



State of
**Open Smart
Communities**
in **Canada**

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Glossary

Algorithms: A sequence of instructions, rules, and calculations executed by a computer in a particular order to yield a result, typically an answer to a specified problem. Algorithms can be used in combination with other algorithms to solve complex problems ([Brookfield Institute](#)).

Artificial Intelligence (AI) as technology: Computer programs capable of behaviour commonly thought to require intelligence ([Brookfield Institute](#)).

Artificial Intelligence (AI) as a field/discipline: The study and development of artificially intelligent systems (Brookfield Institute). ([Brookfield Institute](#)).

City / Community: The governing body responsible for managing the affairs of the local community, (e.g. the municipality, regional government, or Indigenous Community), including any bodies, authorities or subsidiaries established or governed by the city or community (Community Solutions Network definition).

Data Governance: The overall management of data availability, relevancy, usability, integrity and security in an organization. ([IBM Analytics](#))

Digital Privacy: The protection of individual or collective information collected through digital technologies ([Edmonton Public Library](#))

Maturity Model: A maturity model (or capability maturity model) is a tool used to determine capability across a spectrum of functions and to identify areas in need of improvement. ([Carnegie Mellon University Software Engineering Institute](#))

Open Procurement: A concept and a series of methods centred around openness used by cities and governments that alleviate or solve common procurement

problems. It is referred to as “Open” because it refers to fair market practices (i.e. neutral procurement), transparency principles, and uses open standards (Community Solutions Network Definition).

Open Smart City: An Open Smart City is one where all sectors, including residents, collaborate in mobilizing data and technologies to develop their community through fair, ethical, and transparent governance that balances economic development, social progress, and environmental responsibility. (OpenNorth, [Open Smart Cities Guide V1.0](#))

Personal information: Information about an identifiable individual that is recorded in any form ([Privacy Act](#))

Privacy Impact Assessment: A process that helps determine whether government initiatives involving the use of personal information raise privacy risks; whether the government measures, describes, and quantifies these risks; and whether it proposes solutions to eliminate privacy risks or mitigate them to an acceptable level ([Office of the Privacy Commissioner](#)).

Smart City: Technologically instrumented and networked cities, with systems that are interlinked and integrated, and where vast troves of big urban data are being generated by sensors and used to manage and control urban life in real-time. (adapted from [Kitchin, 2015](#))

Social Procurement: The combination of the instrumental activity of procurement with the strategic intent of generating social value ([Barraket, Keast, & Furneaux, 2016](#)).

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COMMUNITY Solutions Network

Réseau de solutions pour les COMMUNAUTÉS

A Program of Future Cities Canada
Un programme de Villes d'avenir Canada

About the Community Solutions Network

The Community Solutions Network is designed to help communities build service area capacity and improve the lives of residents using data and connected technology approaches. We help communities navigate the smart cities landscape. Our focus includes such topics as security, data, procurement, governance, and public engagement. The Network is a program of Future Cities Canada, led by Evergreen with OpenNorth and a national community of partners.

Services Offered by the Community Solutions Network to Municipalities Across Canada:

Advisory services

We provide personal support by sharing knowledge, expertise, experience and guidance to municipal and community leaders. The goal is to help them build internal capacity and navigate the open smart city landscape on relevant topics such as technology, data management, security, privacy, procurement, public engagement, and outcomes-based project planning.

The Community Solutions Advisory Service consists of a personalized community needs assessment, a tailored Capacity-Building Action Plan, and a customized learning path to help build the capacity needed towards the implementation of open smart cities approaches. There is no cost to participate.

Event-based programs

We provide advisory and capacity building resources and support in all regions across the country and in communities of every size through a series of Regional Idea Camps, Collision Days and Roundtables.

Community Solutions Portal

The Community Solutions Portal is Canada's digital hub on smart cities and a space for collaboration for communities of all sizes. On the Community Solutions Portal you can access resources, connect with other practitioners and see examples of smart cities approaches that can help your community thrive.

Community Resources and Assistance

A targeted grant (up to \$5,000) will be available to support travel or event attendance to help engage in opportunities linked to the Community Solutions Network. Evergreen will be working with the Community Foundation of Canada's national network of community foundations. We want to source candidates for this opportunity to build local innovation capacity and advance smart cities approaches in key areas of data and technology, helping to improve the lives of residents.



Executive Summary

As the smart city landscape across Canada evolves, cities, towns, and Indigenous communities of all sizes are learning from each other and are building a “made in Canada” version of the smart city. This report identifies the self-assessed needs and capacities of Canadian municipalities, emerging challenges and risks faced regarding data and technologies, and the innovative approaches applied to address those challenges. Drawing from conversations with city leaders across the country over the past nine months, we see evidence that cities are increasingly expressing a desire to adopt smart city practices that align with the *Open Smart City* concept. Communities across Canada are proactive as they develop policies and strategies that uphold the public interest and represent the values of openness and accountability, while at the same time fostering innovation and inclusion. This report discusses what we have heard.

The preliminary observations in Open Smart City domain areas include:

Inclusion: Canadian cities are on the threshold of embracing a new form of inclusion, one which builds digital, technical, and data literacy and breaks down the digital divide and organizational silos.

Data Governance: Cities are experiencing challenges associated with the data governance of smart systems. They recognize the need to learn from other Open Smart Cities, especially when it comes to building their internal capacity to develop robust and inclusive data governance strategies and policies.

Procurement: Procurement in an Open Smart City is about open and transparent contracting with clearly defined processes in place for the acquisition of hardware and software and the governance of data. Few cities have adopted an Open Smart City approach to procurement, although the incentive is there to do so.

Automated Decision-Making and Artificial Intelligence: AI is not yet widely adopted at the municipal government level in Canada. This presents an opportunity to proactively learn more about AI and develop standards for the use of AI and automated decision-making prior to widespread implementation.

