PROCUREMENT OFFICE OR "LIVING LAB?"

Experimenting with procurement and partnerships for smart cities technologies in Canada

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Communications Technology Council

PREFACE

The Information and Communications Technology Council (ICTC) is a not-for-profit, national centre of expertise for strengthening Canada's digital advantage in a global economy. Through trusted research, practical policy advice, and creative capacity-building programs, ICTC fosters globally competitive Canadian industries enabled by innovative and diverse digital talent. In partnership with an expansive network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 25 years.

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Designed by Raymond Brand.

ABSTRACT

A "smart city" uses technology to manage resources more efficiently and equitably, and/or pursues long-term planning to that end. Smart city projects have been led by numerous actors, including the private sector and community groups, but a large portion of smart city work takes place within the public sector. As such, public procurement has the potential to be a highly strategic tool for building smart cities: it allows municipalities to signal investment intentions, engage in long-term planning, and manifest their values through procurement criteria for sustainability and inclusion. There are many different forms of public procurement, both traditional and novel, in Canada today. The successes and challenges posed by different procurement methods are an important and underserved area of study in smart cities research. Traditional procurement, challenge-based procurement, grant programs, sole-source mechanisms, and innovative pre-procurement (for example, "living labs") offer municipalities and companies a variety of alternatives. Through interviews with numerous stakeholders and document analyses of procurement mechanisms (requests for proposals [RFPs]), this study investigates how municipalities in Canada enter into public-private-partnerships (PPPs) for smart cities technology projects, and how the results of these projects are tied to procurement mechanisms. Procurement mechanisms may include stipulations about other topics important to smart cities conversations, such as data ownership, degree of municipal involvement, and social impact, and this study also examines these aspects of procurement and PPPs in Canada. The study concludes that smart cities technology companies could benefit from more accessible procurement practices and recommends measures to achieve this. In addition, it identifies areas where PPPs, RFPs, and contracts have room to mature: such as in areas detailing IP guidelines and understandings of municipal involvement and risk-taking within a project.

Key Words:

SMART CITY

TECHNOLOGY

PROCUREMENT

REQUEST FOR PROPOSALS (RFP)

PUBLIC-PRIVATE PARTNERSHIP (PPP)

LIVING LAB

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In the face of rapid global population growth, commensurate urbanization, and the urgency of climate change, managing urban resources sustainably and equitably is more important than ever. While the idea of a "smart city" has many iterations, at its simplest it is a way to achieve environmentally minded efficiency by using technology to solve urban problems. A smart city is a city that uses technology to manage resources more efficiently and equitably, and/or pursues long-term planning to that end. While there are many fruitful examples of smart city projects led by both the private sector and community groups, a large portion of smart city work takes place within the public sector.

EXECUTIVE SUMMARY

Before smart technology can be used by the public sector, it must be procured. Procurement has the potential to be a highly strategic tool for building smart cities: it allows municipalities to signal investment intentions, engage in long-term planning, and manifest their values through procurement criteria for sustainability and inclusion. There are many different forms of public procurement, both traditional and novel, in Canada today, and the successes and challenges posed by different procurement methods are an important and underserved area of study in smart cities research.

Municipalities engage with smart city technology companies through public-private partnerships (PPPs) that procure a technology or service through a request for proposals (RFP), a contract, an MOU, an informal arrangement, or novel forms of partnership like accelerators and "living labs." Accordingly, this study investigates the following questions, with a particular focus on the Canadian context:

How do smart city technology companies in Canada enter into partnerships with the public sector, and vice-versa? What challenges do both parties face along the way? What other implications do these partnership approaches have? Finally, how do these varying partnership and procurement agreements address other topics closely interwoven with smart city projects, such as equity, environmental impact, privacy and security, and IP?

There are many ways to initiate PPPs. In general, "procurement" refers to a process where the public sector identifies a need and what the market can provide, selects a solution or service, develops a sourcing strategy, negotiates with suppliers, awards a contract, and carries out a project. However, different forms of procurement emphasize different steps of this process or take slightly different approaches. **The first section of this paper examines different smart cities procurement mechanisms and their pros and cons.**

TRADITIONAL PROCUREMENT refers to a solution-based RFP, request for information (RFI), or request for quotation (RFQ). In this system, a city initiates a procurement process for a specific technology or solution that it has already identified, and the private sector responds with bids. Traditional procurement has several advantages: it is well known, transparent, competitive, and (for proven solutions) low risk for both parties once an agreement has been reached.

