

Incorporating stakeholders in policy assessment: Generating a framework for  
system analysis and data driven policy making

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## Abstract

Incorporating stakeholders in policy assessment: Generating a framework for system analysis and data driven policy making

In this thesis, we explore the use of social media in assisting in decision making and present a case study of the development and implementation of an open data framework in a small organization.

We analyze the role of social media data for providing policy insight and prioritization of initiatives among citizens in particular we explore the sentiment analysis application in data mining in twitter. Data related to poverty and basic income was collected for 24 days in 2019, cleaned and prepared for natural language processing. A subset of the data was manually labeled for sentiment analysis in order to inform and train the AI. This analysis of public opinion on poverty is situated within the sustainable development goals and support for poverty reduction policies.

We also explore the case of study of the district of Squamish in the development and application of an open data framework aligned to the strategic values and with a look into the continuous improvement and correct documentation of the system. We develop a policy, guidelines and framework tailored to this organization with small communities in mind.

We use the open data case of study of Squamish as a model for the framework, we feed the framework with information based on the strategic direction and meeting with the district working group to better direct the development and application.

We finally explore a joint solution for the progress of equality policies and targeted governmental initiatives while exploring the interactions of external and internal stakeholders. We present the social media case as a component to support the overall framework and to empower citizen with valuable data and potential for information analysis for other stakeholders.

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## Dedication

In loving memory of my father,  
Americo Humberto Del Pino Carcamo

## Contribution of Authors

Chapter II is a version of the paper "*The importance of poverty in sustainability policies: An approach to understanding online opinion*" presented at the 3rd International Congress on Systems Engineering; special thanks to the co-authors for their contributions to the construction of the artificial intelligence and for providing cases of sentiment analysis.

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## Abbreviations

**SDG** Sustainable Development Goals [Page 1, 2, 20, 40]

**UN** United Nations [Page 1]

**ABM** Agent based model / Agent-based Modeling [Page 8,9, 51]

**ILO/OIT** International Labour Organization (Organisation internationale du travail) [Page 10]

**ODC** Open Data Charter [Page 15, 36, 37, 40]

**DOS** District of Squamish [Page 33]

**AB** Province of Alberta [Page 22]

**BC** Province of British Columbia (Colombie-Britannique) [Page 22]

**MB** Province of Manitoba [Page 22]

**NB** Province of New Brunswick (Nouveau-Brunswick) [Page 22]

**NL** Province of Newfoundland and Labrador (Terreneuve et Labrador) [Page 22]

**NS** Province of Nova Scotia (Nouvelle-Écosse) [Page 22]

**ON** Province of Ontario [Page 22]

**PE/PEI** Province of Prince Edward Island (Île-du-Prince-Édouard) [Page 22]

**QC** Province of Quebec (Québec) [Page 22]

**SK** Province of Saskatchewan [Page 22]

**NT** Northwest Territories (Territoires du Nord-Ouest) [Page 22]

**NU** Nunavut Territory

**YT** Yukon Territory

# Chapter I: Research Overview

## 1. Introduction

This thesis explores frameworks to capture stakeholder opinion to support policy making and foster analysis in government decisions. This is explored through two case studies in Chapters 2 and 3. Both are aligned with the United Nations (UN) Sustainable Development Goals (SDGs).

As defined and stated by the UN Brundtland Commission, sustainability is fulfilling and meeting the needs of our present society without compromising the future (United Nations, 2021) But going beyond that, sustainability also involves and intersects with other issues of great importance such as well-being, access to proper education and reducing inequalities and barriers.

Poverty and other inequality problems are interrelated with each other and with a myriad of social structures issues, including education, disability, race, and class. These social structures and barriers are spelled out in part by the SDGs. Society is a system that involves individuals who interact in a physical and social geography (Bunge, 1979). Systems dynamics teaches us that systems can lead to surprising and complex results (Grösser, 2017). Poverty and gender equality exemplify this, as they covary with a high number of other variables. This is also borne out by data; no country in the world has achieved gender equality or the eradication of poverty.

An essential part of achieving the objectives outlined in the SDGs is assessing how well they are achieved across the world. This data is collected at the national, regional, and municipal levels. Indicators are used to assess the extent to which geographical areas achieve the SDGs. Accurately reporting these assessments requires government transparency and accountability to their constituents. Good governance is itself captured in the SDGs, highlighting the interconnected goals required to reach a sustainable society (Chaverri et al., 2020)

Transparency and accountability can be achieved in numerous ways. The change to transparency and open data can help have better development and assessment of policies (The Open Data Charter, 2021b) as well as provide opportunities for researchers (Secretariat & Open Government, 2020). Open data is a recent movement to provide government data in an easily accessible format. The advantages of open data include its potential to reuse of available open data in commercial purposes, transparency, and better governance (Secretariat & Open Government, 2020). But a commitment to transparency is not sufficient for success. Open Data programs have associated start-up and operations and maintenance costs, along with hidden costs that can increase staff workloads and demands. Determining how much data to share and at what level of granularity is crucial to controlling these costs.

Managing Open Data platforms requires tailored frameworks and policies to ensure that local open data programs create the most benefit for the available resources. But developing these frameworks and policies are time consuming and require extensive literature review along with deep procedural knowledge of data management and certification systems. This is a specific and technical skillset that may not exist in many municipalities. Expertise and resources currently limit the reach of Open Data systems. A Bloomberg Philanthropy report found that while 70% of cities studied supported open data systems, only 18% had in-house processes to ensure that data was released on a timely basis (Bloomberg Philanthropy, 2016). Moreover, each data stream chosen adds costs as well as benefits, but those benefits will not be equal and may vary by community. Determining which data could be used to best help the individual community is key to controlling the potential cost and workload while setting the groundwork for the most potential economic, social, and democratic benefits.

Open Data is thought to have wide benefits, both social and economic. The total value of the open data as a market was estimated to be on the order of \$184 billion euros in 2015 (Heyer & van Knippenberg, 2020) . We argue that the benefits of open data extend beyond economic benefits and include increased public participation and faith in government. For any of the potential benefits to open data – economic, governance or social – governments need to be able to set up and maintain reliable open data networks, and make decisions about the presentation, availability, and granularity of data. All these activities take time and funds, and these tend to be particularly scarce at the municipal level.

The management of cities is key to Canada’s transformation to a sustainable and equitable economy. We share a vision of open-data systems and good governance as a pathway to a future that works for everyone. The open data framework and policies that we develop here can be applied throughout smaller municipalities in Canada who may not have the funds to lead this type of research.

The co-occurrence of the covid-19 pandemic, rising inequality and protests against racial injustice have led the public to seek data and government guidance on the state of our reality every day. The lack of easily comparable data between jurisdictions has become evident, along with the difficulties in compiling data with different reporting structures, dispersed across different platforms. Uncertainty is evident in the context of current events. On a global scale, this situation has presented setbacks in the progress of many initiatives and goals. In relation to SDGs goal 1, the United Nations states that this pandemic is undoing the once positive trend of poverty reduction (United Nations, 2020) .This shows us that even successful, targeted efforts to identify the variables related to outcomes of interest (poverty) and policy levers to reduce their intensity can be overcome by unexpected events, which can trigger a different result. The great uncertainty puts a large barrier to analysis that involves multiple decisions and variables that contain high uncertainty.

The present pandemic not only makes evident the uncertainty in trying to understand and analyze future outcomes but has also intensified some of the problems that our society faces. COVID-19 pandemic impacts everyone, everywhere but impact different group of people differently (Guterres, 2020) the situation has exacerbated inequalities present in different realities and has affected different population groups and in different countries in different ways (Bokun et al., 2020; Bottan et al., 2020; Ro, 2020).

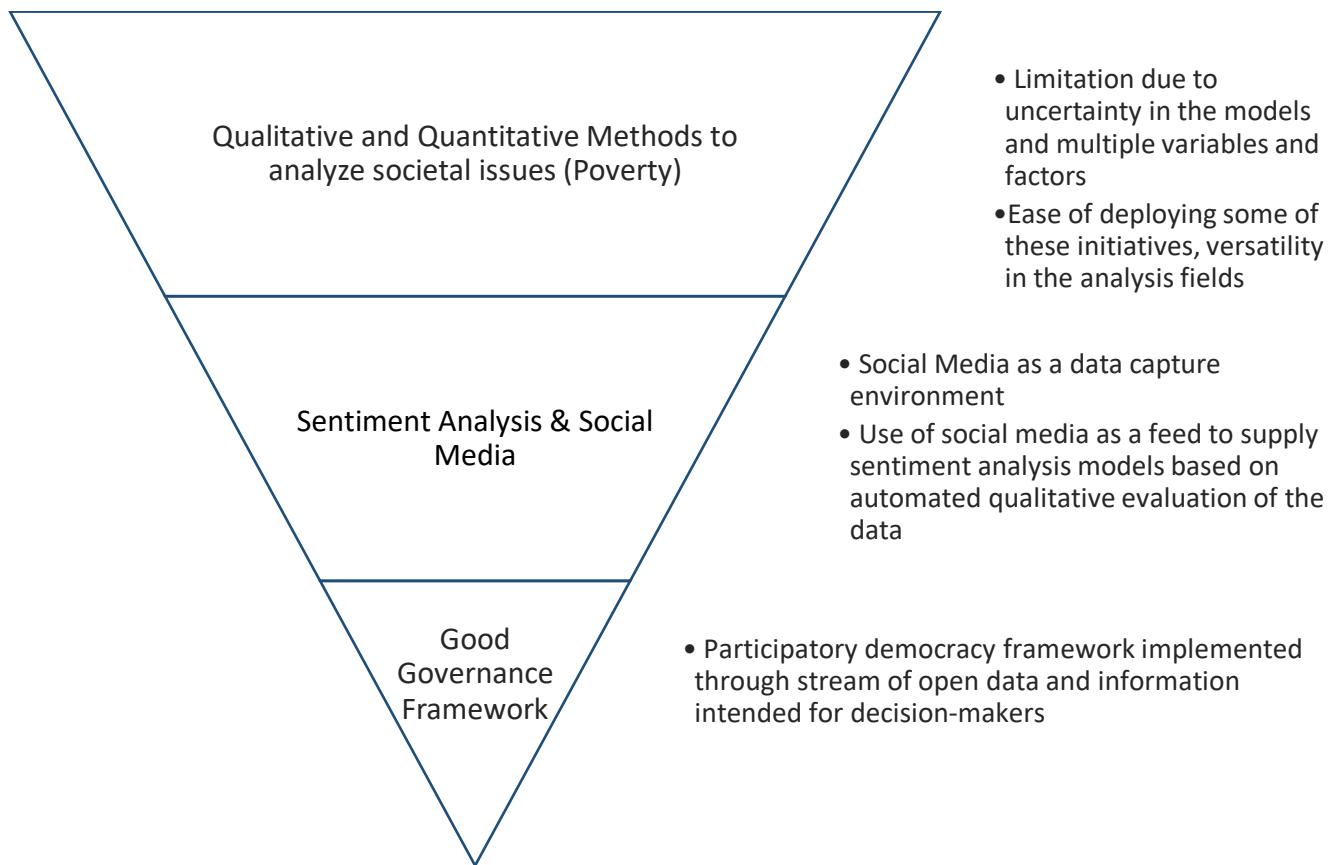
The support required to address these complex problems lies in smart policy choices and the use of appropriate engineering tools. Industrial engineering responds to the application of methodologies to address and solve problems in specific systems and each process that is involved. The potential benefits of applying engineering tools are evident. Industrial engineering applies analytical methods for systems of great complexity and allows for better management and decision-making, especially in systems characterized by high uncertainty (Oregon State University: School of Mechanical, Industrial, and Manufacturing Engineering, 2012). Industrial engineers are well positioned to design and develop systems to improve society quality and effectiveness (Department of Industrial Engineering Dalhousie University, 2020)

We live in an extremely connected and globalized world; the flow of information is no exception. When we talk about the design of a project or the development of a public policy, we find that there are different interactions between stakeholders, a flow of seeking and receiving information. In this research we explore the interactions between different levels and areas of government, business, civil society, and laypeople.

The federal and provincial government are the ones that establish a common vision, objectives and provide a development framework for the country. In terms of a stakeholder relationship, both the provincial and federal government have a close relationship with the local governments. This study attempts to provide decision makers with different tools to encompass the opinion, principles, relevant input, and values of selected stakeholders for each project. Including input about opinions or underlying principles of the stakeholders helps to generate tailored and adapted policies for the population, workers, or the community.

## 2. Literature review

The following literature review offers an overview of available qualitative and quantitative models from engineering with the potential to address societal problems such poverty and with the capacity to capture and analyze poverty and its conversation. As shown in Figure 1, the review focuses on the limitations that some of these methods present as well as the opportunities for integrating different methodologies to generate an analytical framework for decision support.



*Figure 1: Literature review overview*

We review methods have been used to analyze poverty and other societal challenges. The analysis of policies and the course of initiatives of social character are linked with the use of novel analytical methods of qualitative and quantitative cut or a combination of both, in the subsequent subsections we will deal with methodologies that seek the analysis and improvement of social and problematic conditions.

## 2.1. Numerical/Quantitative approaches

Several numerical and empirical approaches are applied to the study of societal issues and the analysis of policies, policy assessment or policymaking make use of numerical data to power data driven decision making. In this subheading we have a review of statistical approaches, empirical studies, mathematical modeling, simulation, Agent based models and microsimulation.

### 2.1.1. Empirical and statistical approaches

There are also studies of societal issues that consider an empirical approach to understanding poverty. Urakawa et al. raises the hypothesis that the lack of time, sometimes marked by poverty, can be an obstacle to health in Japan (Urakawa et al., 2020). This survey of households in Japan presents an interesting econometric model to analyze the hypothesis and posits an equation to determine the poverty of time (Urakawa et al., 2020) The study yields results and conclusions that suggest policies targeted at certain groups in society to alleviate time poverty (Urakawa et al., 2020). An analysis of household welfare and determinants of poverty in South Africa examined the factors involved in influencing household welfare and poverty, using data from the national income survey (Biyase & Zwane, 2018). Khan et al. assessed multidimensional poverty in Pakistan, they compare and expose some of the limitations of unidimensional measurement of poverty and proposed a multidimensional analysis using a randomize collected data through a set of questions, they include calculation of unidimensional and multidimensional poverty and found that non monetary related calculations are important in poverty analysis and evaluation (Khan et al., 2020). Beyond directly assessing poverty, the impacts of poverty on other social ills have been explored. Maddah evaluated the correlation between the unemployment rate and theft offenses in Iran through a empirical analysis, finding that there is considerable evidence on the relation of unemployment and crimes related to theft offenses in the evaluated data (Maddah, 2013). Mba et al. estimated vulnerability to Poverty in Nigeria using a 2010 dataset from a general household survey for Nigeria and deploying the vulnerability formula presented by Chaudhuri et al. in the 2002 in the paper that assess household vulnerability in Indonesia (Chaudhuri et al., 2002) Mba et al. find that households with few household members are less vulnerable to poverty in comparison with households located in rural areas with higher number of members, this paper also finds that households with a female head are more vulnerable to poverty in relation to male-headed households (Mba et al., 2018). A different empirical approach to analysis reviewed the ecological and social results of government subsidies in Fisheries, this case study from Chile find that the geographical distribution of this subsidies did not follow an



even distribution among fisher ports, Mondaca-Schachermayer et al. concludes pointing the simplicity of considering linear relationships in this types of cases (Mondaca-Schachermayer et al., 2011). Muhammad-Bashir et al. sought the factors that determine poverty among the beneficiaries of a support fund using data from national survey (Muhammad-Bashir et al., 2016). While other case of household-vulnerability was presented by Y. Zhang & Wan, the vulnerability was studied by sampling a survey dataset and applying the vulnerability measurement by Kuhl & Ris (Kuhl & Ris, 2003) the research by Zhang & Wan concludes in the importance of education as a variable for vulnerability (Y. Zhang & Wan, 2006). Perceptions matter in policy making, both for those impacted by poverty and for the general polity. Bavetta et al. present how perceptions can be beneficial to policy assessment, the research follows how the perception of inequality is a multidimensional consideration this related to the views of the different actors, the perception was assessed using an empirical approach of multi indicators and its correlations, they use data from the International Social Survey Programme (ISSP) and focussed the analysis to some OECD countries, the authors concludes in the benefit of integrate with behavioral assumptions to understand and analyze the perception (Bavetta et al., 2019). Bigger picture analysis was used to understand the effect of aid as a tool of growth using a multivariable equation to calculate economic growth, Ali & Isse concludes in the non-linearity of the aid on growth and the importance of the political or policy structure in the impact of the international aid (Ali & Isse, 2005)

There are other quantitative approaches to analyze societal issues, poverty and poverty alleviation policies like the paper presenting a statistical overview of the farmers and farmers' cooperatives in China (H. Shao et al., 2021) the approach of this study was the collection of data by using questionnaires addressed to farmers' cooperatives to understand the different actions taken by these cooperatives towards their low-income members (H. Shao et al., 2021). We also identified the paper that approaches the issue of energy poverty in Latin American countries with the use of a multidimensional lens (Santillan et al., 2020) the paper uses a Multidimensional Index in relation to Energy Poverty and evaluates the situation of the Latin American countries of Peru, Mexico, Colombia, Dominican Republic, Guatemala, Haiti and Honduras (Santillan et al., 2020); and the paper that discusses heating poverty and its relation to Clean energy heating in low-income households in China, the paper also presents a cost-benefit angle of this policy (Feng et al., 2021). We also encountered the study that tries to find links between poverty reduction and climate change mitigation through an analysis of empirical data in relation to a Colombian program (Malerba, 2020); and the paper that presents fuel poverty in relation to air cooling in Japan, the study approaches this issue with an empirical analysis that looks for angles on possible vulnerabilities of certain populations (Tabata & Tsai, 2020). We also find different applications of statistical and empirical analysis such as the paper that addresses the study of Transport poverty and its relation in geographical areas using a equation model, Jiang et al. finds the relation between transport and in special road infrastructure initiatives on the poverty reduction and

economic impact (Jiang et al., 2020) Prince et al. present the look into water poverty and its spatial analysis for decision making support in districts of India, the data was obtained from survey, interviews and discussions of relevant stakeholders and the analysis was performed using a multi-indicator formula and the use of regression to determine the influence of the variable in the outcome of water access (Prince et al., 2021). Carvalho and Cabral approach the analysis of poverty patterns in favelas in Brazil by using census tract data of the 2010 Brazilian census and analyze 5 representative cities (Carvalho & Cabral, 2021).

### 2.1.2. Mathematical modeling and Mathematical approaches

Poverty is also approached from a mathematical modeling angle. Chinnadurai and Athithan explore and present a mathematical model relating alcohol use and poverty, presenting a non-linear model followed by a numerical simulation of the proposed model (Chinnadurai & Athithan, 2020) Zhao et al. employ a cost optimization model to identify the best deployment strategies to mitigate crime in relation with poverty, they deploy a cost-effective analysis of crime control initiatives and analyze 2 scenarios, Zhao et al. present the limit conditions to determine the point of crime control (Zhao et al., 2015). Mathematical models have been used to optimize interventions to reduce poverty. Mohd Roslan et al. present a mathematical model that analyze poverty with the probability of crime to identify an equilibrium point using Malaysia data, the research also replicate the effect of governmental initiatives by modifying parameters of the modeling (Mohd Roslan et al., 2018)

Other mathematical modeling approaches focus on decision-making. In Oberhausen, Germany, fuel poverty was analyzed by geographical identification to determine fuel vulnerability by multi-criteria decision analysis in order to efficiently target and adapt poverty-reduction strategies (März, 2018). Other

### 2.1.3. Micro simulation and Agent based modeling

The use of traditional simulation in poverty alleviation approaches show promising results to properly approximate the model to the real system. A simulation of the Microfinance system and its relation in poverty reduction, presents an objective of optimization of welfare and institutional sustainability (Kaicer, 2020). Micro-simulation approaches are particularly valuable in that they further specialize in explaining behaviour and response to specific governmental policies (Urban Institute, 2015), we encounter this type of simulation in the paper by Chaton and Gouraud use a similar approach to study fuel poverty and the relation with variables like the income in the future

and the employment rate. They also consider the probability of fuel poverty reduction through renovation of the dwelling, using information from the French *Enquête nationale logement* (ENL) survey. The authors propose the solution of incentivize thermal housing renovation to mitigate fuel poverty (Chaton & Gouraud, 2020). Simulation and microsimulation has been applied in a number of contexts for societal issues, such as the simulation of recycling initiatives and carbon tax in Peru (Malerba et al., 2021) or the study of scenarios in Europe in relation to subsidize childcare to mitigate poverty (Hufkens et al., 2020).