Photo by Stephen H.



Introduction

As the smart city landscape across Canada evolves, cities, towns, and Indigenous communities of all sizes are learning from each other and are building a “made in Canada” version of the smart city. This report identifies the self-assessed needs and capacities of Canadian municipalities, emerging challenges and risks faced with data and technologies, and the innovative approaches applied to address those challenges. Drawing from conversations with city leaders across the country over the past nine months, we see evidence that cities are increasingly expressing a desire to adopt smart city practices that align with the [Open Smart City](#) concept. Communities across Canada are proactive as they develop policies and strategies that uphold the public interest and represent the values of openness and accountability, while at the same time fostering innovation and inclusion.

This evolution signals a shift toward Open Smart Cities, which OpenNorth defines as an approach rooted in multi-sectoral inclusion. An Open Smart City is defined as **one where all sectors, including residents, collaborate to mobilize data and technologies to develop their community through fair, ethical, and transparent governance practices that balance economic development, social progress, and environmental responsibility.**

Interest in smart city approaches was accelerated with the launch by Infrastructure Canada of the [Smart Cities Challenge](#), which received over 200 submissions from communities big and small. The objective of the Challenge was for communities to propose “smart” solutions to community challenges according to principles that are strongly aligned with an Open Smart City: openness, integration, transferability, and collaboration.

Infrastructure Canada also supported the creation of the [Community Solutions Network](#) to help communities build their knowledge about smart city approaches dedicated to improving the quality of life of their residents. The project is led by [Evergreen Canada](#) as a program of [Future Cities Canada](#) collaborative program

Photo by Eddie Lee

and [OpenNorth](#) is the lead technical partner. It is responsible for the One-to-One [Advisory Service](#), the objectives of which are to help communities develop the knowledge, skills, and capacity necessary to navigate this data, process, and technological transformation.

To date, the *Community Solutions Network* has led eleven Regional Idea Camps, Collision Days, and Roundtables attended by 370 people across the country¹. The *Advisory Service* has begun to provide personalized needs assessments, tailored capacity-building action plans, and customized learning paths to 36 communities. The advisory support consists of an Open Smart City curriculum with over 25 courses planned, as well as one-on-one access to experts on various topics such as data governance, open procurement, and civic engagement.

Data

Launched in the spring of 2019, the *Community Solutions Network* first connected with the [20 Smart City Challenge finalists](#). Shortly thereafter, it extended its outreach to 620 communities across Canada, offering the potential to join the *Advisory Service* or attend a *Community Solutions Network* event. Of these 620 communities, 36 have formally joined the *Advisory Service*: 19 small, rural or northern communities, 13 mid-sized cities, and 4 large cities. For those who joined the *Advisory Service*, the outreach process includes several data collection touch points between February and November 2019 with senior municipal staff. These touch points include preliminary needs assessment and semi-structured interviews, the completion of a capacity self-assessment survey, and an interview to validate the survey's findings. Data collection will be ongoing until the end of March 2020 with an additional evaluative baseline survey and interviews.

The data collected from interviews and surveys were augmented by reviews of grey literature such as Smart City Challenge proposals, smart city strategy and policy documents, federal committees and working group minutes, private, public and non-profit white papers, and a review of the findings and results from the 370 individuals who attended *Community Solutions Network* events.

Methodology

The work of the *Community Solutions Network* is underpinned by the *Open Smart City Maturity Model*. This methodological framework is derived from the [Open Smart Cities Guide](#) developed in collaboration with experts in law, data governance, accessibility, and IT procurement expertise. The Maturity Model measures capacity across five levels (Appendix A) in 22 distinct Open Smart City topics (Appendix B).

The self-assessment questionnaire is methodologically aligned with the maturity model and includes questions that cover 22 topic areas relevant to the Open Smart City concept (Section 1 of this report provides the preliminary findings). Results are subject to the community's self-perceived capacity in each topic area, and were shared with communities for validation purposes.

Limitations

The results reported here stem from the first nine months of a year-long program. It is therefore partial; the final report in 2020 will include information from forthcoming regional events, webinars, and Open Smart City *Advisory Service* activities such as municipal staff training and one-on-one expert consulting.



Nearly half
of participating
small and medium
sized-communities
have data governance
policy or strategy
development
as a smart city
priority

Preliminary Open Smart City

Trends Across Canada

Of the 36 communities participating in the *Advisory Service*, 23 have completed the capacity self-assessment survey and all 36 have participated in semi-structured interviews. When combined with other sources of data, the findings provide preliminary observations of the Open Smart City's ecosystem-specific trends in Canada.

Preliminary Observations:

When we compared how cities self-assessed across the five capacity levels (Appendix A), we observed that **communities that have some sort of municipal, provincial, or federal legislative frameworks² in place did better overall.** Cities with legislative frameworks in place had an average capacity across all topic areas of 3.5, while those without had an average capacity rating of 2.5, a difference of 20%.

