high-speed data services and better broadband “infrastructure” emerge as core concepts in the 2016 hearings. In opening itself to more input from “people”, the agency generated public support for realigning the federal regulatory framework with the economic reality that broadband networks have become a basic input into social and economic participation of individuals over the past two decades.

B. Evolution of the debate: 2016

To provide a richer picture of the increasing diversity of concepts relating to “people” in the policymaking process, Figure 3 offers an overview of a larger number of discovered concepts from the text of all substantive first stage interventions submission (longer than 5-10 pages) to the CRTC 2015-134 basic proceedings that led to the 2016-496 decision.²⁹ In contrast to the analysis above where we used a “topical network” clustering algorithm to highlight conceptual differences across bodies of text, here we use Leximancer’s “social network” algorithm which is designed to emphasize interconnectedness among discovered concepts. We decompose the concept map into four higher level clusters/“themes” which help capture the importance of (moving from left to right): “bandwidth” needs of “video”, “low” “current” “speeds”, implications of this for “education” and the “digital economy”, and the role of the “Commission” with respect to “funding” and “transport” capacity. As well, the concept of “subsidy” is closely associated with its implications for “competitive market” (on the right-hand side of the figure in the green cluster). At the core of the debate (intersection of concept clusters), questions emerge about the implications of “low” “network” “capacity” for “Internet” “connections” that are available in “rural” and “remote” “communities”, as well as those relating to advanced “fibre” and “mobile” “technologies” needed to overcome this problem.

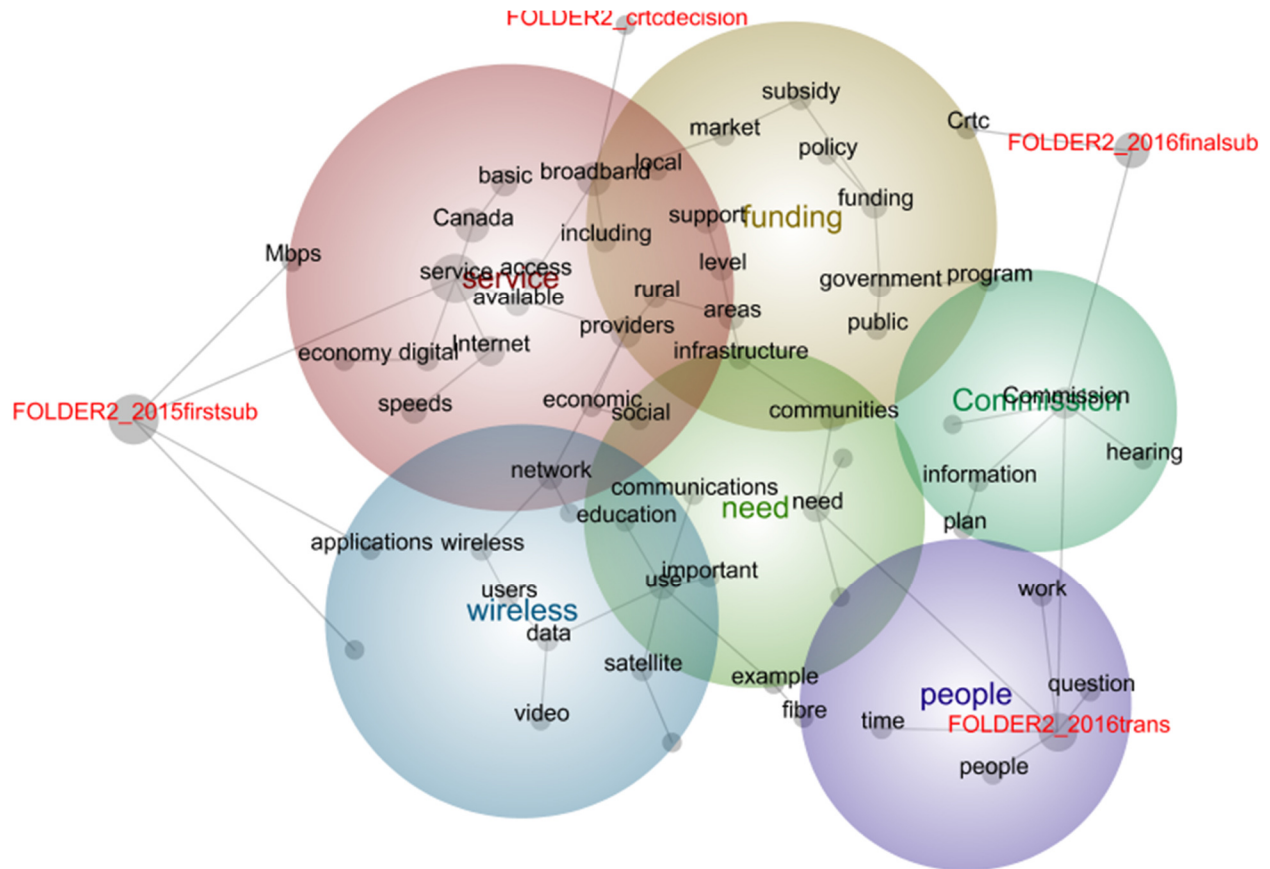
²⁹ Due to our methodology we exclude all submissions in French, as well as form letter petitions and individual comments submitted on behalf of individual users by the consumer advocacy organization OpenMedia. In preliminary analysis of the corpus of all submissions, we tried to analyze individual comments prompted by responses to questions from the CRTC in the first proceeding and those from OpenMedia in the second. Prompting through questions or high-level statements about what is at issue appears to create significant “noise” in responses as individuals tend to build on the language of communications used to engage and prompt them, making it challenging to extract meaningful “signals” from the corpus (versus transcripts or detailed conceptually rich submissions).