Agent based models (ABM) are a type of simulation that uses a computational approach by encoding specific details about individual actors (agents), their interactions with each other and the coded environment (geography) and how they make decisions. There is an extensive literature related to poverty using ABM, with notable applications in understanding opinions such as in the paper by Schweitzer, Krivachy and Garcia that tries to link individual behaviour and the relationship between emotions and opinions in modeled agents (Schweitzer et al., 2020). ABM has been applied in relation to economic development, like the study of COVID-19 infections and economic activities (Kano et al., 2021). ABM has been used in market simulation and design (Mizuta, 2020), transportation and bus operation (L. Zhang et al., 2021) and also in relation with policy generation and evaluation, where Ortiz Salazar, Klein and Klycheva that generate scenarios related to agent recycling behaviour (Ortiz Salazar et al., 2021). There are many applications and examples of uses of agent based models in social issues, and ABM has ample capacity to respond to the complexity and dynamism in social systems (Gilbert, 2005) Varying system conditions in ABMs is straightforward and of open nature, allowing for a large number of scenarios to be explored and thereby deepening the understanding of the emergent system behavior related to assumptions encoded in individual agents.

ABM is also used in the development and assessment of policies and strategies both in organizational and governmental settings; Rashid et al. analyze the application of an ABM framework and the impact of microfinance in relation with poverty through the Netlogo platform and used the versatility of this approach to conduct simulations with assumptions about agent behaviour and agents characteristics (Rashid et al., 2011). Widener et al. use ABMs to model policy scenarios in relation with the food access for low income individuals in urban settings (Widener et al., 2013), while Kremmydas et al develop an ABM policy assessment using to study agricultural policy (Kremmydas et al., 2018)

ABM has the benefit of being applicable in areas where system simulation efforts are not normally deployed (Heath et al., 2009), and allows for important insights through analyzing systems that involve complexity (Heath et al., 2009). A wide range of applications have been developed around this methodology and social phenomena (Manzo & Matthews, 2014), in part because ABMs have a strong capacity to retain complexity due to the inherent flexibility in the approach. ABMs hold promising applications in multiple sectors. This is linked to the fact that this

methodology approaches social phenomena and tries to provide insight into human systems by encoding relatively simple decision making and evaluating the result translated into emergent behavior.

While ABMs present multiple opportunities that could benefit the policy analysis, the appropriate verification and expert validation or traditional validations pose a limitation of this approach (Pullum & Cui, 2012) Even when ABMs can capture emergent phenomena and heterogenic behaviour the validation of this models holds a drawback related to the fact of the limitations on the reproducibility of the models, we see newer models that does not build on the previously results. (Manzo & Matthews, 2014)

## 2.2. Qualitative approaches

Appropriate methods to evaluate social systems are necessary to arrive at the most effective policies to combat and mitigate these problems. Societal issues are complex, diverse and can be seen from multiple perspectives. There is no common formula for resource allocation into the socio-political system, effective policies are data driven while considering opinions, the generation of successful policies is not only reflected in the optimization in the allocation of resources but also in the sustainability of the policy and its management capacity while considering heterogeneity, that compounded with uncertainty poses a limitation for deterministic models while making the relevance of qualitative inputs more evident. Limitations also include the non linear characteristics of emergent phenomena and behaviour (Bonabeau, 2002)

Qualitative approaches have been developed in several domains for the analysis of societal issues and policy generation. While quantitative approaches poses clear benefits for data driven policy making, qualitative approaches have a strong use in policy analysis (Tierney & Clemens, 2011) Qualitative or nondeterministic models are presented in the following sub-sections. The use of gamified approaches to rise awareness in societal issues are further explained in 2.2.1, while an overview of participatory democracy and consensus processes are given in subheading 2.2.2, finally the analysis of social media to harvest opinion data and the use of sentiment analysis to empower this approach is given in 2.3.

### 2.2.1. Simulation and gamification of learning

Simulation and gamified approaches have been used to introduce the lay public to academic scholarship on poverty, both to increase knowledge and to generate empathy and

understanding. These case applications help participants experience the barriers low-income families in daily life. One application of this experimental learning is a mandatory poverty simulation workshop for the College of Health and Human Services at a university in Virginia for students in fields related to health and social work (Vandsburger et al., 2010) In this case of study, students did not alter their thoughts regarding the causes of poverty, but they changed their perceptions about difficulties and increased their capacity to consider individual circumstances (Vandsburger et al., 2010). Other cases of learning simulations have evaluated the effectiveness of poverty simulations to change clinical care for staff and professors of nursing (K. Yang et al., 2014), including attitudes about poverty comparison (K. Yang et al., 2014). Additional poverty simulations were identified that target changes in attitudes and empathy toward poverty in nursing students, findings of the implementation of the Missouri Community Action Poverty Simulation and experiential learning in bachelor's degree students (Menzel et al., 2014; Nickols & Nielsen, 2011; Noone et al., 2012; Steck et al., 2011).

### 2.2.2. Public participation and Participatory democracy

Public decision processes can involve community meetings, which have been used to determine major environmental siting decisions. The Mackenzie Valley Pipeline Inquiry in Canada (Berger, 1978; Coyle, 2017) is a seminal example of stakeholder involvement in public decision making. The Peruvian Law on the Right to Prior Consultation of Indigenous People and First Nations, has the purpose of conducting consultations in order to reach an agreement on measures that directly affect Indigenous communities (Congress of the Republic of Peru, 2011; Sanborn et al., 2016) This example is a law that aligns with the ILO Agreement No. 169, Indigenous and Tribal Peoples Convention (OIT Pro 169 América Latina, 2015) and ratified in 24 countries including Argentina, Brazil, Chile, Costa Rica, Mexico and Peru. (International Labour Organization, 2021) Other public decision processes use representative models, either as selected members of decision-making bodies to represent stakeholders like Structured Decision Making (Gregory et al., 2012; Martin et al., 2009) or the Danish consensus conferences model or citizens' panels of participatory technology assessment (Guston, 1999; Joss, 1998; Sclove, 2010; Seifert, 2006)

A particularly well-developed process of public consultation is the participatory budgeting, which gives citizens an opportunity to oversee and supervise public spending, allocate resources, and prioritize initiatives according to the community's vision. Participatory budgeting has been practiced in some form since the late 1980s in Latin America and Europe (Ash Center for Democratic Governance and Innovation, 2020). Examples of political institutional frameworks and participatory budgeting are found in the Latin-American context, for example the participatory budgeting system in place in the Municipality of Rosario in Argentina

(Municipalidad de Rosario, 2002) or those expressed by the participatory budget of the municipality of La Victoria (Municipalidad de La Victoria, 2021) and the municipality of San Isidro (Municipalidad de San Isidro, 2019, 2021) under the Peruvian Participatory Budget Framework Law (Congress of the Republic of Peru, 2003) These initiatives aim to generate a space for participation and commitment to the vision and objectives of the locality and to contribute to a healthy governance.

Governments around the globe express commitment to transparency and openness. Examples of these declarations are found in the cities of Ottawa, London, Beverly Hills, Kitchener (Canada) and the City of Woodstock (Canada) (City of Beverly Hills, 2021; City of Kitchener, 2018; City of Ottawa, 2020; City of Woodstock, 2020; Greater London Authority, 2015) Notable mention is the work of the City of Edmonton in the commitment to improve Open Government with the Open City initiative (City of Edmonton, 2021; Romero, 2019) Citizen participation also provides an opportunity not only for input on what is important to each community but an opportunity for oversight and accountability of elected officials to the citizens.

The inclusion of consensus and consultation in democratic processes seeks to achieve a dialogue among the different stakeholders to prioritize public spending preferences and initiatives according to the objectives and vision of the community. Examples of this types of dialogue are the Participatory processes held by the Barcelona City Council, consisting of meetings to promote debate between citizens and decision-makers (Ajuntament de Barcelona, 2021) these actors can interact in controlled environments under defined frameworks for the facilitation of meaningful conversations. Including different members of society in a safe and open environment is essential for consensus building and to achieve political decentralization. Respect and recognition of the diverse visions, positions and opinions of the members of society is one of the guiding principles of the Peruvian participatory budget framework law (Congress of the Republic of Peru, 2003)

### 2.3. Social Media as a tool

Data-driven approaches have a clear potential to complement and support participatory decision making. People-driven decisions have a great power to generate a pipeline of ideas that address the problems that each society considers as paramount.

As demonstrated in this literature review, democratic processes and participatory democracy is a recurrent tool for engaging with citizenry, but a critical question facing participatory governance processes is finding a way to implement them at large scale. Citizen participation in a large scale could sacrifice effectiveness of the system (Dahl, 1994)

This leads to several interesting research questions: Can existing interactions among stakeholders on social media be used to advance collective decision making or harnessed to drive public policy decision making? What new tools or changes to existing platforms need to be made to facilitate public democratic engagement? Answering this question requires understanding the role of civil society, social media platforms, political organizations, and other stakeholders. Social media is important as a public democratic engagement platform with great potential for community-based policy decision making.

Multiple studies related to social media, open data and community decision-making exist. Machine learning has been used to predict personality (Golbeck et al., 2011) There is a growing use of microblogging in analytical contexts (Kouloumpis et al., 2011) machine learning application are also seen in the detection cyberbullying in online platforms (Chavan & Shylaja S S, 2015). While Sentiment analysis has been used to evaluate social media posts broadly in English, Chinese, and Spanish, and with potential expansion to other group of languages (Habernal et al., 2013)

Semantic analysis (Lipizzi et al., 2015; Saif et al., 2012) has been used to new products analysis in twitter. Data mining has been used to detect fake news in social media (Shu et al., 2017) and for understand engineering student experiences with geolocated data from twitter posts (X. Chen et al., 2014). However, in our review of the literature, we did not identify existing literature that evaluates how stakeholders interact online across social media platforms and gather this information to analyzed poverty conversation in the Canadian context. This is an important gap in implementing social media-based stakeholder engagement and missed opportunity in capitalizing on the opportunities offered by open governance. This thesis explores the prospect to generate cross stakeholder synergies that encourage the exchange of local knowledge about what matters in communities.

Social media is a space associated with disinformation and misinformation initiatives or campaigns, particularly related to issues of trust, democracy and health (Allcott et al., 2019; Chou et al., 2018; Wu et al., 2019), and these campaigns can be intensified by their ability to be concealed by anonymity(Rainie et al., 2017) Social media has also been a space where extremist ideologies have been promoted and a space for recruiting people who concur with these ideologies and spread hate speech (Awan, 2017; de Gibert et al., 2018) However, social media has also served to connect the citizenry and expose social problems and call for reform. Hashtag activism like #heforshe, #blacklivesmatter and #metoo (Jaffe, 2018; UN Women, 2019; G. Yang, 2016), have taken an important place in public opinion and have had the potential to inform and encourage citizens, politicians, and other stakeholders to act. Social media campaigns like these demonstrate the potential for social transformation. What if this connectivity could be captured and translated into targeted and impactful policies? We believe that social media can be a tool

to assist policy making and be a source of useful data that can be translated into better governance and a better democracy.

## 2.4. Sentiment Analysis

While several qualitative approaches are used to analyze online commentary and the perception of topics in social media, one of the most popular methods to the formal analysis of online platforms content is sentiment analysis (Andreotta et al., 2019; Greaves et al., 2013; Neuendorf & Kumar, 2016). Sentiment analysis is part of text mining and utilizes techniques from natural language processing (NLP), information extraction (IE), artificial intelligence (AI), and information retrieval (IR) (N.-C. Chen et al., 2018; Farzindar & Inkpen, 2015; Patel et al., 2020).

These techniques capture opinions efficiently from a text written in syntactically correct and explicit language. However, sentiment analysis techniques demonstrate lower accuracy when processing informal language (Kumar & Garg, 2020). Kouloumpis et al. present the analysis of lexicon resources and the use of them (Kouloumpis et al., 2011)

Both published articles and proposed techniques for sentiment detection in social media have become more common (Kumar & Jaiswal, 2020). Twitter's open Application Programming Interface (API) contributes to its status as the most studied microblog for sentiment analysis while a supervised classification method called Support Vector Machine (SVM) is the most popular tool for analyzing tweets (Keramatfar & Amirkhani, 2019).

Sentiment analysis has a variety of applications, including healthcare (Tuarob et al., 2014), finance (Oliveira et al., 2017), consumer markets (Arias et al., 2014), and government (Finn & Mustafaraj, 2013). For example, sentiment analysis of health-related tweets can be used for disease surveillance and prevention including HPV (McGregor & Whicker, 2018) and Covid-19 (Chakraborty et al., 2020). These studies developed automatic processing algorithms to score and detect positive and negative tweets in order to understand how topic-specific messages are broadcasted and to provide strategies for debunking incorrect information. They found that while most individuals who write novel tweets share positive or neutral information, negative tweets were more likely to be retweeted. Their finding that negative information is more likely to be amplified suggests the use of fact-checkers to mitigate broadcasting of misleading information.

Several studies (Sanz-Hernández, 2019a, 2019b) evaluated energy poverty press releases to evaluate the impact of stakeholder engagement on energy policies. They demonstrated that



press participation reflects social dynamics but can improve both policy and perception by engaging the public. While these studies did not include social media, this case provides a strong analogue for the value of public engagement in the policy process. Despite extensive academic interest in social media analysis, to our knowledge no existing study examines public opinion concerning poverty on Twitter.

## 2.5. Open data

The development of policy and processes at the local level has been addressed in other studies with an orientation towards participation and community consultation (Cuthill, 2007). Existing literature supports the benefit of transparent public information in general and open data programs in particular (The World Bank Group, 2020). Open data offers numerous benefits, but in particular there is a great public benefit from open data (European data portal, 2020; Organisation for Economic & Co-operation and Development, 2020). Pairing open data efforts with social media and stakeholder participation can enable greater citizen participation (European data portal, 2020).

Existing open data practices and organizations that support the deployment of open data initiatives. For example, the Sunlight foundation offers principles for developing and maintaining open data policy guidelines and principles (Sunlight Foundation, 2014). The Open Data Charter foster collaboration and a common set of guiding principles and policy alignments (The Open Data Charter, 2020) while searching for transparency in institutions and trust.

A robust literature exists on the development and application of open data systems, along with excellent examples of community applications of open data (City of Edmonton, Open city and innovation branch, 2017; City of Ottawa, 2018, 2019). However, the examples that have been identified tend to be in larger cities with much higher levels of funding.

The concept, planning, and implementation of these frameworks and policies require procedural knowledge of data management. One of the barriers to fully deploying an open data framework is related to limited resources to reach an effective Open Data system. A Bloomberg Philanthropy report found that while 70% of cities studied supported open data systems, only 18% had in-house processes to ensure that data was released on a timely basis (Bloomberg Philanthropy, 2016). Determining which data could be used to best help the individual community is key to controlling the potential cost and workload while setting the groundwork for the most potential economic, social, and democratic benefits.

## 2.6. Analytical frameworks and implementation roadmaps

As previously shown, open data initiatives have great potential, but as evidenced in the literature review there is limited information and guidelines to approach open data systems. While there are sets of principles and templates of guidelines, these are not tailored to small organizations and regularly do not provide an Open Data Framework for open data management. The set of principles proposed by the ODC clearly outline the guiding concepts to follow in an open data environment. These principles safeguard key points of the system, such as privacy concerns, usability of the data, interoperability, and the vision of creating a citizen engagement environment and foster innovation (The Open Data Charter, 2020). The ODC also offer guidelines that accompany each of the principles which specify concrete actions necessary for success and complement the guiding principles with useful compromises (The Open Data Charter, 2020). Multiple municipal governments offer guidelines and policies (City of Austin, 2013; City of Chicago, 2021; City of Louisville, 2013; City of Portland, 2009; City of Waco, 2015; NYC OpenData, 2012; Office of the Mayor - Washington, DC, 2014; San Mateo County, 2014), which, along with guidelines and principles from the Sunlight Foundation outline the process to make data public and implement a policy (Sunlight Foundation, 2014)

Fayaerts et al. evaluate migrant integration in Europe with the research question embarked in decision making and policy assessment, Fayaerts et al. present the concept of the policy process and analysis as a place of interaction of stakeholders and its ideas, they embark into the idea of the policy assessment using the case study analysis of a legislative proposal in the Brussel region in Belgium the data was obtained from interviews, communications and meetings, Feyaerts used this data to evaluate the conceptual framework and concludes in the potential contribution of policy assessment policy learning (Feyaerts et al., 2017).

The review of the literature shows that is essential to develop a framework for open data tailored to the municipality. This presents a challenge for small municipalities. Encouraging the advancement of open data and the implementation of open data systems in smaller communities requires targeted assistance, tailored to their needs and strategic alignment to allow them to achieve these governance benefits. The proposed Open Data Framework will answer the critical questions posed by municipalities about how to manage their data.

### 3. Research questions and intended research

Policy solutions embedded in industrial management strategic frameworks have enormous potential to enable stakeholder engagement and open frameworks through social media. The literature review identified a pressing need for knowledge-based decisions and a potential to transform data to action.

There is an increasing commitment by a number of organizations to pursue organizational transparency. This is particularly embodied in open data systems (U.S. General Services Administration - Data.gov, 2021) and to orient their decisions based on available evidence and have policies aligned to data driven decision making with more proactivity and understanding (Stobierski, 2019) Part of this movement seeks to integrate and engage stakeholders to identify potentialities and optimize investments according to what has been assessed by stakeholders.

This thesis starts with the question of how to best assist decision making with analytical tools and appropriate analytical frameworks in order to generate efficiencies in the allocation of resources. While stakeholder engagement methods are well established to do this, they are expensive and time-consuming. How can we understand and act with the data and information that is already available? The main objective of this research is the transition of data to action, the different ways and methods to translate available data into important information for decision making according to what is exposed by the relevant stakeholders. This is explored through two sustainable minded frameworks for a democratic design of policies in government initiatives in a digital open environment.

Online settings are capable of impacting society both as a source of information and as a safe space for the advancement of social justice and positives initiatives. Can social media platforms be a usable source of information for policy prioritization? The expected outcome of this part of the research is a framework to capture opinion in online settings to be used in people driven policy making and community engagement, which can provide decision-makers with new insights and have the potential to increase community buy-in of initiatives. The research proposal and the potential that this expected outcome can have on public policy and citizen participation in safe platforms that can foster citizenship and democracy.

We recognize the availability of educational resources on open data; however, the frameworks do not consider the need for customization of open data policies and refer to medium to large organizations and in some cases with resources dedicated to these initiatives. The important questions for business and municipal decision-makers are: can small and medium scale organizations deploy open data initiatives? When implemented, can these open data systems include continuous improvement and optimization of resources? Can a small district have a customized policy, guidelines, goals, and indicators following a set framework? Responding to

these questions is pivotal in deepening this area of research and integrating solution frameworks into useful systems to accomplish transparency and good governance. The challenge in this project is to transfer the lessons learned from general principles in open data management systems and develop an approach and that works for budget limited municipalities and local governments.