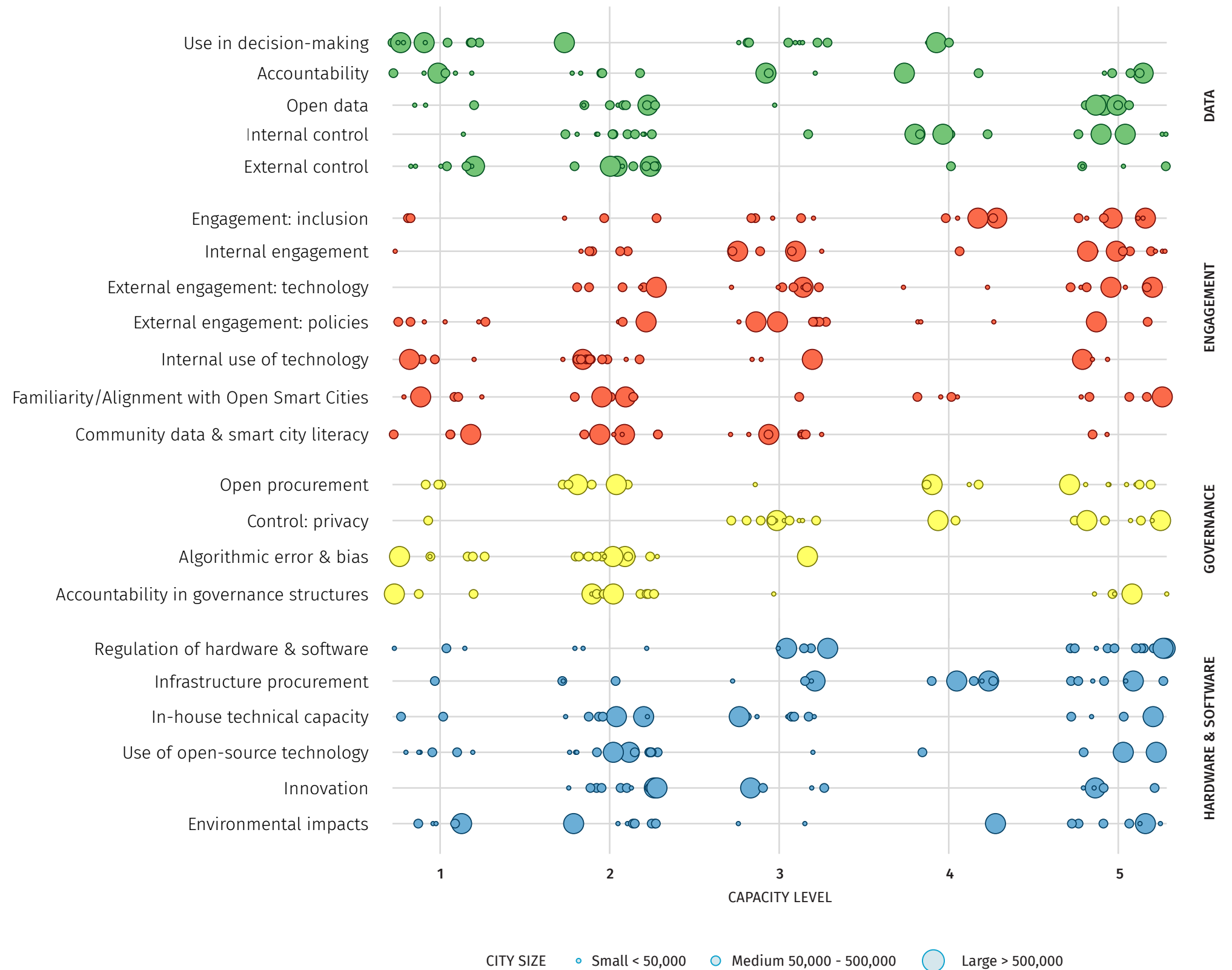
Concurrently, communities that did not have underlying legislative frameworks ranked lowest in overall capacity. These communities lacked processes to ensure, for example, that residents can hold public institutions accountable on how smart city technology is implemented (25% of respondents) or on how to manage data about residents (1 respondent).

An additional 12 communities (52%) do not have data governance or information management policies in place to manage the collection, storage, use, and sharing of data collected by the community.

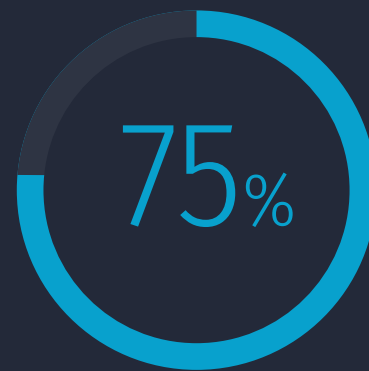
Interestingly, the results of both the self-assessment survey and our analysis of the semi-structured interviews suggest that **city managers and staff report widespread political support for smart city planning, although this support does not always translate into smart city policy or program funding.**

Many of the cities working with the *Community Solutions Network* stated that data governance is a priority. The corollary is that the understanding of what data governance entails differs between communities. We saw that for some (40%) of small and medium sized communities, the focus on data governance is about establishing a common framework (such as policies and strategies to manage data) upon which to build future smart city plans. In contrast, for large cities and higher capacity small and medium-sized cities (such as *Smart City Challenge Finalists*), data governance priorities are about optimizing existing approaches and systems; and building a culture of openness, transparency, accountability and inclusion in their administrations or smart city programming.

Some of the cities that benefited from or received resources to develop smart city plans (such as *Smart City Challenge* finalists) have a proportionally higher capacity in the Open Smart City domains (in all four domain areas, finalists had a proportionally higher number of respondents with capacity levels at four and five than non-finalists). This is especially the case for data and privacy considerations, as finalists had to complete Privacy Impact Assessments which led to more knowledge about privacy controls³. Fifty percent of cities that report seeking informed consent on the ownership of their resident data are finalists, even though they represent only 30% of all respondents.



Three-quarters of respondents state that they either make an effort to educate the public on the use of technology and data by their institution or have policies to do so. However, only two respondents report the existence of programs to increase community digital literacy and knowledge.



Our success as a Smart City comes from collaborating across sectors to create a shared vision for the future. Digital governance and engagement approaches enable dynamic participation and shared ownership of the problem, process and outcomes with community members.

Barbara Swartzentruber, *Executive Director, Smart Cities Office and Smart Cities Challenge Winner*

CITY OF GUELPH, ON

Communities in Canada are expected, as part of their mandate, to actively promote the inclusion and engagement of their residents in their planning and decision-making processes. The advent of smart cities presents new opportunities as well as challenges.