However, traditional procurement also comes with challenges. Smart city technology companies note that traditional procurement can be slow and disadvantages new market entrants. For example, small companies and startups might not have the time, resources, and expertise to monitor numerous procurement websites for relevant RFPs and then successfully apply. In this study's investigation of procurement records of RFPs with publicly listed and confirmed awardees and contract amounts, smaller companies were also likely to get substantially smaller contracts. With respect to bidder parameters, many RFPs requested at least three references from former clients, another challenging ask for pre-revenue companies.

A second challenge pertains to new and emerging technologies. Traditional, solution-based procurement relies on a municipality knowing and understanding the technology they are procuring. This can result in emerging technology providers being excluded from RFPs. Similarly, cities might consider emerging-technology RFPs and contracts to be high-risk if they are procuring an unfamiliar technology that may or may not integrate with legacy systems or perform as desired. Siloed procurement efforts from municipal departments also may preclude smart cities technology solutions, which are often a mix of technology and business needs. An ecosystem of civil society organizations, industry associations, and other parties has emerged in part to educate the public sector about smart cities technologies, help them form productive partnerships, and build capacity in this space.

CHALLENGE-BASED PROCUREMENT might also use an RFI, RFP, or RFQ, but it offers an objective, pain point, or goal, rather than identifying the precise solution a city is trying to procure. Challenge-based procurement helps solve the problem of eliminating (or "writing out") emerging technology companies by not limiting the solution to known technologies, but it still comes with other challenges. RFP application processes might still pose significant barriers for new and small companies, and evaluating and selecting an unknown technology might present a high risk for cities.

Accordingly, some public sector organizations are trialling INNOVATIVE PRE-PROCUREMENT mechanisms to de-risk emerging technology procurement. "Living labs," civic accelerators, and pilot programs allow cities to "try before they buy" and support startup emerging technology companies along the way. These systems help cities assess a technology's efficacy and fit, solicit feedback from citizens, and support

local companies through small grants, use of municipal assets, and other assistance. These programs can be sound opportunities for startups or, in some cases, high risk: if a startup requires financial investment and is unable to attract municipal funds, innovative pre-procurement can represent sunk cost.

Finally, non-competitive procurement or "SOLE-SOURCE" procurement occurs in cases where a company has a highly unique product or a contract falls under a certain cap. In addition, smart cities GRANT PROGRAMS from provincial and federal governments may offer cities a way to fund startups during R&D phases: this allows both parties to engage in a "living lab"-style partnership with lower risk.

In all procurement, pre-procurement, and grant programs, a PPP that uses a public setting as a space for experimentation comes with considerations related to intellectual property (IP), data ownership, degree of municipal engagement, and social impact. **The second section of this paper is a document analysis assessing the maturity of each of these topics in smart cities partnerships in Canada.**

IP in a smart cities partnership may consist of software, algorithms, plans, or other intangible resources brought to (or created during) a contract. Not all RFPs analyzed in this project address IP, which has the potential to lead to mid-project ambiguity. Cities may or may not have the internal capacity to draft appropriate IP statements. Some reuse one statement for all procurements, while others have access to legal aid. In general, companies are able to retain IP that existed before a partnership's launch but are asked to forfeit IP for products developed as part of a PPP.

DATA OWNERSHIP and IP may require different treatment in procurement and contracting. Of those smart city RFPs that address data collection and ownership (less than half of the documents analyzed), some pose general questions to the proponent, some clarify data storage needs (e.g., storage within Canada), while others include a privacy-by-design mandate. In addition, a variety of data ownership structures were proposed, including co-ownership models, public sector ownership, and private sector ownership. In general, most stakeholders prefer to either avoid collecting personally identifying information (PII) or strip it from a dataset before it changes hands. Many municipalities are in the process of building internal capacity to manage their data effectively once collected (e.g., integrating multiple datasets, arranging licensing for startups and researchers.

As witnessed by the wide variety of data and IP ownership arrangements, **municipality involvement in a smart city project varies.** In this study's document analysis, municipalities in larger provinces took more involved, high-capacity roles in their partnerships (e.g., taking over a system after a project's completion rather than soliciting software-as-a-service). Municipal involvement in the form of system integration can impact how scalable a project is. Private sector parties may be

nimbler, with less red tape. Building internal capacity at the municipal level is a time-consuming undertaking. However, using municipal talent can improve cost-effectiveness, allow access to new and better data, and bring important oversight to a project.