In Figure 2 we can see stakeholder involved in the decision making of initiatives and policies analyzed from the lens of a local municipality and government agencies in Canada, we classify this groups in internal and external stakeholders, our first chapter extend in the relation of external stakeholders and Policy makers while Chapter III deepens in the relation between internal stakeholders and a framework to make open data available to the group of policy makers and external targeted groups involved in the decision and assessment this schematization of information and data relations in government agencies and local governments shows the importance of integrating different actors in decision making to generate consensus and respond to stakeholder needs.

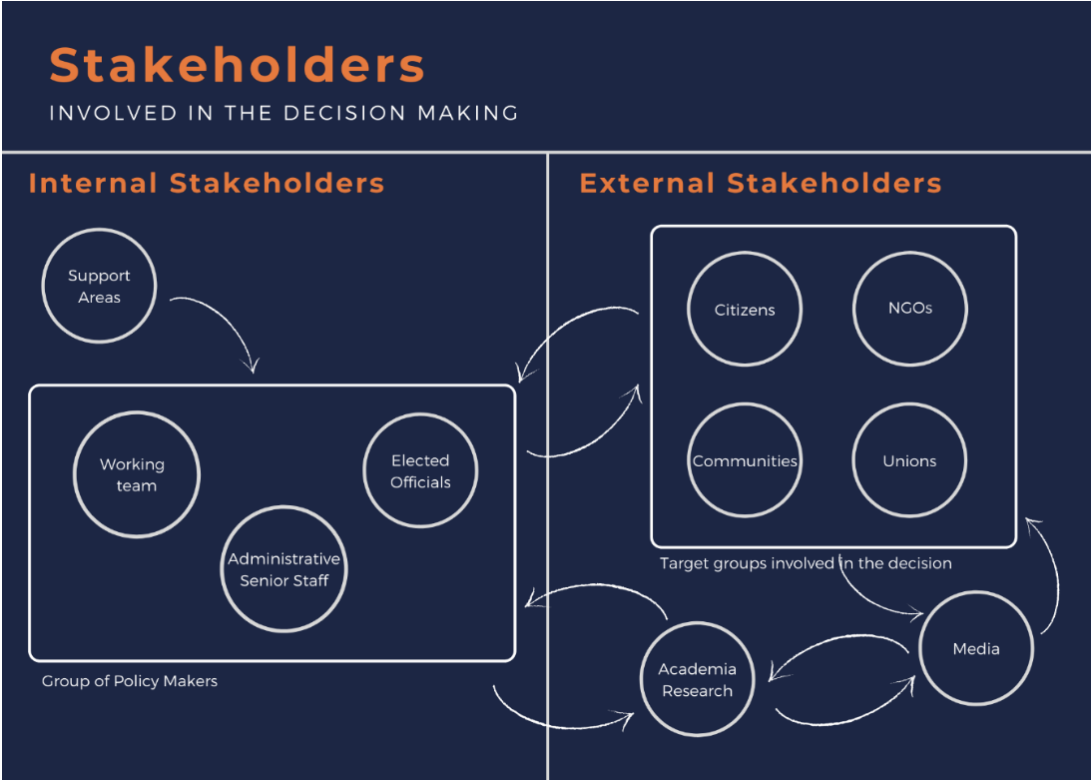


Figure 2: Stakeholders involved in the decision making

We can see in Figure 2 how traditional interested groups (Citizens, unions, communities, and NGOs) have a relation of push and pull of information and requested of policies and initiatives targeted to progress their interest, this is traditionally reflected in petitions, protests, demonstrations or activism on social media platforms, these activities are reflected as push for reform from the citizenry. We also can see how the media have this relation of providing with information and data to the groups involved in the decision making while requesting interviews to these same organizations and individuals, the same logic maintains for the relation between academia and media, both providing of information and data to inform. Finally in Figure 2 we can see another connection between external and internal stakeholder, this in relation to the data and information relation of academia and policy maker, translated in solicited or unsolicited research and data request.

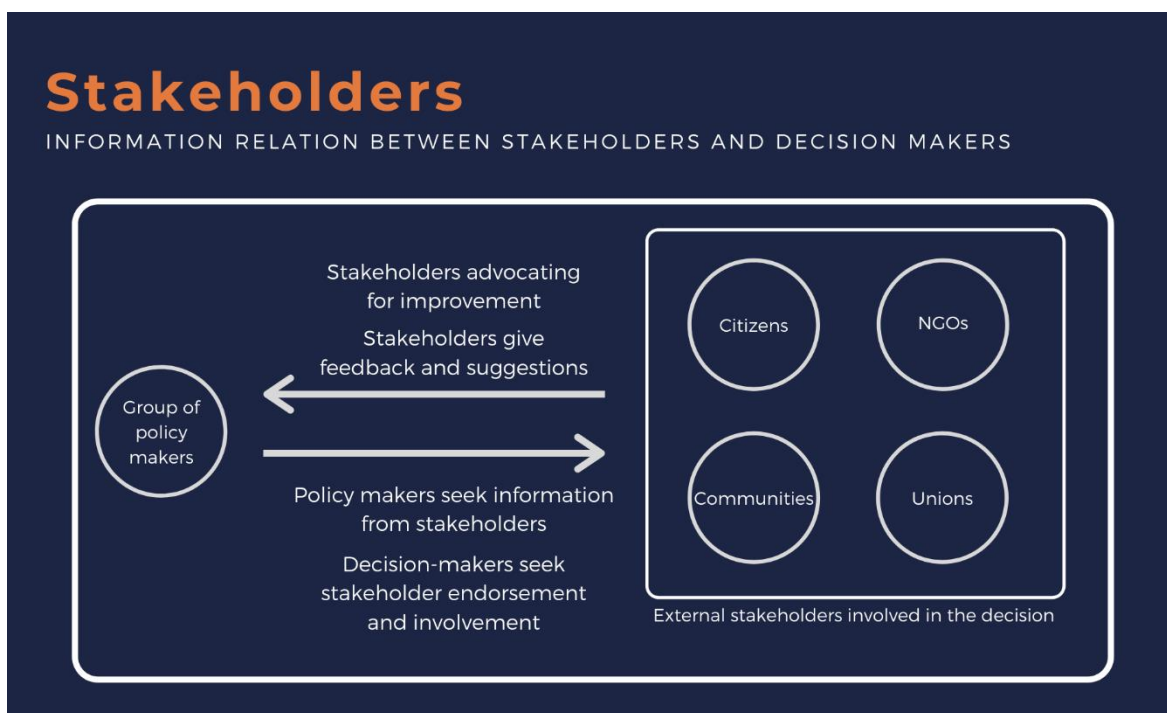
In Figure 2 we can also see the relation of the internal stakeholders, we can see how Support or non-involved areas provide with feedback and requests to the group of departments or roles involved in the policy makers, this group of policy makers is composed by elected officials, administrative senior Staff and working teams.

This outline summarizes the scope and idea behind the conceptualization of these framework solutions both for the evaluation of data mined from social media and for the implementation and deployment of open data systems. This thesis embarks in integrated these relations in an analytical framework to understand online opinion and provide citizenry with available open data. We argue that both frameworks together are able to leverage their benefits, the open data framework is able to positively impact the relationship between data and opinion in social media and the ability to collect opinion-based data. In Figure 17 we present the combination of this approaches that are present in Chapter II and III. More detail of this resulting framework will be provided in the following chapters.

## Chapter II: About poverty and the online discourse

In this chapter we will discuss poverty, and its perception in the online discourse and use these insights to frame a methodology to use data mining and in specific sentiment analysis when shaping new public policies or understanding online opinions.

In Figure 3 we can see the flow of information between external stakeholder involved in the decision and the internal group of policy makers we can see a push for improvement and initiatives to the policy makers and a flow of feedback and suggestions from the external stakeholders involved in the decision, as we are going to explore in this chapter there are opportunities to have a active role for policy makers in seeking information from stakeholders and seek for endorsement and involvement of stakeholders in the decision making.



*Figure 3: Information relation between stakeholders and decision-makers*

We present the case of poverty conversation on Twitter during months in 2019 while using AI to perform sentiment analysis to effectively capture data regarding poverty opinion in this social media platform to assist decision making and policy prioritization in government agencies and local regional or provincial settings. We also explore the federal and global discourse about poverty reduction as an objective for sustainability.

## 1. Introduction

Poverty is one of the problems that affects our present as well as our future as humans. Addressing this problem is of utmost importance to governments around the world. Although the proportion of the world's population living below the poverty line has seen a drastic reduction, going from 25.5% in 2002 to 12.8% in 2012 (United Nations Statistics Division, 2019), the eradication of poverty remains an extremely complex challenge. Canada is not exempt from this problem, in 2018 about 8.7% of the population were classified as low income (Government of Canada, 2019) While poverty is a continuing policy challenge, appropriate allocation of resources and effective strategies can help people to exit poverty (United Nations, 2019).

The eradication of poverty is also expressed in UN sustainable development goals (SDGs). Goal #1 of the SDGs is to “end poverty in all its forms everywhere” (United Nations, 2019). Canada adopted the 2030 Agenda for Sustainable Development in 2015, which includes the 17 Sustainable Development Goals (Global Affairs Canada-Affaires mondiales Canada, 2017).

Poverty reduction is an aspect of a sustainable tomorrow and deepens in our ability to be a successful society. We see these social problems as barriers that keep us from being a society where there is true equality. We argue that the sustainability conversation mostly overlooks vital aspects in the evaluation and analysis of this social problem. Human development and studies of the human condition have the possibility of including useful information to the decision making, while including important aspects of human welfare and the notion of ethical economics and the capability approach.

Human development is targeted in statistical analysis such as the presented internationally in the Human Development Index (HDI) (United Nations Development Programme, 2020a) while we see existing analysis that consider multiple aspects and variables in social problems as presented in the 2020 Global Multidimensional Poverty Index (MPI) that shows three main categories that are involved in poverty, health, education and the standard of living (United Nations Development Programme, 2020c) While we also argue the utmost importance of human welfare and the connection with the capability approach, this framework and set of commitments make a link with the importance of freedom in what we can be capable to do and the concept of a true equality (Alkire, 2005; Robeyns & Byskov, 2021) We argue that the capability approach is important in a holistic approach considering this framework and its philosophical application.

While poverty reduction is expressed as a goal for national and international policy, the policy decisions required to allocate resources and opportunity equitably are highly dependent on local attitudes, opinions, and biases regarding poor people.

These attitudes are reflected at the voting booth, influencing what policy is made. They are also reflected in conversations, both in person as well as virtually. Discussions around poverty and universal basic income are flourishing online.

The analysis of online conversations to understand general attitudes presents problems that are related to the fact that the online population on different platforms does not always directly represent the general population. However, widespread access to the Internet makes data collection through online platforms a way to grasp a considerable percentage of results that reflect different attitudes and opinions in the online platforms. In the world, almost half of the population has access to the Internet, whereas in Canada, 91% of the population has access to the Internet (International Telecommunication Union, 2020b).

As we can see in Figure 4 there is a reduction in poverty and an increase in internet access, this paper tries to exploit this availability of the population that is using internet and to try to capture sentiment and opinions regarding poverty of interested individuals or individuals that have potential initiatives or feedback to policy makers.

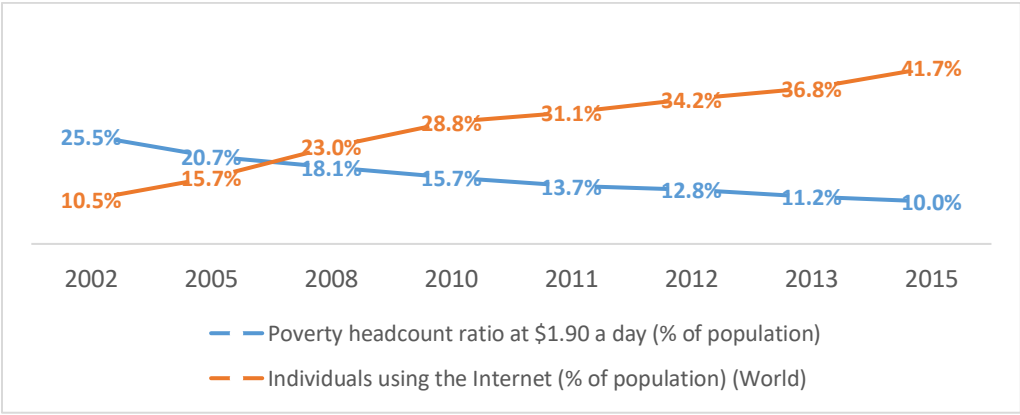


Figure 4: Poverty headcount ratio at \$1.90 a day (% of population) (World) vs. Individuals using the internet (% of population) (World)

Source: (International Telecommunication Union, 2020a) Individuals using the Internet (% of population) and (The World Bank Group, 2021) Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population).

The use of the Internet and specifically Twitter for capturing data is an approach that takes into consideration the posts published from a wide number of individuals (users). The use of Twitter is considerably high in Canada, almost 7 million active users were reported in January 2021,



making a considerable sample of the internet population (Statista Research Department, 2021b) Even though we see that the twitter population is place were sample is considerable in size, there are limitations in the proportionality and representativeness of the sample with respect to the general population. Almost 63% of twitter users in Canada are male (Statista Research Department, 2021b) While globally almost 39% of the twitter population is in the 25 to 34 years of age range (Statista Research Department, 2021a)

Limitations in the use of twitter data are related also to the fact that 80% of the posts are generated by 10% of the users (Wojcik & Hughes, 2019) This disproportionality in the production of tweets makes a database oriented towards the views of users who generate more content, have more followers or have more activity on the platform.

The non proportional nature of the sample and the differences in the use of the platform are severe limitations to see twitter data as a perfect data source for policy making. We argue that even with this limitations twitter is a source of data capable of feeding useful data that complements to participatory democracy processes. The increasing popularity and the importance of social media use and communication has led to significant academic interest. This is particularly true as online conversations have begun to drive real-life social movements (Earl, 2016). Public opinion and associated feelings concerning a specific topic can be measured in social media platforms (Reyes-Menendez et al., 2018).

It is essential to acknowledge that online engagement in general and Twitter in particular is not entirely representative of society. However, the Twitter conversation can drive or reflect national consciousness. We collected and analyzed data on twitter about poverty and use this data to explore the possibility of employing sentiment analysis to understand online opinion. This study seeks to understand the perception of poverty in social media, and to view the results as a decision-making instrument.

## 2. Methodology

As previously exposed, there is a considerable number of Canadians that use Twitter and in general internet, in this paper we try to exploit data available in social media platform. Twitter data were collected using Nexaintelligence (*Nexalogy, 2020*). Nexalogy's custom algorithms identify the network of sharing, liking, and commenting regarding specific tweets and the hashtags, along with geolocation and information on relationships between users.

An initial data capture was performed to understand the conversation, the most popular areas and to determine the terms that would be used in the search. This data was collected between February 11 and March 7, 2019 (a period of 24 days) and captured 15 923 results. Some of the hashtags we found in the query results were #cdnpoli, #Canada, #poverty, #cdnecon and #abpoli furthermore, some of the top words are Poverty, Canada, Canadian and Alberta. These results helped us to set up our search strategy and to define hashtags and terms that effectively capture data from Canada and talking about the desire topic.

With the understanding provided by the initial capture, we performed two main data collections data collection the first was in relation with the words and hashtags as shown in Table 1, this search is linked to the search terms and hashtags and the second search was in relation to data with glocalization information.

### 2.1. Data collection - Terms and hashtags

Twitter data was collected from March 18 to June 18, 2019. The data collection had a duration of 3 months, after this time it was determined that the number of tweets collected was sufficient and representative. The queries showed 58 247 results. After the removal of the retweets and the replicas, there are 11 386 results left. The query looks for the word "Poverty" or the hashtag #Poverty, and in addition, the post must contain one or more of the words specified in Table 1: List of terms and hashtags.

*Table 1: List of terms and hashtags*

Canada	#abpoli	#Canada
Alberta	#bcpoli	Canadian
British Columbia	#mbpoli	Montreal
Manitoba	#nbpoli	Calgary
New Brunswick	#nlpoli	Edmonton
Northwest Territories	#nspoli	Toronto
Nova Scotia	#onpoli	Ottawa
Nunavut	#skpoli	Prince Edward Island
Ontario	#cdnpoli	Quebec
	#cdnecon	Saskatchewan

## 2.2. Data collection - Geolocation

The second data collection search was related to the geolocation of the post to determine if this was a post generated in Canada, this method have the limitation of being able to collect posts that allows to have their location. Data collection was restricted to posts that contained geolocation data. The search was conducted between March 19 and June 18, 2019.

31,820 results were identified that used the word or hashtag povert and matched the geolocation criteria. Location was restricted to a radius of 30 km from geolocated posts in the cities of Toronto, Montreal, Calgary, Edmonton and Ottawa. About 52% of the posts originated within a 30km radius of Toronto, while about 21% of the posts came from a 30km radius of Ottawa. The 30km radius from Calgary, Edmonton and Montreal represent approximately 13%, 9% and 5% of total posts, respectively. It should be noted that the search was conducted in English only. After the removal of retweets and replicas, 9,507 results remain for analysis.

### 3. Sentiment Analysis

In order to conduct the sentiment analysis, a new AI was coded and trained (Daityari, 2019). Developing a case-specific AI ensured that the algorithm was centered on the distinct subject of this analysis.

The first step in the AI training and coding was to manually evaluate a proportion of the dataset in order to allow the AI to correctly assess the subject-based sentiment. Manual coding of the tweets involved labeling them as “positive” if they had a positive connotation and “negative” for those with negative connotations. In total, more than 7% of the database was evaluated manually, which corresponds to more than 1500 tweets. This manual coding was then used to train the AI (See Figure 5)

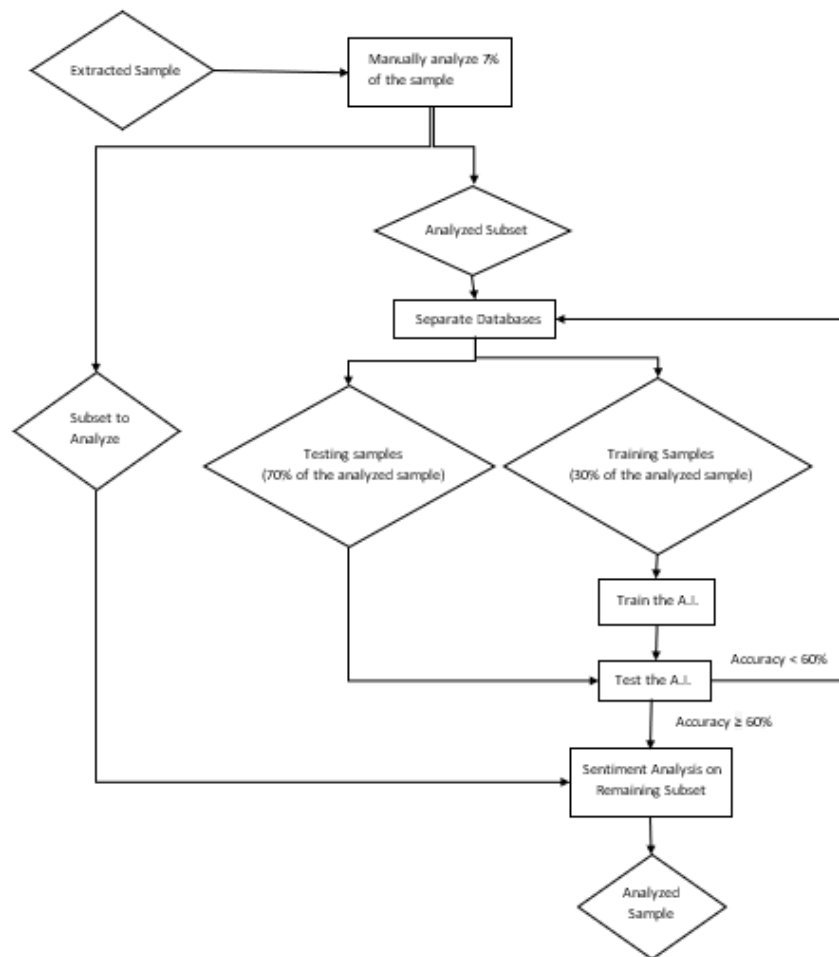


Figure 5: Sentiment Analysis Process

Then, to prepare the training and main samples, the dataset was split into two data frames: the training set contains tweets with pre-coded sentiments in order to exercise the algorithm and the other, which will be used after training the AI. In both data frames, each tweet is then separated word by word and filtered before being fed to the AI. The filter includes removing punctuation, neutral words<sup>1</sup> and converting all words to lower case. To train the AI, two packages were used: the SentimentAnalyzer and NaiveBayesClassifier modules from the NLTK package for Python<sup>2</sup> (Bird et al., 2009). From the database with pre-defined sentiments, 30% of the data were fed to train the AI and the rest was used to test its accuracy. From the sample, the AI would create a dictionary and associate sentiments to specific words. If the AI results' accuracy comparing predicted and known sentiment does not reach at least 60%, another 30% sample from the database would be selected to train the AI. Once the accuracy threshold has been reached, the other database would be fed to the AI, but in this case, get the AI would predict sentiment associated with the sample tweets. The results are then exported and analyzed. The complete flow overview of this methodology is shown in Figure 5.