Along with tried-and-tested methods such as community town halls, surveys, open council sessions, and telephone hotlines, cities are drawing on new tools to ensure that every resident can participate in decisions made by city administrators and elected officials.

At the same time, traditional approaches do not address emerging needs related to smart cities. Technology in the public sphere may affect urban life in multiple ways, particularly in the form of digital privacy and security. For meaningful engagement on such questions, cities have identified the need to increase the digital literacy of the public they serve. Digital literacy provides residents the awareness needed to opt out of data collection and provide informed and meaningful consent to opt in. Literacy also supports digital inclusion that includes bridging the digital divide, so that all residents have access to e-services and can benefit from them without discrimination. In this way representative engagement with residents on public technology infrastructure is necessary for democratic accountability, and different kinds of data require different degrees of consent.

These challenges have changed the responsibilities of municipal staff and elected officials, representing a shift in how inclusion is considered and how engagement is carried out. Traditional models of engagement, often centred around specific projects and plans, need to change in a systems-based Open Smart City context, and this requires new tools, knowledge, skills, and a new mindset when it comes to inclusion across all levels of government.

CivicTechYYC

Resident-led, “bottom-up” engagement is a powerful means of building up residents’ agency in smart city decision-making and for improving digital literacy. Civic tech groups such as CivicTechYYC are helping to build tools such as Volly, a platform for connecting volunteers in Calgary with local non-profits and municipal services.

Edmonton, AB (pop. 980,280)

Using the Government of Canada’s *Gender-Based Analysis+* methodology, Edmonton is incorporating data-driven approaches to *consider gender and diversity* into its urban decision-making. Inclusion in an Open Smart City doesn’t have to be a solitary activity. There are tools, methods and approaches already developed federally, provincially and in other municipalities that can be adapted, scaled, and repurposed.

Photo by Laura Lafurgey Smith



Canadian cities are on the threshold of embracing a new form of inclusion, one which builds digital, technical, and data literacy and breaks down the digital divide and organizational silos.

Cree Nation of Eastmain, QC (pop. 928)

Open Smart engagement doesn’t only exist in big cities: it is an approach that works for communities of any size. In their shortlisted Smart Cities Challenge proposal, The Cree Nation of Eastmain, Quebec held “Cree Cafes,”—places where community members could learn about, discuss, and contribute to smart city plans. This unique approach is exemplary of an Open Smart City approach to inclusion as it puts the needs of residents first to ensure meaningful engagement. It also helps building knowledge and improving digital literacy.

Nunavut Communities, Nunavut (pop. 35,944)

In their award-winning *Smart City Challenge proposal*, the Nunavut Association of Municipalities and their partners proposed innovative approaches to increasing community digital literacy and bridging the digital divide by building a network of “makerspaces”. Makerspaces act as social and digital hubs that promote inclusion and learning in a way which best reaches their residents, young and old: designing (digital) games, providing adult art and technology classes, and other recurrent programming.



Smart Engagement Approaches are Emerging Across the Country

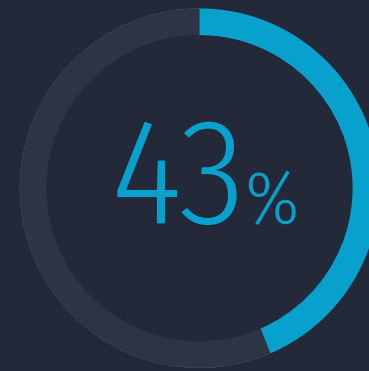
Administrators and elected officials in cities are beginning to work toward inclusion and are investing in efforts to build digital, technical, and data literacy in their communities. This entails educating the public on the use of technologies deployed in public spaces to ensure that a diverse range of stakeholders have a meaningful say in the policymaking process and can access new tools. Doing so provides residents with opportunities to make decisions regarding data and to maintain control of their personal data (such as accessing it when requested) and allows cities to uphold privacy and maintain security.

Canadian municipalities such as Edmonton, Guelph, and Montreal see themselves as inclusion and engagement leaders. They are beginning to evolve with the demands that the smart city brings by taking Open Smart City approaches to empower residents and give them better agency in smart city decision-making.

Cities have the opportunity to learn from each other to share their Open Smart approaches to inclusion. They do so by developing **digital engagement strategies** (or tailored plans for approaching smart city-specific challenges to engagement), providing personalized resident services with digital technologies, and **participating in networks** such as the Municipal Information Systems Association (MISA) chapters, the *Municipal Innovators Community*, the Federation of Canadian Municipalities, and the *Alberta Smart City Alliance*. Engagement in these networks has encouraged the adoption of Open 311⁴, a standardized protocol for tracking issues (such as potholes) that enables greater transparency, participation, and collaboration.

Photo by Brayden Law

Nearly half of survey respondents say they do not have the appropriate hardware or software platforms to implement data analysis, reporting, and data-driven decision-making.



We can either use Smart City tools in a good way or they're going to become highly corporatized black boxes that communities don't have access to because they weren't being proactive.

Leon de Vreede, *Sustainability Planner and Smart Cities Challenge Winner*

TOWN OF BRIDGEWATER, NS

In a Smart City and multi-jurisdictional context, data governance is one of the biggest challenges facing municipalities of all sizes across Canada. While cities have been collecting, managing, analyzing, publishing, and making decisions with data for decades (all concepts strongly related to data governance), smart technologies add a layer of complexity.

At present, existing federal and provincial legislative frameworks exist to ensure the protection of resident data and to govern the ability of city managers to control and make decisions with data that are securely collected. With the exponential increase in data collection by public and private actors, and the rise of new data-intensive applications such as facial recognition and automated decision-making systems, the need for dedicated data governance policies which can proactively mitigate risk has become necessary.