Finally, the idea of a "city as lab," be it arranged via RFP, innovative pre-procurement, or other arrangements implicates some degree of experimentation in public spaces. Accordingly, some RFPs **include social impact requirements** (in addition to minimum guidelines under the law) to encourage socially and environmentally positive applications. Less than half of the RFPs analyzed (41%) included a social impact parameter. Of those that did, some were general, high-level, and had established core values, while others included explicit evaluation criteria related to environmental sustainability, accessibility, equity and non-discrimination, and inclusion of Indigenous personnel or Indigenous-owned businesses.

In conclusion, it is clear that smart cities technologies require innovative approaches to public procurement. Innovative procurement strategies for smart cities technologies might include traditional RFPs, but there are many ways to make the RFP process more accessible for startups and emerging technology companies. Canada can work toward an integrated bids-and-tenders site (our commitment under CETA) and replace siloed and paywalled alternatives. In addition, smart city technology RFPs can pose questions instead of assuming solutions, ensure that parameters do not "write out" emerging technologies, and support local businesses and startups via tailored experience requirements and active dissemination methods. In addition, innovative "pre-procurement" initiatives allow cities to trial new technologies in a low-risk way, and grant funding can lower the risks for pre-revenue companies. Nevertheless, PPPs have significant room to mature with regard to IP guidelines, ownership and collection of data and PII (personally identifiable information), collaboration and municipal involvement, and social impact parameters.

Over the next three decades, increases in population and urbanization will reinforce the already urgent need to manage resources more sustainably and equitably. In 2018, the United Nations projected that 68% of the world would live in urban areas by 2050 (up from 55%).[1] With an expected global population of 9.7 billion in 2050,[2] 6.6 billion people could live in cities in just 30 years, a significant increase from the 4.4 billion that do today.[3] As a part of considerations like housing density, healthcare infrastructure, and mobility planning, today's municipalities are faced with the challenge of managing resources efficiently and fairly. Cities are sites of opportunity, experimentation, economic activity and, importantly, significant energy expenditures, accounting for approximately 75% of global CO2 emissions.[4]

INTRODUCTION

There are numerous factors at play in managing urban resources well, and the COVID-19 pandemic of 2020 has illustrated that extreme policy measures (such as widespread lockdowns) and commensurate changes in public behaviour are possible and comprise an important tool in responding to crises. On the other hand, the pandemic has highlighted numerous vulnerabilities in urban systems, as witnessed by issues such as housing insecurity, inequitable internet access, energy poverty, and crises in public transit systems.[5] The long-term impact of widespread changes to everyday life—such as permanent work-from-home arrangements—is yet to be seen, as are the lasting impacts of such permanent social changes (for example, organizations are currently estimating the trade-off between potential reductions in commuting and increases in digital carbon footprints from remote work).[6]

In addition to policy measures and behaviour change, many new and old technologies offer opportunities to design more efficient cities. In Canada, a "smart city" might call to mind the now withdrawn collaboration between Waterfront Toronto and Sidewalk Labs, a high-tech, "from the internet up," full-service smart neighbourhood with sensors in everything from pavement to light posts.[7] While Sidewalk Labs dropped its proposal to build in Toronto in the spring of 2020,[8]

[1] Population Division of the Department of Economic and Social Affairs of the United Nations, 2018 Revision of World Urbanization Prospects, United Nations. https://population.un.org/wup/, 2018

[2] Department of Economic and Social Affairs, "Growing at a slower pace, world population is expected to reach 9.7 billion in 2050 and could peak at nearly 11 billion around 2100," United Nations, June 17, 2019

[3] David Satterthwaite, "An urbanizing world," International Institute for Environment and Development, April 9, 2020, https://www.iied.org/urbanising-world#:~:text=Growth%20of%20the%20world's%20urban,to%204.4%20billion%20in%202020.

[4] United Nations Environment Programme, "Cities and Climate Change," n.d., accessed November 22, 2020, https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/cities/cities-and-climate-change

[5] These and other priorities are outline by the Federation of Canadian Municipalities in "Building back better together," 2020, https://data.fcm.ca/documents/COVID-19/fcm-building-back-better-together.pdf

[6] "To achieve persistent behavioural changes so that the decline of emissions becomes permanent, targeted investments in communication networks can be part of a green recovery package, provided measures are taken also to reduce the environmental footprint of digital technologies." Organization for Economic Cooperation and Development, "COVID-19 and the low-carbon transition: Impacts and possible policy responses," June 26, 2020. http://www.oecd.org/coronavirus/policy-responses/covid-19-and-the-low-carbon-transition-impacts-and-possible-policy-responses-749738fc/

[7] Sidney Fussel, "The City of the Future is a Data-Collection Machine," November 21, 2018, The Atlantic, https://www.theatlantic.com/technology/archive/2018/11/google-sidewalk-labs/575551/

[8] Donovan Vincent, "Waterfront Toronto ditches Sidewalk Labs' vision of high0tech, sensor-driven smart district at Quayside," June 20, 2020, The Star, https://www.thestar.com/news/gta/2020/06/30/waterfront-toronto-ditches-sidewalk-labs-vision-of-high-tech-sensor-driven-smart-district-at-quayside.html?