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<sup>1</sup> Neutral words include "i", "me", "my", "myself", "we", "our", "ours", "ourselves", "you", "your", "yours", "yourself", "yourselves", "he", "him", "his", "himself", "she", "her", "hers", "herself", "it", "its", "itself", "they", "them", "their", "theirs", "themselves", "what", "which", "who", "whom", "this", "that", "these", "those", "am", "is", "are", "was", "were", "be", "been", "being", "have", "has", "had", "having", "do", "does", "did", "doing", "a", "an", "the", "and", "but", "if", "or", "because", "as", "until", "while", "of", "at", "by", "for", "with", "about", "against", "between", "into", "through", "during", "before", "after", "above", "below", "to", "from", "up", "down", "in", "out", "on", "off", "over", "under", "again", "further", "then", "once", "here", "there", "when", "where", "why", "how", "all", "any", "both", "each", "few", "more", "most", "other", "some", "such", "no", "nor", "not", "only", "own", "same", "so", "than", "too", "very", "s", "t", "can", "will", "just", "don", "should" and "now".

<sup>2</sup> The NLTK package is specialized in natural language tools: <https://www.nltk.org/>

#### 4. Results and Analysis

Figure 3 compares the heat map of location-based words and hashtags on the left-hand side with geo-located data on the right-hand side. Location-related words and hashtags like "Canada," #abpoli, "Alberta," and #bcpoli yielded data from across the Americas as well as some European and African data. In contrast, geolocated tweets about poverty in Canada were generated within the country.

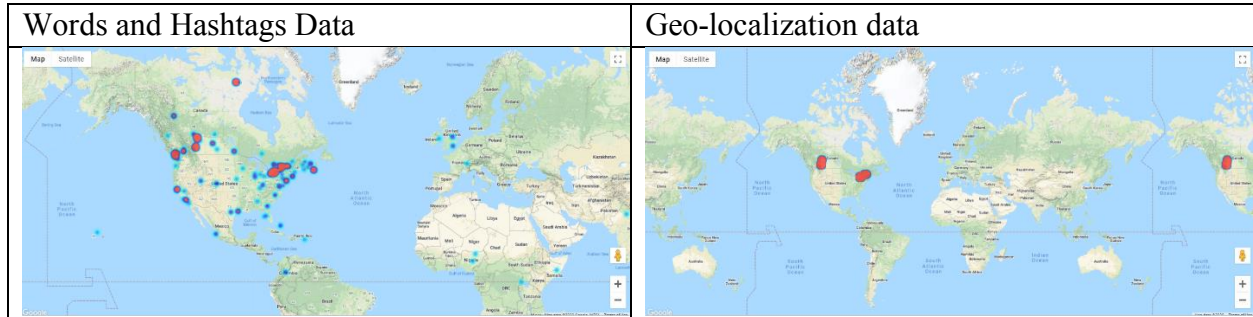


Figure 6: Heat Map

Source: Nexalogy search (Nexalogy, 2020)

During this period, the most highly shared link related to a New York Times opinion article comparing the management of poverty in the United States and Canada (Brooks, 2019). Chief among this discussion was the policy choices behind the level of poverty in both countries. This tweet was viewed as positive through manual annotation. The link was shared 3148 times. After removing the retweets and duplicates as well as tweets that were evaluated manually, we were left with 524 Tweets that share the links that were evaluated by the AI. Our analysis indicated that 389 are tweets that were classified as positive and 135 tweets that were considered negative. We can see that almost 75% of the evaluated posts that contain this link have been listed as positive. In a closer look we can see the Timeline shown in *Figure 7: Timeline - Words and Hashtags* query exhibits a behavior of publications with small peaks of publications in a sustained manner and little variation with the exception of a substantial increase in the number of tweets on April 5th with more than 3000 tweets from 2317 publishers or users, much of this increase is due to an opinion piece published in The New York Times on April 4 titled "Winning the War on Poverty: The Canadians are doing it; we're not" opinion piece that had resonance and traction in the social media platform.

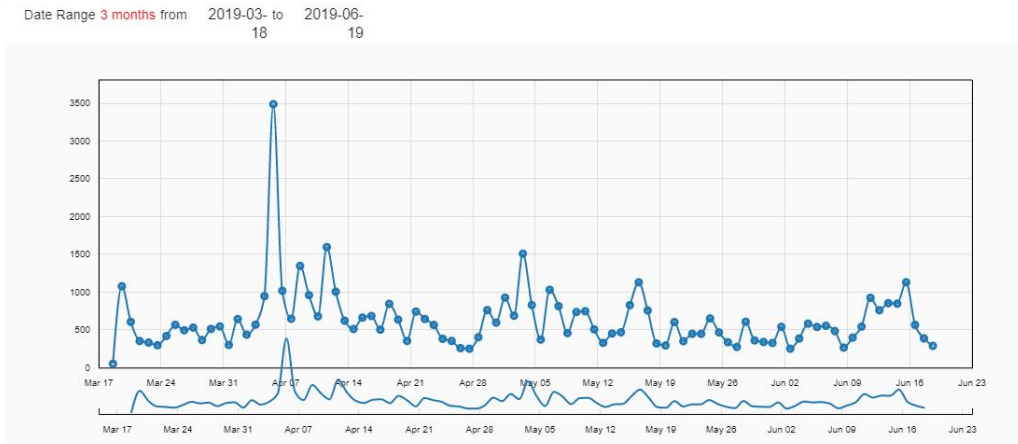


Figure 7: Timeline - Words and Hashtags query

Source: Nexalogy search (Nexalogy, 2020)

As we can see in Figure 8: Top terms - Words and Hashtags query, there is a widespread use of several hashtags related to Canadian politics such as #cdnpoli with more than 17000 posts and retweets, and provincial politics such as #onpoli with more than 7000 results, and #bcpoli and #abpoli both with more than 2000 results.

TOP HASHTAGS <input type="text" value="type to filter"/>				TOP WORDS <input type="text" value="type to filter"/>			
Rank	Frequency	#Hashtag		Rank	Frequency	word	
1	17510	#cdnpoli	<div style="width: 100%;"></div>	1	37806	poverty	<div style="width: 100%;"></div>
2	7913	#poverty	<div style="width: 45%;"></div>	2	15809	canada	<div style="width: 42%;"></div>
3	7151	#onpoli	<div style="width: 40%;"></div>	3	7179	canadian	<div style="width: 19%;"></div>
4	4053	#canada	<div style="width: 23%;"></div>	4	5102	lift	<div style="width: 13%;"></div>
5	2507	#socialism	<div style="width: 14%;"></div>	5	5009	rate	<div style="width: 13%;"></div>
6	2504	#politics	<div style="width: 14%;"></div>	6	4499	000	<div style="width: 12%;"></div>
7	2495	#bcpoli	<div style="width: 14%;"></div>	7	4434	unemployment	<div style="width: 12%;"></div>
8	2494	#capitalism	<div style="width: 14%;"></div>	8	3826	job	<div style="width: 10%;"></div>
9	2490	#blog	<div style="width: 14%;"></div>	9	3593	government	<div style="width: 9%;"></div>
10	2458	#ableg	<div style="width: 14%;"></div>	10	2933	income	<div style="width: 8%;"></div>
11	2113	#topoli	<div style="width: 12%;"></div>	11	2923	ontario	<div style="width: 8%;"></div>
12	2085	#poor	<div style="width: 12%;"></div>	12	2918	money	<div style="width: 8%;"></div>
13	2063	#essay	<div style="width: 12%;"></div>	13	2829	policy	<div style="width: 8%;"></div>
14	1976	#medium	<div style="width: 11%;"></div>	14	2802	benefit	<div style="width: 8%;"></div>
15	1935	#abpoli	<div style="width: 11%;"></div>	15	2514	country	<div style="width: 7%;"></div>

Figure 8: Top terms - Words and Hashtags query

Source: Nexalogy search (Nexalogy, 2020)

Table 2 reflects and displays two representative tweets from our dataset. Table 2a shows a tweet predicted as positive by the AI.

*Table 2: Positive and Negative posts*

Class	Tweet
Positive	The world needs more Canadian energy via energy solves poverty
Negative	Approximately 1.3 M CHILDREN in Canada are living in poverty that is 1 in 5

Table 2a shows a tweet, which focused on Canadian energy, argued that energy availability solves poverty. Table 2b shows the representative negative tweet. The language was rated as negative by the AI. We can see that the positive sentence mentions "solves poverty" which has a positive connotation. While the negative sentence indicates that "Approximately 1.3 MILLION CHILDREN in Canada are living in poverty", poverty has a negative connotation, sentences like "solves poverty" or "Win the war against poverty" are positive sentences and indicate that poverty is detected as a negative word, even though the informative action may be to raise awareness and with the intention and a sentiment to change something.

At the end we evaluated 20 894 results, we can see that the 44% of the results were classified as positive while 56% of the results were classified as negative (See Table 3: Sentiment Analysis Results)

*Table 3: Sentiment Analysis Results*

	Number of results	Percentage
Positive	9259	44%
Negative	11635	56%
Total	20894	100%

Because poverty is not a simple or neutral concept, the ability of the AI to detect sentiment was limited. During verification, our AI was able to detect sentiment for a cleaned dataset at 99.7% accuracy (Daityari, 2019). In contrast, our AI correctly identified pre-annotated sentiment in our novel dataset at only 60% accuracy. Indeed, poverty is not a naturally neutral topic. Mentions of poverty generate strong responses, and the concept itself is seen as negative. The tweets highlighted in Table 2 demonstrate the challenges inherent in assigning sentiment values to communications regarding poverty.



## 5. Conclusion

While the proportion of positive tweets regarding poverty is slightly lower than negative ones, this result does not get us closer to understanding sentiment regarding poverty in Canada. In order for algorithmic approaches to sentiment analysis to be useful in understanding public opinion, this method must be paired with more traditional approaches to understanding opinion.

We see the potential of provide a modified approach to semi-structured interviews, survey instruments or “seed tweets” related to specific anti-poverty policies. The AI could then be trained on this targeted information to analyze actual sentiment related to anti-poverty policy. The results also do not reflect the margin of error associated with the AI. In future work we will estimate a confidence interval that places the predicted sentiment in a probably range of results and provides with a more robust picture.

In this chapter we also encounter that there is only a flow of data from the citizens to the governmental organizations, this model tries to feed from social media streams of data. We recognized that further transparency and open data systems will complement this initiative making data available to citizens and ready to be analyzed and evaluated by Media, communities, unions, NGOs and all the stakeholder involved and interested in the decision making of policies. More information of open data systems and transparency will be provided in chapter III of the present thesis.

Social media have users in different communities but have more traction in big cities with special hashtags or to talk about a special issue surrounding the community, it is common to find on twitter the hashtag #TOPoli or provincially the hashtag #ONPoli or #BCPoli. What pose as a positive side of this initiative in big metropolis, present a downside in small communities. We argue that for communities of few inhabitants it is better to apply traditional methods such as open town meetings or population surveys for even smaller communities; create a hashtag and generate a conversation in relation to each community would not necessarily be the mode of operation of all communities.

# Chapter III: Open Data Policy Framework and Continuous Improvement: The Case of the District of Squamish, BC

## 1. Introduction

Discussions of government transparency and accountability often focus on the national level, highlighting policies such as Canada's Access to Information (Minister of Justice, 2020) and Privacy Act (Minister of Justice, 2019) allowing individuals to access government information, and agencies such as the Office of the Comptroller General that have a mission related to transparency and accountability (Treasury Board of Canada Secretariat, 2007) . But most people access government agencies at the local level (United Nations Development Programme, 2020b). Ensuring that municipalities can deliver the benefits of Open Data requires policy and processes targeted to local government.

Open data is an essential ingredient in transparency, a bedrock principle of good governance. While transparency is essential to public trust and collective governance, decisions regarding how to manage and share data, and how to allocate scarce resources for data are difficult to manage at the municipal level. The Open Data Guidelines and Policy will provide a framework for data governance across municipal and local organizations, to improve access to and use of data to empower community decision making.

The open data environment seeks to serve as a reliable and quality source of knowledge for citizens and companies. This environment is based primarily on the publication and use of data of high relevance and ultimately promote policies and initiatives that enable the district to become a data-driven organization.

Open data initiatives require commitment from the internal stakeholders and feedback from the external stakeholders (members of the community), as we can see in Figure 9 there are different internal stakeholders involved in the decision making in a governmental local organization. While we see that the federal, provincial, or central government outline the path and set common strategies, there is a potential to local municipalities to explore and considered community opinion to support decision making.

As we saw in chapter II, communities and citizens already push for reform and inquire about policies and focused strategies, in this chapter we delve into the role of transparency and in specific open data systems in building a good governance and data driven policies.

We can see in Figure 9 an interconnection of data and information in different roles within a local governmental organization. These roles and departments are grouped into four encompassing

groups; the elected official are the group which considers politicians and roles and roles involving popular election; the administrative senior staff refers to the upper management that governs within the organization, who have not been elected and occupy administrative positions; working groups bring together elected and non-elected members of the organization who form a group to generate direction or work within the context of a policy framework; finally we have the support areas which include members of the organization who are not involved in the generation of this policy and who do not constitute senior management or elected individuals. It is important to note that members of the support areas can provide feedback on issues related to the policy, although this group is not involved in the elaboration of the policy.



Figure 9: Internal stakeholders involved in the decision making

As we can see in Figure 9, there is a flow of information and feedback concerning policy decision making, we can see that the elected officials have a direct communication with the Administrative Senior Staff, while the latter group has a close communication and involvement in the working team. As previously noted, the support areas provide valuable feedback to the working group which after taking into consideration the overall information flow analyze and

provides policies or draft policies to the elected officials and Administrative Senior Staff for policy validation.

The management of open data platforms requires tailored principles and guidelines to ensure that local open data programs generate the maximum benefit for the resources available and to aligned to the strategic direction of the organization.

In this chapter we explore this information dynamic in the generation of an open data policy as well as explore how this initiative can benefit the general public and assist in the generation of informed policy and foster adequate decision-making support. For this chapter we respond to the needs and strategic vision of the District of Squamish located in British Columbia, this district has a commitment to open data and good governance.

## 2. Project background

The Open Data Policy responds to the District of Squamish's commitment to digital evolution set out in the Squamish Digital Strategy. The DOS has objectives aligned to open data; notable efforts have been undertaken. In the Open Cities Index 2019, the district is ranked 27th out of 56 participants (PSD Research Consulting Software, 2020), ranking behind large cities and regions such as Edmonton, Ottawa, Calgary, Montreal, Halifax, Mississauga, among others.

At the beginning of this project The District of Squamish presented a website and well-developed open data platform (See Figure 10) and the internal stakeholders emphasized the need of proper documentation and an implementation roadmap.

Implementing societal beneficial systems and in special open data systems, requires careful planning for time, resources, and systems. In order to effectively roll-out open data efforts, management systems and roadmaps are essential. The use of roadmaps and its application to policy has been addressed in other studies (Ahlqvist et al., 2012; Lourens, 2007; Woods et al., 2015; Yasunaga et al., 2009)

The screenshot displays the Squamish Open Data portal interface. At the top, there is a search bar with the text 'Search' and a 'Sign In' link. Below the search bar, the portal is titled 'Squamish Open Data' and includes social media icons for Instagram, Twitter, and Facebook. The main navigation bar has tabs for 'All', 'Data', 'Documents', and 'Apps & Maps', with 'Data' currently selected. On the left side, there is a 'Filters' section with a 'Reset' button and '1 - 20 of 64 results' displayed. The filters include 'Content Type' (with checkboxes for 'Feature Layer' and 'Feature Service'), 'Last Updated' (with a date range selector), and 'Tags' (with checkboxes for 'M4CC', 'Environment', 'ESA', 'Infrastructure', and 'Boundaries'). A 'More' link is visible below the tags. The main content area shows two search results. The first result is titled 'Business Licence Monthly' and is a 'Data' type. It includes a description: 'Monthly update of active and paid Squamish business licences. Please Note: location information has been removed from all "Home Occupation Office" licence types.' It also shows 'Type: Feature Layer', 'Last Updated: June 18, 2021', 'Rows: 1,692', and 'Tags: Business\_Licence, Business, M4CC'. The second result is titled 'Form and Character DPA' and is also a 'Data' type. It includes a description: 'OCP2040 Form and Character Note: DPA 3 guidelines apply to all commercial, industrial, mixed-use, multi-family (including triplexes, fourplexes, courtyard apartments, bungalows, townhouses,...' It also shows 'Type: Feature Layer', 'Last Updated: January 29, 2021', 'Rows: 11', and 'Tags: OCP2040, Boundaries, M4CC'.

Figure 10: Squamish Open data portal

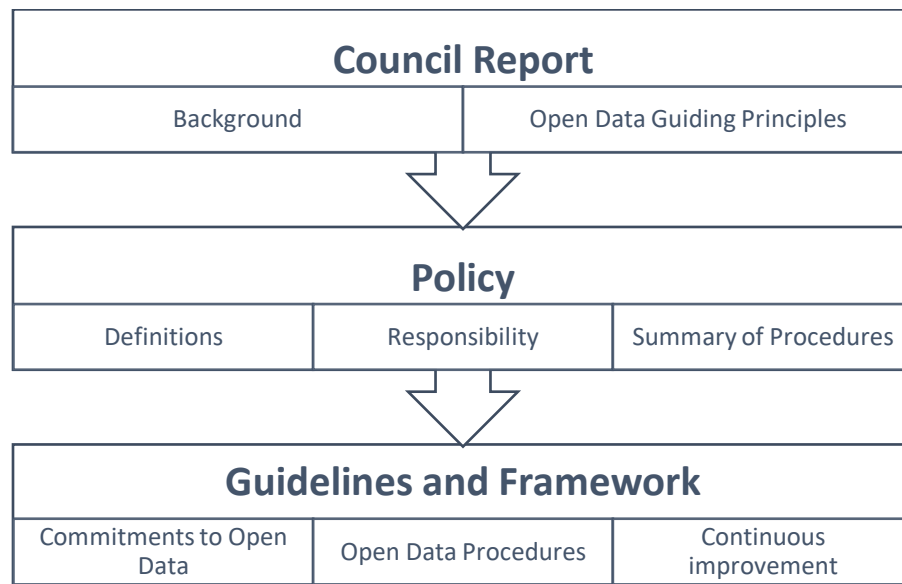
Implementation roadmaps and system framework encompasses the needs of the system and can progress the development of the initiative. As we can see in the number of results of the portal

(64 results, See Figure 10) there is a limited number of datasets available in the portal. The openness commitment of the district is also reflected in the quality of the available data, if we inspect the first result of the query *Business License Monthly*, we can see a GIS Feature Layer last updated on June 18, 2021, and with publication date of May 2019, we also can see that this database has 1692 recorded units of data and available for the general public. Each recorded unit has the business and licence details including the NAICS number and description and the zoning of the building.