Existing regulations, such as the Privacy Act and the Personal Information Protection and Electronic Documents Act, are *not equipped to deal* with emerging risks such as municipal data privacy breaches and ransomware attacks, nor with existing biases in machine-learning training data. Data governance models are needed to enable innovation in municipal government and to build trust in the administration of cities and of democratic processes.

Open Smart Cities address these emerging smart city needs by effectively communicating the opportunities and risks of expanded data use with public servants, residents, and other stakeholders; developing clear data sharing agreements, protocols, and contracts with technology vendors; and carefully defining how data are used in decision-making processes within municipal government.

The benefits of data governance extend beyond city hall. For example, robust data governance practices can enable open data policies with directives such as "*publish with purpose*", encouraging the use of municipal data sets for civic tech initiatives⁵, and driving resident-led innovation. These initiatives can in some cases be less costly and more adaptive to resident needs than top-down digital ones, while also providing agency and building trust.

Bridgewater, Nova Scotia (pop: 6,200)

Using the existing framework for data governance implemented by [Nova Scotia Power](#), a smart city project in Bridgewater will implement a consent-based resident data governance policy. In doing so, they show that collaboration can allow effective policy to be executed without having to rewrite them.

Data Governance Standardization Collaborative Steering Committee (DGSC)

The DGSC is a multisectoral steering committee led by the Standards Council of Canada, which is prescient in identifying the need for the standardization of a national-level data governance strategy. The DGSC is working on identifying different data governance priorities in Canada, and to address gaps where the need for standards and conformity might be required. Upon the completion of their work, they will have identified data governance priorities that could benefit from data standardization and aim to deliver a comprehensive “smart” road map of standards that will benefit Canadian organizations and residents.

Kelowna, BC (pop. 132,084)

In their soon to be released Intelligent Cities Strategy, Kelowna, like many communities, will deploy data-driven decision-making and automated processes. To address potential risks, increasing staff digital literacy is a key sub-strategy to ensure that people learn how to use analytics and data to inform their decisions.

Communities Are Prioritizing Data Governance

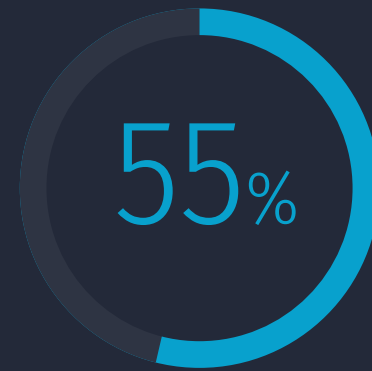
Canadian cities are ambitious and proactively seek to create or improve data governance strategies and want to ensure that any new smart city initiatives are aligned with existing information systems (e.g. transit and waste collection data). Communities across Canada are eager to learn from leaders across the country and around the world about data governance. For example, Kelowna, British Columbia is (at the time of writing) in the final stage of developing their

Cities are experiencing challenges associated with the data governance of smart systems and recognize the need to learn from other Open Smart Cities, especially when it comes to building their internal capacity to develop robust and inclusive data governance strategies and policies.

Intelligent City Strategy, a plan which includes a road map for using effective data governance to meet council priorities. Also, St. Albert in Alberta has a multidisciplinary data governance committee working to create data governance policy to preemptively mitigate risks.

Effective Open Smart City approaches to data governance are being developed and implemented across all levels of government in Canada. Federally, Canada’s [Digital Charter](#) identified ten principles for digital technology and data, bringing together 29 different initiatives under the Innovation and Skills Plan. Meanwhile, provincial governments have begun to launch initiatives such as the Quebec guidelines for combining ethics and data in municipalities. Cities have developed open data strategies that consider privacy and interoperability, creating a culture of openness while seeking to create new consent-based models of data control.

More than half of survey respondents (55%) say that their city partially or fully incorporates open procurement practices. Two-thirds of respondents can assess their hardware and software needs as being interoperable and accessible.



Using a standard [data] format and open source software allowed us to create a model, which other organizations can adopt, to transform data that is publicly available, but difficult to access, into a vehicle for more transparency and better informed citizens.

Stéphane Guidoin, *City of Montreal (2016)*

CITY OF MONTREAL, QC

Calls for tender and electronic bidding are de facto approaches to acquiring goods and services in municipalities across Canada. These approaches fall under the authority of provincial and municipal legislation and have become more transparent and open in recent years, as cities proactively disclose the results of contracting online in machine-readable data formats.

In the smart city context of procuring the underlying technologies that drive data-intensive projects, it is becoming increasingly apparent that there is a need to make systems-level changes to procurement practices. Information Technology (IT) procurement is often, depending on the size of the contract, a long and costly process. Modernizing and streamlining procurement processes, while still maintaining accountability mechanisms, can significantly reduce the *time and cost* of procuring innovative solutions, and can reduce the potential of vendor lock-in that can often result in sunk costs.

Unlike most other goods and services, in an Open Smart City, IT procurement is intrinsically related to data governance. Any hardware or software purchased poses potential cybersecurity risks to privacy at the individual, group, and municipal level. For instance, ransomware attacks have become so widespread in Ontario that the provincial police has issued a formal advisory, and the Association of Municipalities of Ontario has asked for support from federal and provincial governments.

Procurement should include data ownership, third party resale and re-use parameters, and privacy protection. How data sovereignty will be operationalized and intellectual property will be addressed must be made explicit. Not doing so leaves governments unprepared and unable to serve the public interest, and may lead residents to lose trust in government.

Procurement in an Open Smart City is about open and transparent contracting with clearly defined processes that circumscribe the relationship between the community and the private sector when it comes to the acquisition of hardware and software.