The CRTC 2015-134 proceeding consisted of multiple phases soliciting input from different audiences and enabling parties to offer multiple submissions, requests for information and further responses from the CRTC to the parties, interrogatories put by the parties to each other, reply comments, presentations at the oral hearing, and a final written submission. To help capture the evolution of the debate along different stages of the proceeding, Figure 4 maps conceptual emphasis of the first submissions, hearing transcripts, and final post hearing comments relative to each other using nested learning algorithms. As before, objects (folders of submissions in this case) are “tagged” and placed in closer/further proximity in the map based on their co-frequencies relative to each other. We also include the text of the CRTC 2016-496 decision in the analysis to capture how it relates to the submissions that tried to shape the regulatory outcome.

Moving from left to right, the first submissions placed a relatively heavy emphasis on growing demand for “data” due to increasing use of “video”, relevance of “speeds” in terms of “Mbps” for enabling the use of “applications”, the “social” and “economic” implications of broadband access, for instance in terms of “education”. These submissions also draw attention to “wireless” data services and applications, which the CRTC ultimately included in its conceptualization of high-speed as a basic service in the final decision. At the core of the debate at centre of the figure is the concept cluster capturing the “infrastructure” “communities” “need”. The final submissions and the decision focused relatively more heavily on practical aspects of how the public sector can “support” infrastructure development through subsidies and design of

government programs to achieve the Commission’s basic service objective.³⁰ In addition to the implications of access to high-speed connectivity for “people”, their “time” and “work”, public input at the oral hearing placed a relatively heavy emphasis on the need to deploy fibre optic technologies to meet the communication needs of “people” and “communities”. The “tag” for the text of the final CRTC decision (on top of figure) is located far away from concept clusters/themes relating to “people” and their “needs” (on the bottom right), but instead centralizes the key threshold regulatory issue of the agencies rational for “including” “broadband” in the “basic” “service” framework and development of a “subsidy” regime to “support” “infrastructure” development in “rural” “areas”.