In the following chapters we further analyze the status of the open data in the district, and we present the development of this framework, the dynamic of information and the recommendations presented to the district working group.

### 3. Project implementation

This project followed a roadmap of implementation of the initiative and a structured documentation. The structure of the documentation (See Figure 11) does not follow a chronological order of the development of the elements but responds to the practicality of the use of the documents according to the level of detail expected at each stage of the project. The definition of the procedural content documentary structure of this system was carried out in stage 1 in the third action item as shown in the roadmap and action items (See figure 14).



*Figure 11: Structure of the documentation*

The first document delivered in the project was the council report, the same that contains the open data system background and open data recommended guiding principles (See point 3.1 for more details) The policy document groups the system lexicon, definitions, policy objectives, responsibilities, governance of the system and a summary of the procedures. Finally, the Guidelines and Framework deliverable exposed the commitments to open data, project timeline, project framework, a detailed procedural information, and the continuous improvement approach of the system.

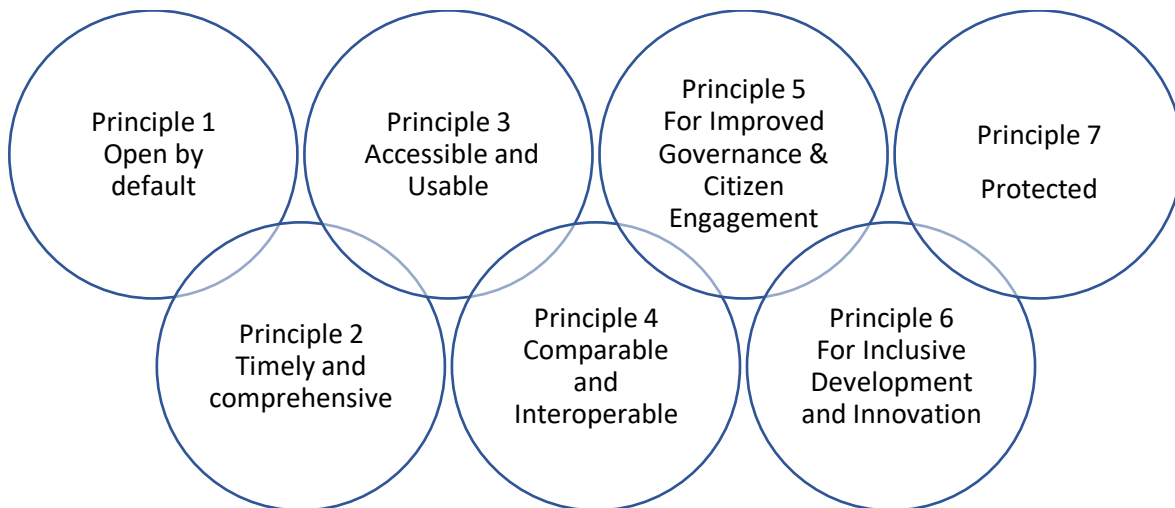
The project was tackled in four mayor stages each one setting a milestone of progress and implementation as seen in Figure 14.

### 3.1. Stage 1: Guiding principles

It is worth highlighting the district's commitment to the creation of an open data committee as well as the existence of an open data portal that provides GIS data sets. This is a suitable starting point to further promote open data initiatives and advance the implementation of a system that governs open data information.

According to the aforementioned considerations and the information acquired, the research group recommended the use of the principles linked to the Open data Charter. Building a policy around the principles outlined by the ODC has promising prospects that leave flexibility for tailoring the policy to the special objectives of the Squamish District while being anchored in a proven framework.

The district ratified the open data initiative project and the use of the 6 principles (See Figure 12 principles 1 through 6) of the ODC (The Open Data Charter, 2020) as well as an additional principle that will be further explained (See Figure 12, principle 7).



*Figure 12: Squamish Open Data Principles*

The first principle (1) Open by default (The Open Data Charter, 2021b) focuses the main principle of open data without compromising privacy.

The principle of timely and comprehensive (2) refers to the need that data should be made available in a complete a timely lapse and, if possible, in its original format and without having been modified (The Open Data Charter, 2021b).



The principle (3) Accessible and Usable, focuses on the commitment of readability of the data both by machines and humans (The Open Data Charter, 2021b).

Principle (4) Comparable and Interoperable guides on the importance of data held in standardized formats (The Open Data Charter, 2021b).

Principle (5) For Improved Governance & Citizen Engagement guides regarding transparency, reporting and training (The Open Data Charter, 2021b).

Principle (6) For Inclusive Development and Innovation, guides about the potential of these type of systems for economic development (The Open Data Charter, 2021b).

We recommended the addition of additional principles to the six presented by the ODC. The principle of protected (7), that encompass the need to keep data as confidential and protected for the safety and security of citizens (New Zealand government, 2016).

Squamish's open data principles lay the foundation for the system as well as introduce general commitments around the initiative. Having adequate documentation of processes and best practice guidelines in place sets organizational goals to get the system online.

The objective of this project is to implement the open data system and thus achieve the proposed vision "Make data open to encourage innovation and enhance the efficiency and governance of the District of Squamish", to achieve this a major benchmark point is to present a framework and guidelines, the same which will contain specific information on the activities, the structure and scope of this implementation.

Open data can be a source of innovation in non for profit organization and in companies with the intention of make innovation for the gain and development of the business.

Figure 13 shows the chronological order of the project from the study of the background and strategic direction of the district to the implementation and continuous improvement. We clearly define a Project Roadmap guided by traditional flow of analysis and implementation. The lack of a Gantt chart responds to the fact that this is a recommendation of a timeline, and the implementation is strictly responsibility and disposition of the organization.

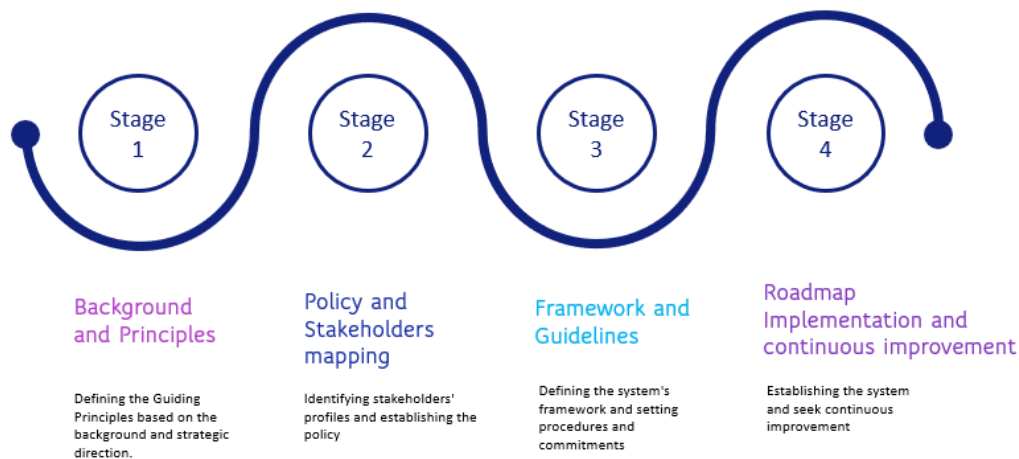


Figure 13: Project Roadmap

As we can see in Figure 13 there is a path summarized in 4 stages. In the second stage there is a consideration for stakeholder mapping, the same information that we can see in Figure 14 stage 2 point 1. This point is made by using profiles already developed by the Open North organization (OpenNorth, 2021). We recommend the use of premade profiles because of a time constrain concern but recognizing that the development of particular profiles is of outmost importance, we must remark that these profiles are based in a city in Canada and approximate to the profiles that Squamish could developed.

In the final stage we present the implementation roadmap and the commitment to continuous improvement, this point set the initial establishing of the system with proper documentation and following governing open data guiding principles, more detail could be found in point 3.4.

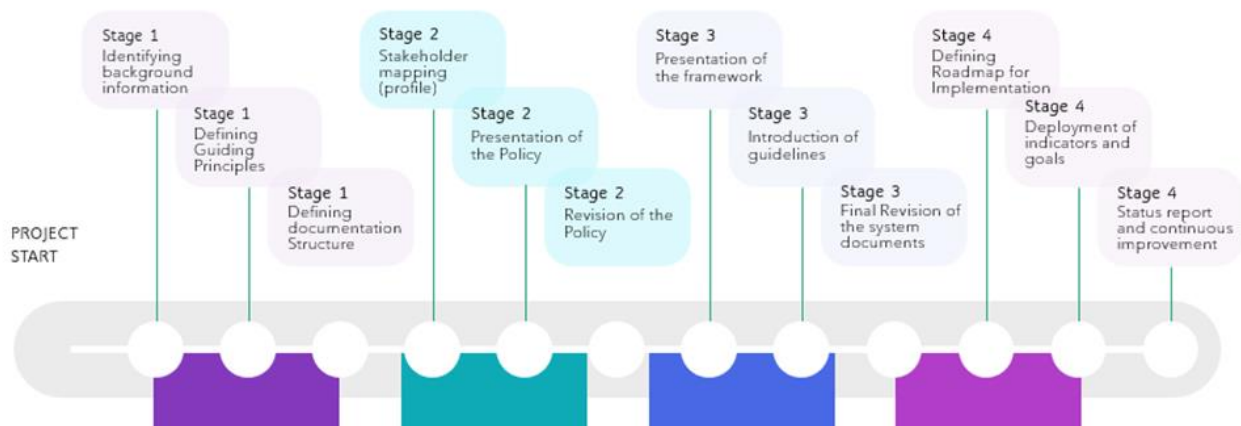


Figure 14: Roadmap and Action items

### 3.2. Stage 2: Policy and stakeholders mapping

Open data serves as a reliable and quality source of knowledge for citizens, business, all levels of government and institutions; to connect and respond to the vision of citizens; foster digital interaction between internal and external stakeholders; present a space for transparency of information and greater awareness of new services. In this context the *Open Data Policy* outlines the principles, as well as the roles and responsibilities of the district in the administration and the strategic deployment of open data initiatives that emphasize the importance and practice of safeguarding protected data.

The policy also outlines the general process for identifying and publishing open data including maintenance and ensures that the adopted principles are being followed. The *Open Data Policy* seek to ensure that open data is identified and undergoes an efficient input process that complies to normal procedures while respecting the confidentiality and protected information. The policy also outlines the adequate procedures that ensure a proper administration of the overall system, to provide reliable data that is aligned to guiding principles and available for analysis and decision making.

This project also includes a recommendation of roles, responsibilities and governance of the system in the policy draft, this point recognized the active task that open data systems and its management required, and this is an interdepartmental effort. This project covers the importance of the Information technology department (IT) and broadly the Corporate Service responsibility in the process of maintaining and managing of the open data created by District departments according to the needs and in alignment to the district strategies, policies, and plans, and is in charge of the safeguarding of personal information maintained within the system in concert with the Legislative Services department. This part of the report concludes with the suggestion to include other departments in a reviewer position, such as the Legal, Second Language department and Privacy and Protection of information areas.

The Policy also include an overview of the guidelines to follow in the process of publication of data to respect the open data guiding principles, it must be remark that this did not constitute the actual procedural steps and/or a document that outline extensively the procedure. This overview is an adaptation of the guidelines presented by the Open data charter (The Open Data Charter, 2021a) and are grouped in four categories in relation to the nature of each of the guiding principles and the close relations of the same. The first subheading stated the importance of *Ensuring that information is made available and respect the privacy and security (Principle 1 and 7)* This point encompasses the principle 1: Open by default and principle 7: Protected. The second point talks about *ensuring that strategic open data is available in a timely and comprehensive manner (Principle 2)* in relation to the second principle of Timely and comprehensive. The third

point overview the importance of *ensuring that the data is usable, accessible, and interoperable (Principle 3 and 4)* both talking Accessible and Usable, and Comparable and Interoperable respectively. Finally, we talk about *Open data to advance the district data governance and open government, civic engagement, and innovation (Principle 5 and 6)* in relation to the principles of Open data for Improved Governance & Citizen Engagement and for Inclusive Development and Innovation.

The procedural document describes the step-by-step guidelines informed by best practices to be followed to ensure publication standards and the maintenance of the open data system.

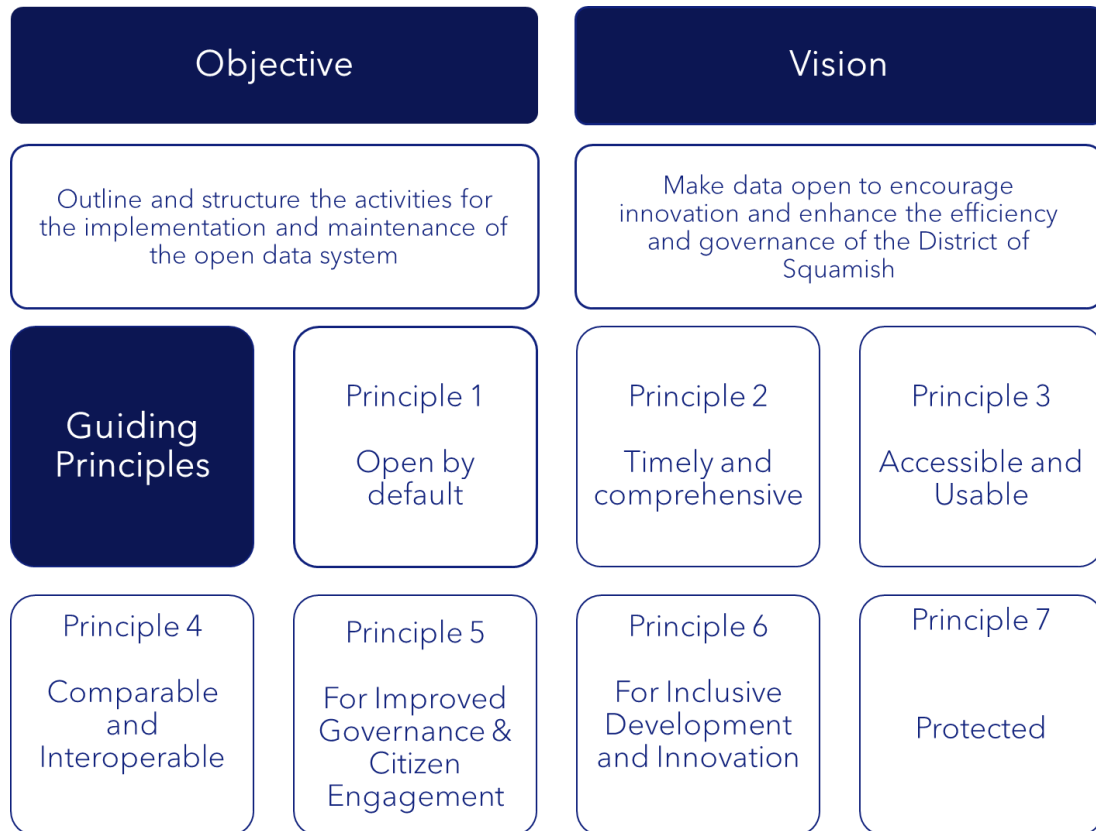
Open data procedures and principles are adapted from ODC principles (The Open Data Charter, 2021) and guidelines and procedural information obtained and adapted from the Ontario government's Open Data Guidebook (Government of Ontario, 2020)

### 3.3. Stage 3: Open data framework and guidelines

Open data can open several possibilities in terms of transparency and governance, open data can showcase disaggregated data to reflect the current status of each demographic group and evaluate how policies impact people.

Result of the council meeting where the open data guiding principles were endorsed, disaggregation in data was a topic expressed as a priority and a of the interest for the council and the district. Disaggregated data is a path that can provide a clearer and more complete picture (Bizikova, 2017). There is a clear global commitment towards disaggregated data, in the 2030 Agenda for Sustainable Development was adopted the guiding principle of *Leave no one behind* (United Nations Sustainable Development Group, 2021) the same that is reflected in the targets of SDG 10 *Reduce inequality within and among countries* (United Nations Department of Economic and Social Affairs, 2021) and in the request that indicators of the SGDs have disaggregated data. Disaggregated data could be riskier from a privacy perspective, the level of granularity must respect the rights of individuals and safeguard privacy. The disaggregated data must be used for the progress of equality and not to increase discrimination. While disaggregated data poses benefits there are privacy concerns and risk related to the publication of this type of data in an open data platform. This recommendation was expressed to the working group and treated in the deliverables presented to the District of Squamish.

As reflected in Figure 15, the objective and vision of this project implementation are linked to Squamish's overarching goals and objectives for open government and presents the District's Vision and guiding principles for open data in a quick overview. It is essential to reflect and encourage the understanding of open data principles as they function as the fundamental basis of the system. The vision is key to establish the expected situation of the project in the future.



*Figure 15: Strategic Framework*

The procedure is comprised of nine main point in relation to the publication and maintaining of Open Data these mayor steps range from the identification of the data to measuring of performance. The first step is related to (1) Data Identification and prioritization, this point follows the best practices to identify key priority data and to identify potentially available data. Step (2) Assess and make data releasable (respecting the privacy and security), follow how the data must be evaluated prior the publication to respect legal, privacy, security, and sensitivity standards, and summarizes the importance in the priority to strategic data. Step (3) Prepare data for publication, underscored and detailed present the guidelines to comply with the usability, accessibility, interoperability, and consistency standards. Step (4) Follows the approval process and the proper documentation to be accompanied for. Step (5) follows the inclusions in the submission process and the steps to submit the complete information to the department in

charge of the open data management. Finally, the last main step (6) encompasses the publishing and communication efforts, this point talks about the communication efforts and the proper channels of publication while also mentioning the final considerations.

Steps 7, 8, 9 are related to non-publication related steps, step (7) talk about the proper guidelines to carry out a dataset maintenance while safeguarding the integrity of the open data system. Step (8) is a conditional step related to Dataset removal, this step is only reserved to dataset published by error or other mayor reason the same that need to be included in the open data inventory.

Lastly, we have step (9) Performance and adherence to principles, these guidelines have an overview of the importance and the methods to measure and set objectives for the progress of the open data system and the recommended set of indicators and performance metrics to adhere to. More detail of the continuous improvement effort is included in point 3.4.

#### 3.4. Stage 4: Implementation and continuous improvement

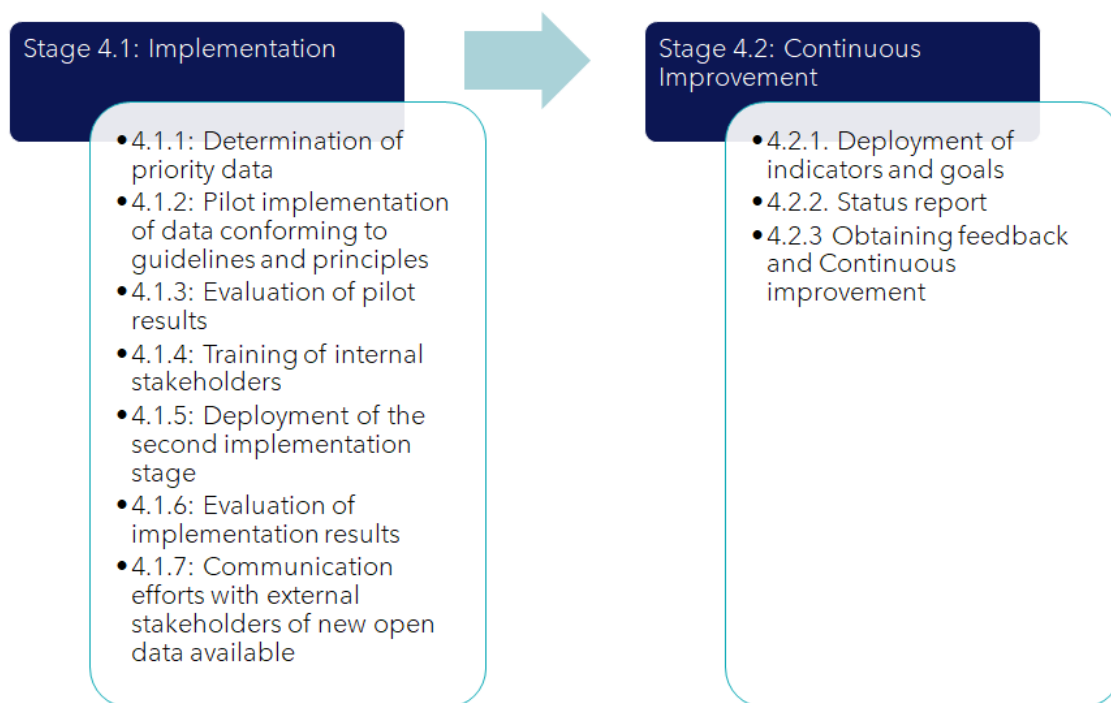
The final phase of the project comprises 2 fundamental stages for the success and materialization of the project, the execution activities, and the work for continuous improvement (See Figure 16).