Using Social Procurement to Generate Social and Environmental Benefits

Using a social procurement framework to align with their mission and vision, several municipalities (including Calgary, Cumberland, Edmonton, Fort McMurray, Surrey, Tofino, Toronto, Vancouver, and Victoria) have adopted social procurement practices, which add social value considerations to public sector spending. Social procurement practices offer an opportunity to generate additional social and environmental benefits, moving beyond the value-for-money paradigm to include positive societal benefits, alongside high quality and competitive bids.

Ensuring Flexibility in Contractual Arrangements in St. Albert, AB (pop. 65,589)

A frequently stated risk faced by municipalities is the prospect of being locked into a single corporate partnership for a prolonged, and sometimes costly period. To address this, St. Albert takes a flexible approach to procurement by ensuring that project contracts don't include long-term commitments or alliances with companies as a means of maintaining flexibility and independence. This is a simple, but effective Open Smart City approach which cities of all sizes can adopt.

Open Resource Exchange (ORE)

Procuring goods and services collaboratively (such as through open source software development, using open standards, or partnering with developers in software creation) is an effective way of saving costs, and promoting capacity building and growth within public administrations. The ORE acts as a hub wherein Canadian jurisdictions (federal, provincial, municipal and Aboriginal) exchange, share and build with open source software, open data, open information, and open dialogue. This collaborative approach is aligned with openness in an Open Smart City and is exemplary of the positive benefits which the approach can bring to cities.

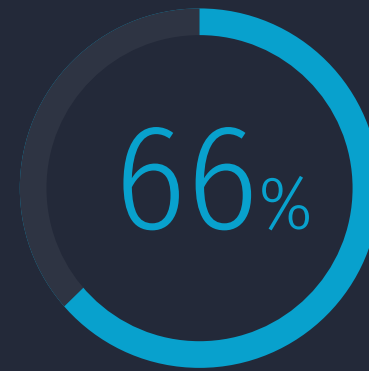
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A Positive Future for Open Smart City Procurement in Canada

Recent high-profile cases such as the Quayside project led by Waterfront Toronto with Google sister company Sidewalk Labs. They are now focusing on how to address the challenges posed by "smart" technologies by adopting Open Smart City approaches.

Following the lead of cities such as Montreal, cities are looking into open contracting to increase transparency and competition in bidding processes. Cities are collaborating in the spirit of an open-market by sharing lessons learned in procuring IT services, while others are collaborating to increase innovation in how contracts are awarded, and in working with more innovative service providers⁶. There is a positive future in smart city procurement in Canada, and by learning from Canadian leaders in open procurement, cities can be more assured in their processes.

Two-thirds of survey respondents are aware of potential bias in algorithms in AI, but only 1 responded to having staff dedicated to document potential assumptions and bias. Close to a third were unaware of potential sources of error and bias in AI and algorithms.



The use of artificial intelligence systems in the municipal context must advance the public interest. How do we make sure this happens? Designing new data governance models that promote transparency, accountability and civic participation in decision-making processes about data and AI would be a good place to start

- Philip Dawson, *Public Policy Lead*

ELEMENT AI

Automated and algorithmic decision-making and artificial intelligence (AI)-based initiatives are important research and development sectors in Canada. While AI is not widespread, there are many examples of automated e-government decision-making systems such as online forms and applications and *red-light detection cameras*. These approaches offer the opportunity for data informed decision-making and automated service delivery by helping to identify patterns, to automate simple tasks such as data verification, make recommendations, and even deliver human customer service with chatbots. Cities in Canada are aware of the growth of AI and looking for ways to take advantage of these technologies, and to do so in a way that it is in the public interest.

Relying on AI and machine learning (ML) presents ethical governance challenges including the potential added risk of exacerbating existing inequalities and injustices, particularly if digital literacy and resident engagement are weak. For example, predictive policing techniques (such as facial recognition technologies) that rely on historical data will likely reflect the historical and continued discrimination against black people, Indigenous, gender diverse, and other marginalized communities. Communities and residents have often had little or no input in how these technologies are deployed, or insight into the potential impacts these may have on their communities. Transparency and democratic accountability are required when operationalizing these techniques.

Decision-makers can be provided with the means to address issues such as AI/ML bias and increase social trust. To do so, they need to communicate on how automation and AI are used in communities, to support digital literacy, to adopt ethical safeguards, and to provide the necessary training to elected officials and senior city managers.

Montreal Declaration for a responsible development of Artificial Intelligence

A multisectoral, collaborative initiative led by the University of Montreal, the [Declaration for a responsible AI](#) is a framework for guiding ethical decision-making, including at the municipal level. The *Declaration* includes 10 principles which identify the potential limitations, risks, and bias inherent in AI. As stated in the Declaration’s preamble, “[t]he principles of the current declaration are like points on a moral compass that will help guide the development of artificial intelligence toward morally and socially desirable ends”, and can help municipalities as they establish policies and guidelines for its usage.

Algorithmic Impact Assessment (AIA): A Tool to Assess and Mitigate Risk When Deploying Automated Decision Systems

The AIA was developed to identify the impact of AI automated decision systems deployed by federal agencies so that they may comply with the [Directive on Automated Decision-Making](#). The AIA is a highly innovative tool which can be used by organizations and government branches of all sizes. *The tool* (currently in testing) is a questionnaire which provides program or project designers with a way to measure their AI solutions from an ethical and human perspective to ensure that they are built in an economic and socially responsible way. Once fully deployed, it is possible that Canadian cities can use it to guide their own AI decision-making systems.