C. Stakeholder semantics

To better understand distinctive semantic strategies used by participants to influence CRTC in its decision with respect to the regulatory categorization of high-speed access under the federal regime, we decomposed final submissions from the parties into 6 separate sub-groups. These

³⁰ In this context, it is perhaps relevant to note that during the oral hearings, the CRTC Chairman made a speech in which he essentially declared that based on input from Canadians the agency now recognizes that broadband is a basic service and directed the parties to focus on practical implementation issues in terms of program design and subsidies: “Overall, in a nutshell, witnesses that appeared so far have agreed to a self-evident truth. Today, in Canada, broadband is vital. Dictionaries define “vital” as being essential to life, to the existence of a thing, to the matter at hand, and to success, more broadly. So unless you disagree with this conclusion, let us not spend more hearing time on this self-evident truth. We have other more important things to focus on.” Available at: https://www.canada.ca/en/radio-television-telecommunications/news/2017/05/jean-pierre_blaissatthepublichearingonthereviewofbasictelcommuni.html

V. Summary and applications

As Internet access has transitioned from a luxury affordable to a few early adopters to a necessity for social and economic participation, its quality and affordability have emerged as questions of general economic policy relevance. In this article, we utilized automated content extraction and mapping technologies to provide a systematic analysis of the interplay between stakeholder conceptualizations of broadband as an essential utility and the policymaking process that ultimately led the CRTC to redefine high-speed Internet access as a “basic service” in 2016. By opening communications channels with the public, the regulatory agency generated political support for aligning the federal regulatory definition of broadband with economic reality. It also created the opportunity to decommission regulatory obligations and funding mechanisms that helped develop universal access to legacy copper and the public switched telephone network (PSTN) in the 20th century.

From a methodological perspective, public participation in policymaking has the potential to create large volumes of input that can be hard to evaluate by policymakers and other participants in such processes. This analysis highlights the capacity of quantitative content analysis to help develop a systematic and realistic picture of relatively complex and subtle submissions by parties trying to shape law and policy. This has practical implications for stakeholders involved in these types of processes as it enables them to lower the costs of monitoring the semantics of other parties, identify potential allies and adversaries, and optimize their strategies in shaping public policy. Utilization of content analytics tools is also increasingly relevant for policymakers who seek public input into their decision making, but have limited resources to devote to actually absorbing and incorporating this input when they start to open communications channels with the public at large.³¹

³¹ i.e. versus industry dominated exclusive forums in which public regulation has historically been made. For independent regulatory agencies, considering public input into the impact of their rulemaking is increasingly a basic legal obligation in modern administrative law. While commitments to the “duty to consult” vary among countries and subject areas, for matters of general interest their implementation can create significant amounts of information from the public that requires resources to understand and potentially consider.

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Appendix			
Emergent Concepts in Universal Access Policy Formation			
CRTC basic service hearing transcripts: 2011 v. 2016			
Normalized % of concept blocks in corpus associated with a concept (with most relevant at 100%)			
2011		2016	
Concept	% Relevance	Concept	% Relevance
service	100	services	100
subsidy	55	need	53
areas	54	people	43
costs	52	communities	42
serve	45	use	40
provide	39	access	38
question	37	broadband	36
broadband	35	question	34
customers	31	areas	32
competition	31	funding	31
access	29	work	28
local	29	speed	28
market	29	basic	24
Silecs	26	network	23
wireless	26	government	23
basic	22	cost	23
satellite	22	program	18
companies	21	data	18
high-cost	20	rural	18
rural	19	business	18
price	19	example	17
cases	18	able	17
business	16	satellite	16
regime	16	important	16
people	15	infrastructure	16
contribution	14	fibre	15
communities	13	wireless	14
example	12	support	13
position	12	digital	13
public	10	plan	12
telephone	9	public	11
important	8	information	10
remote	7	home	10
large	7	video	10
cable	7	social	9
population	7	policy	8
infrastructure	5	future	8
information	4	local	8