The Implementation stage starts by defining and identifying priority datasets to be published; this activity is followed by a pilot that consists of priority datasets (Step 4.1.2), and the pilot should be of a limited scope for adequate monitoring and mapping of performance and outcomes, subsequently stage 4.1.3. The intent of this piloting round is to test the open data process and procedural documents and to evaluate the performance of the system in a controlled setting to generate conclusions, necessary adjustments and if required a second round of pilot to evaluate substantial changes.

Step 4.1.4 involves training, workshops, and other materials to support the adoption, understanding and performance of District staff in the publication, inquiry and maintenance of data in the open data system.

Once clear procedures and guidelines, adequate training and a deployment plan are in place, the next step is 4.1.5, which refers to the publication of the previously prioritized databases; this stage is parallel to 4.1.6, which is linked to the monitoring and evaluation of the implementation indicators and sets in motion phase 4.1.7, the deployment of communication efforts to make public the availability of more data in the open data portal.

Continuous Improvement is a key component of every established system, this project finds the benefit of using continuous improvement cycles to emphasize the effectiveness of the system. This study mainly based the continuous improvement cycle in the applications of the Deming cycle. The PDCA cycle is essential in the well development and maintaining of the systems, as the acronym stands this methodology is based in planning, doing, checking, and finally acting and this cycle repeats to generate a continuous improvement loop. As stated by the American Society for Quality this approach is useful when dealing with new services or change (American Society for Quality, 2021) both situations well aligned with the implementation of a open data system when considering the plethora of possible scenarios and feedback provided by the different stakeholders profiles and special priorities.



*Figure 16: Stage 4 Implementation and continuous improvement*

Once the system is fully launched the district will look for opportunities to continually refine the system with a clear commitment to continuous improvement. For this purpose, it is essential to implement indicators and set goals and objectives (See Figure 16, Step 4.2.1), the district must also generate system status reports and evaluate the system's performance (Step 4.2.2). We recommended the deployment of open data portal user satisfaction; this can be achieved by asking to fill exit surveys in the portal. We also encourage the use of indicators and performance metrics accompanied by ambitious objectives and constantly measure the progress of the

initiative. We recommended the use of the Open data Charter Measurement Guide because of the embedded compatibility to the guiding principles or the Open data Barometer (World Wide Web Foundation & Omidyar Network, 2017)

Finally in the last milestone (Step 4.2.3) the District of Squamish must proactively seek feedback from its stakeholders and pursue continuous improvement of the system. This is a key point in the overall framework related to the potential of collect useful opinion from the citizens while progressing the efficiency of the system.



## 4. Results

As presented in this chapter there is embedded capacity in local municipalities to adopt open data initiatives, while respecting a pre-set capacity and prioritizing key open dataset. We argue that there is an extensive benefit on applying this framework as a structure to implement open data systems regardless of the open data system limited capacity, but we also recognized the resource constraint imposed in small governmental organization.

We recognized the limitations in terms of system maintenance and the time commitment related to this. Open data can required extensive time to be maintained and ready to be used (Huston et al., 2019)

At the time of this thesis presentation the District of Squamish endorsed the open data guiding principles, as presented in the Council Resolution these guiding principles were set as the foundation for the development of the procedures, guidelines and policy in relation to this initiative, the stakeholders remarked the importance of disaggregation in the datasets and climate change considerations (District of Squamish, 2021)

The district also recognized the usefulness of the policy draft and guidelines to the progress of the initiative and the commitment with the project to continue the development and pilot test of the documentation.

Continuous improvement, and measurement and performance metrics are key components for the improvement of the initiative, because of the potential to expand the efficiency of the system while taking into consideration key rising issue presented by the stakeholders or analyzed by the group of decision makers.

The present chapter is a key component of a good governance environment and is endorsed by the commitment of transparency around the world, we see this chapter and the developed work as a potential to integrate with opinion-based methodologies such us the presented in Chapter II. The main reason for setting an open data initiatives is to the progress of policies, initiatives and transparency of the overall governmental environment.

## 5. Conclusion

The project demonstrates in a practical way the feasibility of adopting an open data framework and guidelines in communities with limited resources, following a systematic and structured approach. As discussed above, the open data system generates a platform that encourages governance and facilitates the transfer of ideas for the advancement of community driven initiatives and innovation in the private sector.

The excerpt also mentions the dichotomy of disaggregated data, on the one hand it can be used to advance policies that seek the progress of communities but such data risks being used to perpetuate inequalities, as we discussed in chapter IV this poses an opportunity to integrate this concept to the analytical framework as a are for guiding principles.

We recognized that the present chapter can be drove by stakeholder analysis and profile mapping as previously stated and benefit of the clear guidelines to govern the stakeholder relations and informed opinion conversation in social media. The conceptual framework shows in a general way the information exchange flow and decision making involved in local governmental organizations and presents the potentials of data disclosure to the population for the advancement of initiatives directed to priority issues related to the interest and needs of the community.

Open data and transparency have the potential to be a driving force for mobilization of citizenry. The implementation of an open data system generates efficiencies and time optimization while helping with the promptly available and easy to communicate datasets.

The advancement of open data initiatives responds to the willingness of change and the commitment of the organizations, in this case of study we presented an organization driven by data and willing to be a driving force of change and to be a community where open data can have a bigger impact in the different stakeholders. We identified that when data is readily available there are growing interest and potential to be transformed in data driven opinion and information for the progress of the governance.

## Chapter IV: Result, Conclusion and Future work

### 1. Results / Integrated Framework

In Figure 17 we can see the combination of both approaches presented in Chapter II and III. We also included analytical tools to improve the effectivity and reliability of the overall framework.

In the upper left corner, we can see the open data environment include of the OD Guiding principles, the same that endorsed the system and govern the open data portal. These open data portal feed data to the community stakeholder involved in the decision process, we see how this group seek data from the Open Data (OD) platform/portal and build an Open data feedback which could benefit the improvement cycle; values that will be encompassed in the organizational community values; and lastly data-based ideas and opinions that are translated into social media conversation.

The social media conversation is a place were academia and media can divulge important information and were these stakeholders collect data to understand public interest topics.

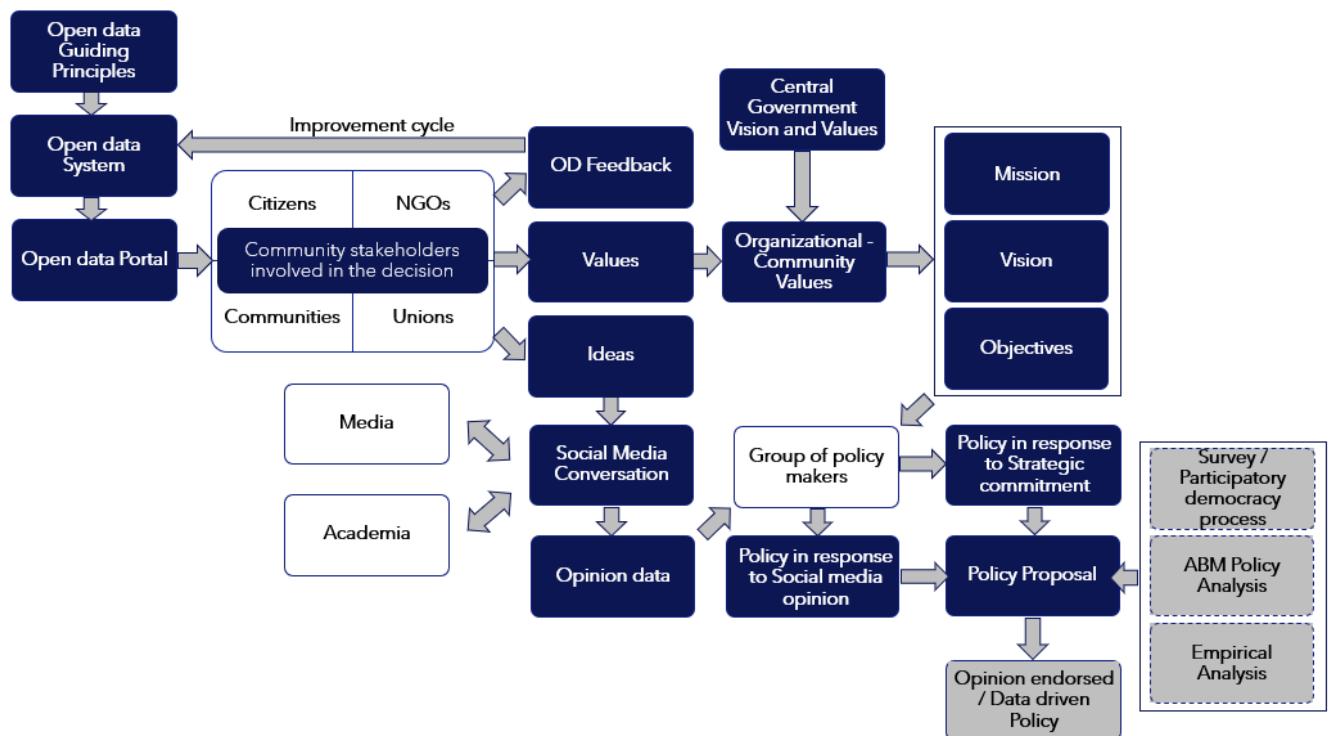


Figure 17: Integrated Framework

Figure 17 also explain the dynamics of policy generation in the recommended policy making framework, this research recognized the policy generation in response to social media opinion or community push and the policy in response to strategic commitment or policy related to the Mission, Vision, and objectives of the organization. In some cases, these two policy groups can overlap to reflect the priority of the involved stakeholders and a clear path of priority in the implementation for the policy makers.

As we can see this framework encompasses both methodologies and search for an opinion endorsed and data driven policy making, we argue of the importance of support methodologies as a empower factor to the framework as we can see in the Figure.

## 2. Conclusion

Sustainability goes beyond preserving the environment and being eco-friendly, also considers our ability to successfully co-exist with nature and other human beings. Issues such as gender inequality, lack of drinking water and poverty are social problems that keep us from being a society where there is equality. Most discussion of sustainability does not overtly include this discussion of human welfare and equality. This is the reason why the present research was focussed on poverty and open data transparency which are related to Sustainable Development Goals (United Nations Statistics Division, 2019)

In this thesis, we explored the use of social media in providing policy insights along with informing citizen priorities for specific initiatives. Social media can be used as a platform of democracy and expression; however, special attention must be paid to the quality of the data. Beyond traditional statistical concerns of sampling bias, social media data could be compromised by hate speech, misinformation, and disinformation campaigns. This study recognizes that the visions, objectives, and principles that govern each community are particular but respond to a common fundamental vision.

The online conversation of poverty on Twitter is a clear example of the iterations of opinions in these platforms, the online community or citizens are a stakeholder that have a role to push information to the decision-making group. In our final case of study about the open data management system, we see the citizenry as a stakeholder that pulls information available in open data platforms.

Social media activism has a wide reach, and campaigns have made remarkable progress in raising awareness of different issues and generating a translation into expressions of citizenship, including the yellow umbrella movement and the Hong Kong Protests (Phillips, 2015; G. Shao, 2019) the #MeToo movement (Jaffe, 2018; McNabb, 2021) the pro democracy protests in Myanmar (Tangen, 2021) and the #BlackLivesMatter movement (Asmelash, 2020; Perrin, 2020). Social media platforms provide governments with the ability to react to popular hashtags, but these movements have typically had years of activity before they are heard by society and governments (Anderson, 2016). Social media also provides a possibility to capture opinions of the population in an active way and not just react to the generalized clamor of the population as presented in the chapter II, constant monitoring of social media conversation can make a link in community priorities and finally respond to initiatives that can potentially encourage equality.

These unprecedented abilities to communicate are also opportunities for surveillance, and privacy and human rights concerns are vitally important in these discussions. As previously stated, complementing social media data mining with traditional methods marks a way to validate the population's view on a "priority" topic.

As we already present in chapter I, a variety of methodologies can be applied to implement government policies and initiatives at the district, regional, provincial, and federal levels. In both cases (Chapter II and III) we see data available to assist in decision making that can be complemented with classical data capture methodologies to generate an adequate information set to build plans and frameworks for policy development and community initiatives. With a further implementation of open town halls, participatory budgeting, surveys, and other traditional methods we will have a broader impact framework.

As stated in previous chapters, there is a plethora of data available at different levels of government or in the hands of different stakeholders. We define two forces at work in social media and societal data. We illustrated both the pull of information by examining data mining in social media along with the push of data to stakeholders using an Open data framework. Both methods, possibly successful on their own, encompass an ecosystem of assistance to decision making, policy prioritization, transparency, and governance by including citizens in decision making and having them be able to analyze open data and expose possibilities for change. The implementation of this joint initiative brings us closer to a true citizen participation in democracy.

### 3. Future work

Throughout the present research we find interesting ways and venues to conduct important advances in our research and to complement the methodologies presented.

We found the opportunity to delve into the application and consideration of Agent Based Models, ABM is a robust tool to reflect reality and individuality in part because of the capacity to replicate and represent assumptions of agents' heterogenous behaviour (Bonabeau, 2002) but also we find that ABM models can complement the social media opinion framework or model opinion systems.

There are possibilities to include the development of stakeholder mapping that consider especial priority areas of groups of the population. In the present research we embark in understanding internal stakeholders' considerations, but we recognized the importance to reflect the priorities of the citizens in the proposed framework. A proper stakeholder mapping and study can reflect key priority areas of the population, this engaging has potential capabilities to understand the human players, the priorities of the working group, important key elements and in overall engaging with stakeholders.

We must remark the importance of disaggregated open data and disaggregation in the data collection, as previously show disaggregation can provide a clearer and more complete picture and it is a target to reach equality among citizens (United Nations Department of Economic and Social Affairs, 2021) but as we also argue the level of granularity can affect privacy concerns in open data environments, there is a potential in integrate guidelines to govern data collection and in special disaggregated data to respect individuals rights while progressing equality. Embarking in responding this consideration is an important angle to progress the future research.

As a future venue of research, we find the integration of ABM models as a possibility to complement natural language approaches and traditional approaches, ABM is a bedrock of emergent phenomena analysis and can easily reflect connotations and considerations that are not reflected by the previously presented framework. As presented in Figure 17 there is a strong possibility to include these methodologies to give endorsement and support to policies proposal and have data and opinion driven decision making in the policy assessment and implementation process.

## References

- Ahlqvist, T., Valovirta, V., & Loikkanen, T. (2012). Innovation policy roadmapping as a systemic instrument for forward-looking policy design. *Science and Public Policy*, 39(2), 178–190.  
<https://doi.org/10.1093/scipol/scs016>
- Ajuntament de Barcelona. (2021). *Plataforma participativa decidim.barcelona*.  
<https://www.decidim.barcelona/?locale=es>
- Ali, A. M., & Isse, H. S. (2005). An Empirical Analysis of the Effect of Aid on Growth. *International Advances in Economic Research*, 11(1), 1–11. <https://doi.org/10.1007/s11294-004-7177-6>
- Alkire, S. (2005). Why the Capability Approach? *Journal of Human Development*, 6(1), 115–135.  
<https://doi.org/10.1080/146498805200034275>
- Allcott, H., Gentzkow, M., & Yu, C. (2019). Trends in the diffusion of misinformation on social media. *Research & Politics*, 6(2), 2053168019848554.  
<https://doi.org/10.1177/2053168019848554>
- American Society for Quality. (2021). *PDCA Cycle—What is the Plan-Do-Check-Act Cycle?*  
<https://asq.org/quality-resources/pdca-cycle#Use>
- Anderson, M. (2016, August 15). History of the hashtag #BlackLivesMatter: Social activism on Twitter. *Pew Research Center: Internet, Science & Tech*.  
<https://www.pewresearch.org/internet/2016/08/15/the-hashtag-blacklivesmatter-emerges-social-activism-on-twitter/>
- Andreotta, M., Nugroho, R., Hurlstone, M. J., Boschetti, F., Farrell, S., Walker, I., & Paris, C. (2019). Analyzing social media data: A mixed-methods framework combining



- computational and qualitative text analysis. *Behavior Research Methods*, 51(4), 1766–1781. <https://doi.org/10.3758/s13428-019-01202-8>
- Arias, M., Arratia, A., & Xuriguera, R. (2014). Forecasting with twitter data. *ACM Transactions on Intelligent Systems and Technology*, 5(1), 8:1-8:24. <https://doi.org/10.1145/2542182.2542190>
- Ash Center for Democratic Governance and Innovation. (2020). *Participatory Budgeting in New York City | Government Innovators Network*. <https://www.innovations.harvard.edu/participatory-budgeting-new-york-city>
- Asmelash, L. (2020). *How Black Lives Matter went from a hashtag to a global rallying cry*. CNN. <https://www.cnn.com/2020/07/26/us/black-lives-matter-explainer-trnd/index.html>
- Awan, I. (2017). Cyber-Extremism: Isis and the Power of Social Media. *Society*, 54(2), 138–149. <https://doi.org/10.1007/s12115-017-0114-0>
- Bavetta, S., Donni, P. L., & Marino, M. (2019). An Empirical Analysis of the Determinants of Perceived Inequality. *Review of Income and Wealth*, 65(2), 264–292. <https://doi.org/10.1111/roiw.12351>
- Berger, T. R. (1978). The Mackenzie Valley Pipeline Inquiry. *Osgoode Hall Law Journal*, 16(3).
- Bird, S., Klein, E., & Loper, E. (2009). *Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*. O'Reilly Media, Inc.
- Biyase, M., & Zwane, T. (2018). An Empirical Analysis of the Determinants of Poverty and Household Welfare in South Africa. *The Journal of Developing Areas*, 52(1), 115–130. <https://doi.org/10.1353/jda.2018.0008>

Bizikova, L. (2017, October 12). *Disaggregated Data is Essential to Leave No One Behind*. International Institute for Sustainable Development.

<https://www.iisd.org/articles/disaggregated-data-essential-leave-no-one-behind>

Bloomberg Philanthropy. (2016). *What Works Cities: The Data Gap at City Hall*.

[https://data.bloomberglp.com/dotorg/sites/8/2016/03/WWC\\_Brief\\_c.pdf](https://data.bloomberglp.com/dotorg/sites/8/2016/03/WWC_Brief_c.pdf)

Bokun, A., Himmelstern, J., Jeong, W., Musick, K., Warren, R., & Meier, A. (2020, July 17). *The pandemic is having a disproportionate impact on children's economic vulnerability*. PBS

NewsHour. <https://www.pbs.org/newshour/economy/the-pandemic-is-having-a-disproportionate-impact-on-childrens-economic-vulnerability>

Bonabeau, E. (2002). Agent-based modeling: Methods and techniques for simulating human systems. *Proceedings of the National Academy of Sciences*, 99(suppl 3), 7280–7287.