Photo by Michael Descharles



The Toronto Declaration: Protecting the Rights to Equality and Non-Discrimination in Machine Learning Systems

Launched on May 16, 2018, the Declaration uses the framework of international human rights law, focusing on equality and non-discrimination in machine-learning systems. [The Declaration](#) identifies the roles and responsibilities of the state and the private sector in the use of machine learning systems. It can also be used as a framework to guide AI use in municipalities across Canada. It does this by identifying government uses of ML systems to include: identifying risks; ensuring transparency and accountability; enforcing oversight; promoting equality; and holding private sector actors to account. Likewise, it identifies the responsibilities of private sector actors around human rights due diligence, which are to identify potential discriminatory outcomes; take effective action to prevent and mitigate discrimination and track responses; and to be transparent about efforts to identify, prevent and mitigate against discrimination in machine learning systems.

Côte Saint-Luc (pop. 32,321)

Aware of the potential risks posed by using IoT devices in their [Smart City Challenge proposal](#), the city of Côte Saint-Luc included a Preliminary Privacy Impact Assessment which reviewed the city’s privacy compliance policies related to the project and across the city. The review produced 91 recommendations and four key findings. The first finding determined that the City needs to “go beyond the baseline requirements of privacy laws” due in part to the proposed use of AI and IoT devices collecting personal health data. This lesson shows that if communities are using AI, automated and algorithmic decision-making, they must consider and be aware of both the positive and negative impacts of their use. It also shows the need in some cases to go beyond what is required in provincial and federal privacy law by creating new sets of policies and laws which would apply in their community, as well as the private sector, to mitigate these risks and minimize discriminatory results of using AI.



AI is not yet widely adopted at the municipal level in Canada. There is an opportunity to learn more about AI and automated decision-making, and to develop standards for their use, before their widespread implementation.

An Opportunity to Increase Beneficial Outcomes While Mitigating the Risks of Automated Decision-Making

AI and machine learning are not yet used on a widespread scale in municipal governments in Canada, which presents an opportunity to proactively develop standards and compliance mechanisms for the use of AI/ML automated decision-making prior to its widespread implementation. Building ethical and just AI governance is an enormously complex task—but one which cities and their communities must be prepared to participate in and contribute to.

Building social trust in AI/ML is rooted in providing a diverse group of stakeholders with the opportunity from the beginning, to explicitly define the boundaries of this form of decision-making, and provides the staff who have the responsibility to operationalize these systems with the tools they need to adequately mitigate potential risks and increase beneficial outcomes.

Photo by Marc Olivier Jodoin



Appendix A

Maturity Model Level Description

The *Open Smart Cities Maturity Model* is based upon the long-standing work of the *CMMI Institute*, which uses a five-level scale to determine an organization's maturity. A fundamental component of the maturity model is that each level builds upon the previous, and all criteria set within that level must first be met before proceeding to the following level.

The *Community Solutions Network Advisory Service* has developed a maturity framework which explicitly identifies criteria that need to be met for each of the 22 Open Smart City subtopic areas (Appendix B).

Level 1: Incomplete

Little or no knowledge of the subtopic: Processes, implementation, and knowledge within the respective practice area may be unknown and unplanned. (e.g. the community does not produce open data, has little or no implementation capacity to do so, nor does it have a culture of promoting the use and sharing of data)

Level 2: Initial

Knowledge of the subtopic area: There are clear knowledge and understanding of the subtopic to inform the implementation of practices, but they are not yet widespread or systematically used. (e.g. the community sometimes produces open data and has a culture that promotes the use and sharing of data that is repeatable and manageable)

Photo by Juliana Loh

Level 3: Defined

Knowledge of the subtopic area with informal processes or practices in place:

Clear and explicit standards and procedures are in place; processes and practices are clearly defined. Consistency in reaching goals within the respective subtopic area is possible. (e.g. the community has an open data policy, and the objectives of the goals of their Open Data Policy are consistent with other practice areas, domains and principles within smart city planning in the community.)

Level 4: Managed

Policies or processes are implemented around the subtopic area: Processes around the subtopic are continually improving through incremental changes and/or adaptations. The practices that are in place see quality improvements and there is a clear organizational understanding of the subtopic, with policies, strategies or formal documentation of the practice in place. (e.g. the community promotes the use and sharing of data; access is mandated as a norm across the administrative organization and amongst the community. For example, data are presented in machine-readable formats and are published automatically.)

Level 5: Optimized

Implementation of the subtopic practice is optimal, and approaches are iteratively improved: Continual improvements are being made in the subtopic area, outcomes are consistently achieved, and both the knowledge and implementation of the subtopic area provide a platform for agility and innovation. (e.g. data published are made available to the community through visualization and other means, open data policies are iteratively improved and the knowledge used to develop them are reproducible).

Appendix B

Open Smart City Domain and subtopic descriptions

The four domains (Data, Governance, Hardware and Software, and People and Engagement) and 22 subtopics used in the survey are an operationalized interpretation of the five Open Smart City characteristics as described in the Open Smart City Guide V1.0.

For the purposes of the *Community Solutions Network*, each subtopic can be mapped to a level found in Appendix A. The highest level (5 of 5) is presented here:

DOMAIN: DATA	
Subtopic	Highest Subtopic Capacity Description
Open Data	Data published are made available to the community through visualization and other means, open data policies are iteratively improved and the knowledge used for their development is reproducible.
Internal Control	The community has established a clear process for granting and withdrawing resident consent for personal data collection. Internal control practices are continuously improved according to new and emergent changes in the community's data landscape.
External Control	The community ensures that any private entities collecting data in public spaces establish a clear process for granting or withdrawing resident consent for personal data.
Accountability	Residents are able to hold the community accountable for information management, including influencing the design of data and privacy policies.

Subtopic	Highest Subtopic Capacity Components
Use in decision-making	<p>The community is able to view and provide input on the hardware and software infrastructure (including automated processes) that produce the data and analysis that informs decision-making.</p> <p>Policy decisions being informed by data is the norm, and the ways in which data is used to influence decision-making are continuously improved.</p>
DOMAIN: GOVERNANCE	
Subtopic	Highest Subtopic Capacity Description
Open procurement	<p>Policies in open procurement and contracting are implemented in full.</p> <p>Procurement practices act as a platform for innovation in other sectors related to Open Smart City technological developments, e.g. equitable procurement opportunities for local vendors.</p>
Accountability in Governance Structures	<p>The governing bodies (e.g. boards, committees) in the community are held accountable for their actions through existing policy and norms (e.g. policies on lobbying and open procurement, corporate auditors, integrity commissioners, ombudspersons).</p>
Control: Privacy	<p>The community implements privacy policies which are aligned with, or exceed, the requirements of the federal and provincial privacy regimes relevant to my community.</p>
Algorithmic Error and Bias	<p>The community implements policies to address any potential errors and biases to the extent technically feasible and limit potential risks and impacts on residents and stakeholders (e.g. monitoring and validation processes, including human input and oversight).</p>

DOMAIN: HARDWARE & SOFTWARE	
Subtopic	Highest Subtopic Capacity Description
Infrastructure procurement	<p>The community develops, procures and implements the hardware and software infrastructure it needs.</p> <p>The development, procurement, and implementation of hardware and software is optimally done, and the community can preemptively plan for future infrastructure demands.</p>
In-house technical capacity	<p>The community has and will be able to build the in-house capacity (e.g. through recruitment or procurement) to meet all of its anticipated technical needs (to the extent appropriate and desirable).</p>
Regulation of hardware and software	<p>The community implements best practices to effectively manage the use of hardware and software.</p> <p>Policies and regulations put in place are adaptive to changing smart city technological developments.</p>
Use of open-source technology	<p>The community publishes open source solutions which are available to, and can be audited or modified by residents and stakeholders. Goals and outcomes around the development and implementation of open-source technologies are regularly achieved on-time and within budget.</p>
Innovation	<p>The community uses and measures the use of innovative technologies and technological practices.</p>
Environmental impacts	<p>The community deploys hardware and software in environmentally friendly ways and proactively uses technology to reduce its environmental impacts.</p>

DOMAIN: PEOPLE & ENGAGEMENT

Subtopic Highest Subtopic Capacity Components

Familiarity/ Alignment with Open Smart Cities	The community actively fosters human resources and invests in professional development (e.g. such as focused training related to open government).
Internal use of technology	The community provides training or professional development opportunities to staff regarding the use of hardware and software technology.
Internal engagement	The community implements policies to encourage internal engagement such that inclusion and collaboration are entrenched into the culture of the organization.
Community data and smart city literacy	The community carries out an ongoing program of public education and literacy on issues relating to the use of technology and data by public institutions and in the public domain, which is inclusive of all residents and stakeholders.
External engagement – technology	The community produces technology solutions that are responsive to the needs and priorities of residents and stakeholders.
External engagement – policies	The community carries out open policy development and implementation (e.g. participatory budgeting) and policy co-creation.
Engagement – Inclusion	The community and its partners (including private and not-for-profit entities) have implemented policies to ensure that inclusion is reflected in all engagement activities.

Appendix C

Communities Participating In the Advisory Service

City/Town/Indigenous Community		City/Town/Indigenous Community	
Beaumont	AB	Parkand Brazeau	AB
Bridgewater	HX	Peterborough	ON
Brossard	QC	Plessisville	QC
Cochrane	AB	Quebec	QC
Dieppe	NB	Richmond	BC
Cree Nation of Eastmain*	QC	Sackville	NB
Edmonton	AB	Saint Lambert	QC
Greater Victoria	BC	Saint Quentin	NB
Guelph	ON	Saskatoon	SK
Innisfil	ON	Saugeen Shores	ON
Kelowna	BC	Smith Falls	ON
Laval	QC	St. Albert	AB
Longueuil	QC	St. Jean sur Richelieu	QC
Midland	ON	Terrebonne	QC
Montreal	QC	Toronto	ON
Mount Pearl	NL	Reg. Municipality of Wood Buffalo	AB
Niagara Falls	ON	Durham Region	ON
Niagara Region	ON	Welland	ON
Nunavut Communities*	NVT	Caledon	SK
Paradise	NL		

* They spoke with representative of the Advisory Service, but no data from those conversations are included in this report to respect data use and confidentiality agreements.

** They completed the Open Smart Cities Self-assessment survey, but are not (yet) in the Advisory Services program.



Endnotes

- 1 Held in Ottawa, Windsor, Vancouver, Olds (AB), Calgary, Iqaluit, Whitehorse, Montreal, Moncton, Mount Pearl, and Winnipeg; seven more events are planned for 2019. Each event presents a unique opportunity for communities to engage, collaborate, and solve problems related to smart cities and their challenges
- 2 The answer was “Yes” if they had policies in all of the following subtopic areas (described further in Appendix B): open data, internal control, accountability, control–privacy, regulation of hardware and software, external engagement (policies), and external engagement (inclusion).
- 3 Finalists of the Smart Cities Challenge were required to provide a data management plan in their proposals, including a Privacy Impact Assessment, with evidence that relevant privacy authorities were consulted and that the plan complies with privacy laws.
- 4 In Canada, Open311 has been adopted by (or has received interest from) the following communities: Ottawa, Toronto, Edmonton, Surrey, Vancouver, and the provinces of Quebec and British Columbia.
- 5 As of October 2019, there are 61 municipalities across Canada with open data portals (Government of Canada)
- 6 For example, the cities of Guelph, London and Barrie are participating in the Municipal Innovation Exchange, using procurement challenges as a way to build innovation capacity.

Photo by Mwangi Gatheca

State of Open Smart
Communities in Canada

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