<https://doi.org/10.1073/pnas.082080899>

Bottan, N., Hoffmann, B., & Vera-Cossio, D. (2020). The unequal impact of the coronavirus pandemic: Evidence from seventeen developing countries. *PLOS ONE*, 15(10), e0239797.

<https://doi.org/10.1371/journal.pone.0239797>

Brooks, D. (2019, April 4). Opinion | Winning the War on Poverty. *The New York Times*.

<https://www.nytimes.com/2019/04/04/opinion/canada-poverty-record.html>

Bunge, M. (1979). A systems concept of society: Beyond individualism and holism. *Theory and Decision*, 10(1), 13–30. <https://doi.org/10.1007/BF00126329>

Carvalho, C., & Cabral, D. de C. (2021). Beyond the Favelas: An Analysis of Intraurban Poverty Patterns in Brazil. *The Professional Geographer*, 73(2), 269–281.

<https://doi.org/10.1080/00330124.2020.1844571>

- Chakraborty, K., Bhatia, S., Bhattacharyya, S., Platos, J., Bag, R., & Hassanien, A. E. (2020). Sentiment Analysis of COVID-19 tweets by Deep Learning Classifiers—A study to show how popularity is affecting accuracy in social media. *Applied Soft Computing*, *97*, 106754. <https://doi.org/10.1016/j.asoc.2020.106754>
- Chaton, C., & Gouraud, A. (2020). Simulation of fuel poverty in France. *Energy Policy*, *140*, 111434. <https://doi.org/10.1016/j.enpol.2020.111434>
- Chaudhuri, S., Jalan, J., & Suryahadi, A. (2002). *Assessing household vulnerability to poverty from cross-sectional data: A methodology and estimates from Indonesia*. <https://doi.org/10.7916/D85149GF>
- Chavan, V. S. & Shylaja S S. (2015). Machine learning approach for detection of cyber-aggressive comments by peers on social media network. *2015 International Conference on Advances in Computing, Communications and Informatics (ICACCI)*, 2354–2358. <https://doi.org/10.1109/ICACCI.2015.7275970>
- Chaverri, J., Del Pino, M. A., Schmitt, K. A., & Eicker, U. (2020). *A framework for gender equality for localizing the SDGs: A first approach from policy to implementation*. 24.
- Chen, N.-C., Drouhard, M., Kocielnik, R., Suh, J., & Aragon, C. R. (2018). Using Machine Learning to Support Qualitative Coding in Social Science: Shifting the Focus to Ambiguity. *ACM Trans. Interact. Intell. Syst.*, *8*(2), 9:1-9:20. <https://doi.org/10.1145/3185515>
- Chen, X., Vorvoreanu, M., & Madhavan, K. (2014). Mining Social Media Data for Understanding Students' Learning Experiences. *IEEE Transactions on Learning Technologies*, *7*(3), 246–259. <https://doi.org/10.1109/TLT.2013.2296520>

- Chinnadurai, K., & Athithan, S. (2020). Mathematical modelling of poverty dynamics with the effect of alcohol consumption. *AIP Conference Proceedings*, 2277(1), 130001.  
<https://doi.org/10.1063/5.0025263>
- Chou, W.-Y. S., Oh, A., & Klein, W. M. P. (2018). Addressing Health-Related Misinformation on Social Media. *JAMA*, 320(23), 2417–2418. <https://doi.org/10.1001/jama.2018.16865>
- City of Austin. (2013). *City of Austin Open Government Directive*. <https://www.open-austin.org/wp-content/uploads/2013/09/Memo-to-Mayor-and-Council-with-attached-Open-Government-Directive.pdf>
- City of Beverly Hills. (2021). *Transparency*.  
<http://www.beverlyhills.org/departments/informationtechnology/transparency/>
- City of Chicago. (2021). *Open Data Executive Order (No. 2012-2)*.  
[https://www.chicago.gov/content/city/en/narr/foia/open\\_data\\_executiveorder.html](https://www.chicago.gov/content/city/en/narr/foia/open_data_executiveorder.html)
- City of Edmonton. (2021, January 27). *Open City* (Edmonton, Alberta, Canada). The City of Edmonton. [https://www.edmonton.ca/city\\_government/initiatives\\_innovation/open-city.aspx](https://www.edmonton.ca/city_government/initiatives_innovation/open-city.aspx)
- City of Edmonton, Open city and innovation branch. (2017). *Open Data Strategy*.  
[https://www.edmonton.ca/city\\_government/documents/PDF/CityofEdmonton\\_OpenDataStrategy.pdf](https://www.edmonton.ca/city_government/documents/PDF/CityofEdmonton_OpenDataStrategy.pdf)
- City of Kitchener. (2018, June 7). *Accountability and transparency policy*.  
<https://www.kitchener.ca/en/city-services/accountability-and-transparency-policy.aspx>
- City of Louisville. (2013, October 11). *Executive Order—Louisville, Kentucky*.  
<https://opendatapolicyhub.sunlightfoundation.com/collection/louisville-ky-2013-10-11/>

City of Ottawa. (2018). *Open Data – Procedures*.

<https://engage.ottawa.ca/8406/widgets/33019/documents/14811>

City of Ottawa. (2019). *Open Ottawa*. <https://open.ottawa.ca/>

City of Ottawa. (2020, December 7). *Accountability framework*. <https://ottawa.ca/en/city-hall/open-transparent-and-accountable-government/accountability-framework>

City of Portland. (2009, September 30). *Council Resolution—Portland, Oregon*.

<https://opendatapolicyhub.sunlightfoundation.com/collection/portland-or-2009-09-30/>

City of Waco. (2015, December 15). *Council Resolution—Waco, Texas*.

<https://opendatapolicyhub.sunlightfoundation.com/collection/waco-tx-2015-12-15/>

City of Woodstock. (2020, December 10). *Accountability and Transparency*.

<https://www.cityofwoodstock.ca/en/city-governance/accountability-and-transparency.aspx>

Congress of the Republic of Peru. (2003). *Ley 28056 Ley Marco del presupuesto participativo*.

<http://biblioteca.unmsm.edu.pe/REdlieds/Recursos/archivos/Descentralizaci%C3%B3nRecursosEcon%C3%B3micos/ley28056.pdf>

Congress of the Republic of Peru. (2011). *Ley N° 29785, Ley del derecho a la consulta previa a los pueblos indígenas u originarios, reconocido en el convenio 169 de la organización internacional del trabajo (OIT)*.

<http://www.minem.gob.pe/minem/archivos/Ley%2029785%20Consulta%20Previa%20pdf.pdf>

- Coyle, J. (2017, June 24). *How a Canadian judge helped preserve the Arctic*. Thestar.Com.  
<https://www.thestar.com/news/canada-150/2017/06/24/how-a-canadian-judge-helped-preserve-the-arctic.html>
- Cuthill, M. (2007). Developing local government policy and processes for community consultation and participation. *Urban Policy and Research*.  
<https://doi.org/10.1080/08111140108727871>
- Dahl, R. A. (1994). A Democratic Dilemma: System Effectiveness versus Citizen Participation. *Political Science Quarterly*, 109(1), 23–34. <https://doi.org/10.2307/2151659>
- Daityari, S. (2019, September 26). *How To Perform Sentiment Analysis in Python 3 Using the Natural Language Toolkit (NLTK)*. DigitalOcean.  
<https://www.digitalocean.com/community/tutorials/how-to-perform-sentiment-analysis-in-python-3-using-the-natural-language-toolkit-nltk>
- de Gibert, O., Perez, N., García-Pablos, A., & Cuadros, M. (2018). Hate Speech Dataset from a White Supremacy Forum. *ArXiv:1809.04444 [Cs]*. <http://arxiv.org/abs/1809.04444>
- Department of Industrial Engineering Dalhousie University. (2020). *What is Industrial Engineering?* Dalhousie University.  
<https://www.dal.ca/faculty/engineering/industrial/about/whatisIE.html>
- District of Squamish. (2021, March 9). *Minutes of the Council of the District of Squamish*.  
<https://squamish.civicweb.net/document/197692>
- Earl, J. (2016). “Slacktivism” that works: “Small changes” matter. The Conversation.  
<http://theconversation.com/slacktivism-that-works-small-changes-matter-69271>

European data portal. (2020). *The benefits and value of open data*.

<https://www.europeandataportal.eu/en/highlights/benefits-and-value-open-data>

Farzindar, A., & Inkpen, D. (2015). *Natural Language Processing for Social Media*. Morgan & Claypool Publishers.

<http://gen.lib.rus.ec/book/index.php?md5=10fbd73c15d6d25d8776c08835e45040>

Feng, T., Du, H., Coffman, D., Qu, A., & Dong, Z. (2021). Clean heating and heating poverty: A perspective based on cost-benefit analysis. *Energy Policy*, 152.

<https://doi.org/10.1016/j.enpol.2021.112205>

Feyaerts, G., Deguerry, M., Deboosere, P., & De Spiegelare, M. (2017). Analysis of the decision-support function of policy assessment in real-world policy making in the field of poverty and social inequalities. Case study on migrant integration policies in the Brussels-Capital Region. *Environmental Impact Assessment Review*, 67, 40–48.

<https://doi.org/10.1016/j.eiar.2017.08.007>

Finn, S., & Mustafaraj, E. (2013). Learning to Discover Political Activism in the Twitterverse. *KI - Künstliche Intelligenz*, 27(1), 17–24. <https://doi.org/10.1007/s13218-012-0227-y>

Gilbert, N. (2005). Agent-based social simulation: Dealing with complexity. *The Complex Systems Network of Excellence*, 9. <https://doi.org/10.1201/9780203461730.ch1>

Global Affairs Canada-Affaires mondiales Canada. (2017, June 8). *The 2030 Agenda for Sustainable Development*. GAC. [https://www.international.gc.ca/world-monde/issues\\_development-enjeux\\_developpement/priorities-priorites/agenda-programme.aspx?lang=eng](https://www.international.gc.ca/world-monde/issues_development-enjeux_developpement/priorities-priorites/agenda-programme.aspx?lang=eng)

- Golbeck, J., Robles, C., & Turner, K. (2011). Predicting personality with social media. *CHI '11 Extended Abstracts on Human Factors in Computing Systems*, 253–262.  
<https://doi.org/10.1145/1979742.1979614>
- Government of Canada, S. C. (2019, February 26). *Low income statistics by age, sex and economic family type*.  
<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110013501>
- Greater London Authority. (2015, June 25). *Openness and transparency*. London City Hall.  
<https://www.london.gov.uk/about-us/governance-and-spending/sharing-our-information/openness-and-transparency>
- Greaves, F., Ramirez-Cano, D., Millett, C., Darzi, A., & Donaldson, L. (2013). Use of Sentiment Analysis for Capturing Patient Experience From Free-Text Comments Posted Online. *Journal of Medical Internet Research*, 15(11), e239. <https://doi.org/10.2196/jmir.2721>
- Gregory, R., Failing, L., Harstone, M., Long, G., McDaniels, T., & Ohlson, D. (2012). *Structured Decision Making: A Practical Guide to Environmental Management Choices*. John Wiley & Sons.
- Grösser, S. N. (2017). Complexity Management and System Dynamics Thinking. In S. N. Grösser, A. Reyes-Lecuona, & G. Granholm (Eds.), *Dynamics of Long-Life Assets: From Technology Adaptation to Upgrading the Business Model* (pp. 69–92). Springer International Publishing. [https://doi.org/10.1007/978-3-319-45438-2\\_5](https://doi.org/10.1007/978-3-319-45438-2_5)
- Guston, D. H. (1999). Evaluating the First U.S. Consensus Conference: The Impact of the Citizens' Panel on Telecommunications and the Future of Democracy. *Science*,



*Technology, & Human Values*, 24(4), 451–482.

<https://doi.org/10.1177/016224399902400402>

Guterres, A. (2020). *COVID-19 Pandemic Triggers Devastating Social, Economic Impact on Women, Girls, Secretary-General Says, Urging Governments to Protect Their Rights | Meetings Coverage and Press Releases.*

<https://www.un.org/press/en/2020/sgsm20040.doc.htm>

Habernal, I., Ptáček, T., & Steinberger, J. (2013). Sentiment Analysis in Czech Social Media Using Supervised Machine Learning. *Proceedings of the 4th Workshop on Computational Approaches to Subjectivity, Sentiment and Social Media Analysis*, 65–74.

<https://www.aclweb.org/anthology/W13-1609>

Heath, B., Hill, R., & Ciarallo, F. (2009, October 31). *A Survey of Agent-Based Modeling Practices (January 1998 to July 2008)* [Text.Article]. JASSS. <https://www.jasss.org/12/4/9.html>

Heyer, E., & van Knippenberg, L. (2020). *The Economic Impact of Open Data Opportunities for value creation in Europe.* <https://www.europeandataportal.eu/sites/default/files/the-economic-impact-of-open-data.pdf>

Hufkens, T., Figari, F., Vandelannoote, D., & Verbist, G. (2020). Investing in subsidized childcare to reduce poverty. *Journal of European Social Policy*, 30(3), 306–319.

<https://doi.org/10.1177/0958928719868448>

Huston, P., Edge, V., & Bernier, E. (2019). Reaping the benefits of Open Data in public health. *Canada Communicable Disease Report*, 45(11), 252–256.

<https://doi.org/10.14745/ccdr.v45i10a01>

International Labour Organization. (2021). *Ratifications of ILO conventions: Ratifications by Convention*.

[https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11300:0::NO::P11300\\_INSTRUMENT\\_ID:312314](https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11300:0::NO::P11300_INSTRUMENT_ID:312314)

International Telecommunication Union. (2020a). *Individuals using the Internet (% of population)*. The World Bank. <https://data.worldbank.org/indicator/IT.NET.USER.ZS>

International Telecommunication Union. (2020b). *Individuals using the Internet (% of population)—Canada | Data*. The World Bank.

<https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=CA>

Jaffe, S. (2018). The Collective Power of #MeToo. *Dissent*, 65(2), 80–87.

<https://doi.org/10.1353/dss.2018.0031>

Jiang, L., Wen, H., & Qi, W. (2020). Sizing up Transport Poverty Alleviation: A Structural Equation Modeling Empirical Analysis. *Journal of Advanced Transportation*, 2020.

<https://doi.org/10.1155/2020/8835514>

Joss, S. (1998). Danish consensus conferences as a model of participatory technology assessment: An impact study of consensus conferences on Danish Parliament and Danish public debate. *Science and Public Policy*, 25(1), 2–22.

<https://doi.org/10.1093/spp/25.1.2>

Kaicer, M. (2020). Sustainable Development Poverty Reduction by Modeling and Simulation in Microfinance. In M. Ezziyyani (Ed.), *Advanced Intelligent Systems for Sustainable Development (AI2SD'2019)* (pp. 661–668). Springer International Publishing.

[https://doi.org/10.1007/978-3-030-36671-1\\_59](https://doi.org/10.1007/978-3-030-36671-1_59)

- Kano, T., Yasui, K., Mikami, T., Asally, M., & Ishiguro, A. (2021). An agent-based model of the interrelation between the COVID-19 outbreak and economic activities. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 477(2245), 20200604. <https://doi.org/10.1098/rspa.2020.0604>
- Keramatfar, A., & Amirkhani, H. (2019). Bibliometrics of sentiment analysis literature. *Journal of Information Science*, 45(1), 3–15. <https://doi.org/10.1177/0165551518761013>
- Khan, M., Saboor, A., Rizwan, M., & Ahmad, T. (2020). An empirical analysis of monetary and multidimensional poverty: Evidence from a household survey in Pakistan. *Asia Pacific Journal of Social Work and Development*, 30(2), 106–121. <https://doi.org/10.1080/02185385.2020.1712663>
- Kouloumpis, E., Wilson, T., & Moore, J. (2011). Twitter Sentiment Analysis: The Good the Bad and the OMG! *Proceedings of the International AAAI Conference on Web and Social Media*, 5(1). <https://ojs.aaai.org/index.php/ICWSM/article/view/14185>
- Kremmydas, D., Athanasiadis, I. N., & Rozakis, S. (2018). A review of Agent Based Modeling for agricultural policy evaluation. *Agricultural Systems*, 164, 95–106. <https://doi.org/10.1016/j.agsy.2018.03.010>
- Kuhl, J. J., & Ris, U. (2003). *Disaggregating Household Vulnerability { Analyzing uctuations in consumption using a simulation approach | Semantic Scholar*. <https://www.semanticscholar.org/paper/Disaggregating-Household-Vulnerability-%7B-Analyzing-Kuhl-Ris/ae27acc96bdf0cac52a8fa735d4ae3de39f81b75>

- Kumar, A., & Garg, G. (2020). Systematic literature review on context-based sentiment analysis in social multimedia. *Multimedia Tools and Applications*, 79(21–22), 15349–15380.  
<https://doi.org/10.1007/s11042-019-7346-5>
- Kumar, A., & Jaiswal, A. (2020). Systematic literature review of sentiment analysis on Twitter using soft computing techniques. *Concurrency and Computation: Practice and Experience*, 32(1), e5107. <https://doi.org/10.1002/cpe.5107>
- Lipizzi, C., Iandoli, L., & Ramirez Marquez, J. E. (2015). Extracting and evaluating conversational patterns in social media: A socio-semantic analysis of customers' reactions to the launch of new products using Twitter streams. *International Journal of Information Management*, 35(4), 490–503. <https://doi.org/10.1016/j.ijinfomgt.2015.04.001>
- Lourens, M. (2007). Route tourism: A roadmap for successful destinations and local economic development. *Development Southern Africa*, 24(3), 475–490.  
<https://doi.org/10.1080/03768350701445574>
- Maddah, M. (2013). An Empirical Analysis of the Relationship between Unemployment and Theft Crimes. *International Journal of Economics and Financial Issues*, 3(1), n/a.
- Malerba, D. (2020). Poverty alleviation and local environmental degradation: An empirical analysis in Colombia. *World Development*, 127.  
<https://doi.org/10.1016/j.worlddev.2019.104776>
- Malerba, D., Gaentzsch, A., & Ward, H. (2021). Mitigating poverty: The patterns of multiple carbon tax and recycling regimes for Peru. *Energy Policy*, 149, 111961.  
<https://doi.org/10.1016/j.enpol.2020.111961>

- Manzo, G., & Matthews, T. (2014). Potentialities and Limitations of Agent-based Simulations. *Revue Francaise de Sociologie, Vol. 55(4)*, 653–688.
- Martin, J., Runge, M. C., Nichols, J. D., Lubow, B. C., & Kendall, W. L. (2009). Structured decision making as a conceptual framework to identify thresholds for conservation and management. *Ecological Applications, 19(5)*, 1079–1090. <https://doi.org/10.1890/08-0255.1>
- März, S. (2018). Assessing the fuel poverty vulnerability of urban neighbourhoods using a spatial multi-criteria decision analysis for the German city of Oberhausen. *Renewable and Sustainable Energy Reviews, 82*, 1701–1711. <https://doi.org/10.1016/j.rser.2017.07.006>
- Mba, P. N., Nwosu, E. O., & Orji, A. (2018). An Empirical Analysis of Vulnerability to Poverty in Nigeria: Do Household and Regional Characteristics Matter? *International Journal of Economics and Financial Issues, 8(ues)*, 271–276.
- McGregor, K. A., & Whicker, M. E. (2018). Natural Language Processing Approaches to Understand HPV Vaccination Sentiment. *Journal of Adolescent Health, 62(2)*, S27–S28. <https://doi.org/10.1016/j.jadohealth.2017.11.055>
- McNabb, D. (2021). *#MeToo in 2021: Global activists continue to build on the movement against sexual violence*. The Conversation. <http://theconversation.com/metoo-in-2021-global-activists-continue-to-build-on-the-movement-against-sexual-violence-152205>
- Menzel, N., Willson, L. H., & Doolen, J. (2014). Effectiveness of a Poverty Simulation in Second Life®: Changing Nursing Student Attitudes toward Poor People. *International Journal of Nursing Education Scholarship, 11(1)*, 39–45. <https://doi.org/10.1515/ijnes-2013-0076>

Minister of Justice. (2019, August 28). *Privacy Act*. <https://laws-lois.justice.gc.ca/PDF/P-21.pdf>

Minister of Justice. (2020, June 21). *Access to Information Act*. <https://laws-lois.justice.gc.ca/PDF/A-1.pdf>

Mizuta, T. (2020). An agent-based model for designing a financial market that works well. *2020 IEEE Symposium Series on Computational Intelligence (SSCI)*, 400–406.  
<https://doi.org/10.1109/SSCI47803.2020.9308376>

Mohd Roslan, U., Zakaria, S., Alias, A., & abd malik, siti madhihah. (2018). A MATHEMATICAL MODEL ON THE DYNAMICS OF POVERTY, POOR AND CRIME IN WEST MALAYSIA. *Far East Journal of Mathematical Sciences (FJMS)*, *107*, 309–319.  
<https://doi.org/10.17654/MS107020309>

Mondaca-Schachermayer, C. I., Aburto, J., Cundill, G., Lancellotti, D., Tapia, C., & Stotz, W. (2011). An Empirical Analysis of the Social and Ecological Outcomes of State Subsidies for Small-Scale Fisheries A Case Study from Chile. *Ecology and Society*, *16*(3).

Muhammad-Bashir, O. Y., Shirazi, N. S., & Ghani, G. M. (2016). An empirical analysis of factors that determine poverty among the beneficiaries of Pakistan Poverty Alleviation Fund. *Journal of Enterprising Communities*, *10*(3), 306–320. <http://dx.doi.org.lib-eproxy.concordia.ca/10.1108/JEC-10-2014-0023>

Municipalidad de La Victoria. (2021). *Presupuesto Participativo 2020*.  
<https://www.munilavictoria.gob.pe/index.php/presupuesto-participativo-2020>

Municipalidad de Rosario. (2002, May 9). *Ordenanza 7326/2002—Normativa*.  
<https://www.rosario.gob.ar/mr/normativa/otras-normas/ordenanzas/ordenanza-7326-2002>

Municipalidad de San Isidro. (2019, March). *Presupuesto Participativo 2020*.

<http://msi.gob.pe/portal/participacion-vecinal/presupuesto-participativo/presupuesto-participativo-2020/>

Municipalidad de San Isidro. (2021). *Presupuesto Participativo*.

<http://msi.gob.pe/portal/participacion-vecinal/presupuesto-participativo/>

Neuendorf, K. A., & Kumar, A. (2016). Content Analysis. In *The International Encyclopedia of Political Communication* (pp. 1–10). American Cancer Society.

<https://doi.org/10.1002/9781118541555.wbiepc065>

New Zealand government. (2016). *New Zealand Data and Information Management Principles*.

<https://www.data.govt.nz/manage-data/policies/new-zealand-data-and-information-management-principles>

Nexalogy. (2020). Nexalogy. <https://nexalogy.com/>

Nickols, S. Y., & Nielsen, R. B. (2011). “So Many People are Struggling”: Developing Social Empathy Through a Poverty Simulation. *Journal of Poverty*, 15(1), 22–42.

<https://doi.org/10.1080/10875549.2011.539400>

Noone, J., Sideras, S., Gubrud-Howe, P., Voss, H., & Mathews, L.-R. (2012). Influence of a Poverty Simulation on Nursing Student Attitudes Toward Poverty. *Journal of Nursing Education*, 51(11), 617–622. <https://doi.org/10.3928/01484834-20120914-01>

NYC OpenData. (2012). *NYC Open Data Technical Standards Manual*.

<http://cityofnewyork.github.io/opendatasm/LocalLaw11of2012.html>

- Office of the Mayor - Washington, DC. (2014). *Transparency, Open Government and Open Data Directive / DC*. <https://dc.gov/page/transparency-open-government-and-open-data-directive>
- OIT Pro 169 América Latina. (2015). *Convenio Núm. 169 de la OIT. El derecho a la consulta*.
- Oliveira, N., Cortez, P., & Areal, N. (2017). The impact of microblogging data for stock market prediction: Using Twitter to predict returns, volatility, trading volume and survey sentiment indices. *Expert Syst. Appl.* <https://doi.org/10.1016/j.eswa.2016.12.036>
- OpenNorth. (2021). *OpenNorth—Homepage*. <https://opennorth.ca/>
- Oregon State University: School of Mechanical, Industrial, and Manufacturing Engineering. (2012, June 22). *What Do Industrial Engineers Do?* [Text]. School of Mechanical, Industrial, and Manufacturing Engineering. <https://mime.oregonstate.edu/what-do-industrial-engineers-do>
- Organisation for Economic & Co-operation and Development. (2020). *Open Government Data—OECD*. <https://www.oecd.org/digital/digital-government/open-government-data.htm>
- Ortiz Salazar, A., Klein, J. M., & Klycheva, Z. (2021). Overcoming Inconvenience: How Society Can Incentivize Individual Recycling Behavior; An Agent-Based Model. *Advances in Simulation and Digital Human Modeling*, 80–85. [https://doi.org/10.1007/978-3-030-51064-0\\_11](https://doi.org/10.1007/978-3-030-51064-0_11)
- Patel, J., Dubey, R., & gupta, R. kumar. (2020). PMI-IR Based Sentiment Analysis Over Social Media Platform for Analysing Client Review. In S. Smys, T. Senjyu, & P. Lafata (Eds.), *Second International Conference on Computer Networks and Communication*



*Technologies* (pp. 204–212). Springer International Publishing.

[https://doi.org/10.1007/978-3-030-37051-0\\_23](https://doi.org/10.1007/978-3-030-37051-0_23)

Perrin, A. (2020). 23% of users in U.S. say social media led them to change views on an issue; some cite Black Lives Matter. *Pew Research Center*. <https://www.pewresearch.org/fact-tank/2020/10/15/23-of-users-in-us-say-social-media-led-them-to-change-views-on-issue-some-cite-black-lives-matter/>

Phillips, T. (2015, September 28). *Hong Kong “umbrella movement” marks first anniversary and vows to fight on*. *The Guardian*.

<http://www.theguardian.com/world/2015/sep/28/hong-kong-umbrella-movement-first-anniversary-democracy>

Prince, B. C., Juran, L., Sridhar, V., Bukvic, A., & MacDonald, M. C. (2021). A statistical and spatial analysis of water poverty using a modified Water Poverty Index. *International Journal of Water Resources Development*, *37*(2), 339–356.

<https://doi.org/10.1080/07900627.2020.1768829>

PSD Research Consulting Software. (2020). *State of Maturity Report—District of Squamish, British Columbia* (p. 15).

Pullum, L., & Cui, X. (2012). *Techniques and Issues in Agent-Based Modeling Validation*.

Rainie, H., Anderson, J. Q., & Albright, J. (2017). *The future of free speech, trolls, anonymity and fake news online*. Pew Research Center Washington, DC.

Rashid, S., Yoon, Y., & Kashem, S. B. (2011). Assessing the potential impact of Microfinance with agent-based modeling. *Economic Modelling*, *28*(4), 1907–1913.

<https://doi.org/10.1016/j.econmod.2011.03.020>

- Reyes-Menendez, A., Saura, J. R., & Alvarez-Alonso, C. (2018). Understanding #WorldEnvironmentDay User Opinions in Twitter: A Topic-Based Sentiment Analysis Approach. *International Journal of Environmental Research and Public Health*, 15(11), 2537. <https://doi.org/10.3390/ijerph15112537>
- Ro, C. (2020, October 26). *Why this recession disproportionately affects women*. <https://www.bbc.com/worklife/article/20201021-why-this-recession-disproportionately-affects-women>
- Robeyns, I., & Byskov, M. F. (2021). The Capability Approach. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2021). Metaphysics Research Lab, Stanford University. <https://plato.stanford.edu/archives/fall2021/entries/capability-approach/>
- Romero, D. (2019, December 6). *Edmonton is Canada's most transparent city: Study*. Edmonton. <https://edmonton.ctvnews.ca/edmonton-is-canada-s-most-transparent-city-study-1.4718701>
- Saif, H., He, Y., & Alani, H. (2012). Semantic Sentiment Analysis of Twitter. In P. Cudré-Mauroux, J. Heflin, E. Sirin, T. Tudorache, J. Euzenat, M. Hauswirth, J. X. Parreira, J. Hendler, G. Schreiber, A. Bernstein, & E. Blomqvist (Eds.), *The Semantic Web – ISWC 2012* (pp. 508–524). Springer. [https://doi.org/10.1007/978-3-642-35176-1\\_32](https://doi.org/10.1007/978-3-642-35176-1_32)
- San Mateo County. (2014, July 15). *San Mateo County Open Data Policy | SMC Datahub*. <https://datahub.smcgov.org/Government/San-Mateo-County-Open-Data-Policy/pebe-j2ye>

- Sanborn, C., Hurtado, V., & Ramírez, T. (2016). La consulta previa en el Perú: Avances y retos. In *Repositorio de la Universidad del Pacífico—UP*. Universidad del Pacífico.  
<https://doi.org/10.21678/978-9972-57-366-8-2016>
- Santillan, O. S., Cedano, K. G., & Martinez, M. (2020). Analysis of energy poverty in 7 Latin American countries using multidimensional energy poverty index. *Energies*, *13*(7).  
<https://doi.org/10.3390/en13071608>
- Sanz-Hernández, A. (2019a). Medios de comunicación y stakeholders: Contribución al debate público de la pobreza y justicia energética en España / Media and Stakeholders: Contribution to the Public Debate on Poverty and Energy Justice in Spain. *Revista Española de Investigaciones Sociológicas*, *168*. <https://doi.org/10.5477/cis/reis.168.73>
- Sanz-Hernández, A. (2019b). Social engagement and socio-genesis of energy poverty as a problem in Spain. *Energy Policy*, *124*, 286–296.  
<https://doi.org/10.1016/j.enpol.2018.10.001>
- Schweitzer, F., Krivachy, T., & Garcia, D. (2020). An Agent-Based Model of Opinion Polarization Driven by Emotions. *Complexity*, *2020*, e5282035.  
<https://doi.org/10.1155/2020/5282035>
- Sclove, R. E. (2010). Reinventing Technology Assessment. *Issues in Science and Technology*, *27*(1), 34–38.
- Secretariat, T. B. of C., & Open Government, T. B. S. of C. (2020, November 5). *Open Data 101*.  
<http://open.canada.ca/en/open-data-principles>

- Seifert, F. (2006). Local steps in an international career. A Danish-Style consensus conference in Austria. *The Public Understanding of Science*, 15, 73–88.  
<https://doi.org/10.1177/0963662506058383>
- Shao, G. (2019, August 15). *Social media has become a battleground in Hong Kong's protests*. CNBC. <https://www.cnbc.com/2019/08/16/social-media-has-become-a-battleground-in-hong-kongs-protests.html>
- Shao, H., Hou, L., Su, K., & Wang, Y. (2021). Analysis of the poverty alleviation status of farmers' cooperatives in Lianghe County, Yunnan Province. *2021 International Conference on Tourism, Economy and Environmental Sustainability (TEES 2021)*, 5-7 March 2021, 251, 01103 (4 pp.). <https://doi.org/10.1051/e3sconf/202125101103>
- Shu, K., Sliva, A., Wang, S., Tang, J., & Liu, H. (2017). Fake News Detection on Social Media: A Data Mining Perspective. *ACM SIGKDD Explorations Newsletter*, 19(1), 22–36.  
<https://doi.org/10.1145/3137597.3137600>
- Statista Research Department. (2021a). *Global Twitter user age distribution 2021*. Statista.  
<https://www.statista.com/statistics/283119/age-distribution-of-global-twitter-users/>
- Statista Research Department. (2021b). *Twitter user distribution by gender Canada 2021*. Statista. <https://www.statista.com/statistics/649539/canada-twitter-gender-distribution/>
- Steck, L. W., Engler, J. N., Ligon, M., Druen, P. B., & Cosgrove, E. (2011). Doing Poverty: Learning Outcomes among Students Participating in the Community Action Poverty Simulation Program. *Teaching Sociology*, 39(3), 259–273.  
<https://doi.org/10.1177/0092055X11407347>

- Stobierski, T. (2019, August 26). *The Advantages of Data-Driven Decision-Making*. HBS Online - Business Insights - Blog. <https://online.hbs.edu/blog/post/data-driven-decision-making>
- Sunlight Foundation. (2014, March). *Open Data Policy Guidelines*. Sunlight Foundation. <https://sunlightfoundation.com/opendataguidelines/>
- Tabata, T., & Tsai, P. (2020). Fuel poverty in Summer: An empirical analysis using microdata for Japan. *Science of the Total Environment*, 703. <https://doi.org/10.1016/j.scitotenv.2019.135038>
- Tangen, O. (2021). *The battle for Myanmar plays out on Twitter, TikTok and Telegram | DW | 20.04.2021*. DW.COM. <https://www.dw.com/en/the-battle-for-myanmar-plays-out-on-twitter-tiktok-and-telegram/a-57267075>
- The Open Data Charter. (2020). *The International Open Data Charter*. International Open Data Charter. <https://opendatacharter.net/>
- The Open Data Charter. (2021a). Adopt the ODC Principles. *International Open Data Charter*. <https://opendatacharter.net/adopt-the-charter/>
- The Open Data Charter. (2021b). Principles. *International Open Data Charter*. <https://opendatacharter.net/principles/>
- The World Bank Group. (2020, October 26). *Starting an Open Data Initiative | Data*. <http://opendatatoolkit.worldbank.org/en/starting.html>
- The World Bank Group. (2021). *Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population)*. The World Bank Data. <https://data.worldbank.org/topic/poverty?end=2018&start=1998>

Tierney, W., & Clemens, R. (2011). *Qualitative Research and Public Policy: The Challenges of Relevance and Trustworthiness* (pp. 57–83). [https://doi.org/10.1007/978-94-007-0702-3\\_2](https://doi.org/10.1007/978-94-007-0702-3_2)

Treasury Board of Canada Secretariat. (2007, November 15). *Accountability* [Organizational descriptions]. Aem. <https://www.canada.ca/en/treasury-board-secretariat/corporate/organization/accountability.html>

Tuarob, S., Tucker, C. S., Salathe, M., & Ram, N. (2014). An ensemble heterogeneous classification methodology for discovering health-related knowledge in social media messages. *Journal of Biomedical Informatics*, *49*, 255–268. <https://doi.org/10.1016/j.jbi.2014.03.005>

UN Women. (2019). *HeForShe. Global Solidarity Movement for Gender Equality*. <https://www.heforshe.org/en>

United Nations. (2019). *The Sustainable Development Goals Report 2019*. <https://www.un-ilibrary.org/content/publication/55eb9109-en>

United Nations. (2020). *Goal 1 | Department of Economic and Social Affairs*. Sustainable Development. <https://sdgs.un.org/goals/goal1>

United Nations. (2021). *Sustainability*. United Nations; United Nations. <https://www.un.org/en/academic-impact/sustainability>

United Nations Department of Economic and Social Affairs. (2021). *Goal 10*. <https://sdgs.un.org/goals/goal10>

United Nations Development Programme. (2020a). *Human Development Index (HDI)*. <http://hdr.undp.org/en/content/human-development-index-hdi>

United Nations Development Programme. (2020b). *Local governance and local development*.

UNDP. <https://www.undp.org/content/undp/en/home/ourwork/democratic-governance-and-peacebuilding/responsive-and-accountable-institutions/local-governance-and-local-development.html>

United Nations Development Programme. (2020c). *The 2020 Global Multidimensional Poverty Index (MPI)*. <http://hdr.undp.org/en/2020-MPI>

United Nations Statistics Division. (2019, December 20). *SDG Indicators*. Sustainable Development Goal Indicators Website.

<https://unstats.un.org/sdgs/indicators/database/>

United Nations Sustainable Development Group. (2021). *Leave No One Behind*.

<https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind>,

<https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind>

Urakawa, K., Wang, W., & Alam, M. (2020). Empirical Analysis of Time Poverty and Health-Related Activities in Japan. *Journal of Family and Economic Issues*, 41(3), 520–529.

<https://doi.org/10.1007/s10834-020-09671-2>

Urban Institute. (2015, January 8). *Microsimulation*. Urban Institute.

<https://www.urban.org/research/data-methods/data-analysis/quantitative-data-analysis/microsimulation>

U.S. General Services Administration - Data.gov. (2021). *Open Government*. Data.Gov.

<https://www.data.gov/open-gov/>

Vandsburger, E., Duncan-Daston, R., Akerson, E., & Dillon, T. (2010). The Effects of Poverty Simulation, an Experiential Learning Modality, on Students' Understanding of Life in

- Poverty. *Journal of Teaching in Social Work*, 30(3), 300–316.  
<https://doi.org/10.1080/08841233.2010.497129>
- Widener, M. J., Metcalf, S. S., & Bar-Yam, Y. (2013). Agent-based modeling of policies to improve urban food access for low-income populations. *Applied Geography*, 40, 1–10.  
<https://doi.org/10.1016/j.apgeog.2013.01.003>
- Wojcik, S., & Hughes, A. (2019, April 24). How Twitter Users Compare to the General Public. *Pew Research Center: Internet, Science & Tech*.  
<https://www.pewresearch.org/internet/2019/04/24/sizing-up-twitter-users/>
- Woods, R., Artist, S., & O'Connor, G. (2015). Learning in Australian local government: A roadmap for improving education & training. *Commonwealth Journal of Local Governance*, 108–126. <https://doi.org/10.5130/cjlg.v0i18.4845>
- World Wide Web Foundation & Omidyar Network. (2017). *Country Detail | Open Data Barometer*. [https://opendatabarometer.org/4thedition/detail-country/?\\_year=2016&indicator=ODB&detail=CAN](https://opendatabarometer.org/4thedition/detail-country/?_year=2016&indicator=ODB&detail=CAN)
- Wu, L., Morstatter, F., Carley, K. M., & Liu, H. (2019). Misinformation in Social Media: Definition, Manipulation, and Detection. *ACM SIGKDD Explorations Newsletter*, 21(2), 80–90.  
<https://doi.org/10.1145/3373464.3373475>
- Yang, G. (2016). Narrative Agency in Hashtag Activism: The Case of #BlackLivesMatter. *Media and Communication*, 4, 13. <https://doi.org/10.17645/mac.v4i4.692>
- Yang, K., Woomer, G. R., Agbemenu, K., & Williams, L. (2014). Relate better and judge less: Poverty simulation promoting culturally competent care in community health nursing. *Nurse Education in Practice*, 14(6), 680–685. <https://doi.org/10.1016/j.nepr.2014.09.001>



- Yasunaga, Y., Watanabe, M., & Korenaga, M. (2009). Application of technology roadmaps to governmental innovation policy for promoting technology convergence. *Technological Forecasting and Social Change*, *76*(1), 61–79.  
<https://doi.org/10.1016/j.techfore.2008.06.004>
- Zhang, L., Huang, J., Liu, Z., & Vu, H. L. (2021). An agent-based model for real-time bus stop-skipping and holding schemes. *Transportmetrica A: Transport Science*, *17*(4), 615–647.  
<https://doi.org/10.1080/23249935.2020.1802363>
- Zhang, Y., & Wan, G. (2006). An Empirical Analysis of Household Vulnerability in Rural China. *Journal of the Asia Pacific Economy*, *11*(2), 196–212.
- Zhao, H., Feng, Z., & Castillo-Chávez, C. (2015). *The dynamics of poverty and crime*.