Canadian municipalities continue to pursue numerous projects that seek to manage resources more effectively using technology. A "smart city" project need not involve high-tech sensors, predictive models, or digital twins: rather, for the purposes of this paper, a smart city project involves the public sector using technology to manage its resources more efficiently and equitably. This may or may not involve data collection but is usually either an evidence-based attempt to solve a problem (e.g., opting to retrofit a public building with a technology known to be more energy efficient) or an attempt to gather evidence about the best way to solve a problem (e.g., a pilot program that tracks transit use).

For example, smart city projects could include the following technologies capabilities:

COLLECT DATA
Internet of Things (IoT) technologies, other types of sensors, crowdsourcing technologies, low-power networks and high-bandwidth networks, GIS/GPS

CONNECT CITIZENS
Public WiFi, universal broadband, low-earth-orbit satellites, platforms that disseminate information and ease engagement)

CLEAN, ORGANIZE, AND ANALYZE DATA
Database technologies, artificial intelligence (AI) and its subsets

KEEP DATA SECURE AND PRIVATE
Synthetic data, security technologies, privacy technologies)

DELIVER SERVICES OR PROVIDE INFRASTRUCTURE
Mobility technologies, open government technologies, smart and renewable energy technologies, electric vehicle infrastructure)

In addition, projects that use these technologies to create long-term plans—multi-modal mobility planning, sustainable planning, or other—are also considered "smart cities projects" within this study. Before becoming part of a public sector-led smart city, however, the companies that build these products need to enter into partnership with a public entity. The remainder of the introduction provides an overview of procurement and partnerships before turning to this study's primary investigation:

How do smart cities technology companies enter into partnerships with the public sector, what challenges do both parties face along the way, and what other ramifications emerge from both traditional procurement and novel partnership approaches? Finally, how do these varying partnership and procurement agreements address other topics closely interwoven with smart city projects, such as equity, environmental impact, privacy and security, and IP?

IMPLEMENTING SMART CITIES PROJECTS: PUBLIC-PRIVATE PARTNERSHIPS AND PROCUREMENT STRATEGIES

Public discussions around Canadian smart cities tend to focus on technology, talent, and regulation—the technologies involved, the skilled talent needed to implement them, and the necessary guardrails (such as public consultations) needed to guide their implementation. Each of these considerations follows an important prerequisite question: is a municipality performing a project on its own, or is it procuring private sector help? In cases where the private sector is brought in to help implement a project, this public-private partnership is often initiated through a formal procurement process, where a city requests bids. Alternatively, a city might hold a pilot program competition, offer grants or municipal services to help new companies with research and development, or form an agreement without formalities if the contract amount falls under a certain cap.

Smart city procurement, while intricately intertwined with technology, talent, and consultations, is underexamined in smart city discussions. Relatively few publications are focused on smart city procurement, and when procurement is discussed, the focus is often on transparency, consultation, and openness in the procurement process and not on the suitability of specific processes to procuring new tech.[9] Yet public procurement is an important aspect of smart cities in Canada: it is the necessary bridge between public sector problems and private sector solutions, which guides the adoption of new and emerging tech by municipalities across Canada.

WHEN DO CITIES CHOOSE TO "GO IT ALONE" INSTEAD OF FORMING A PRIVATE SECTOR PARTNERSHIP?

Municipalities do not always work with the private sector on smart cities projects. In some cases, they seek to build internal capacity and implement a new technology or process alone. In interviews with municipalities, some noted that they might avoid a PPP in cases where the project touched on a "core operational requirement that can't be outsourced" (such as cybersecurity, in one example). In addition, cities working with legacy systems might choose to build new services onto existing municipal platforms.

Cities might also choose to build internal capacity and then take over a system built by a private sector partnership. The degree to which municipalities are involved in PPPs and instances when companies continue to operate solutions they provide to cities are discussed later in this study.

What is Public Procurement and Why is it Important?

Public procurement, or government procurement, is the purchase of goods and services by publicly owned, government organizations.[10] This broad definition encapsulates not only

9   "After Sidewalk Labs, What is the Future of Smart Tech for Canadian Cities?" May 11, 2020, Canadian Urban Institute, https://www.municipalworld.com/wp-content/uploads/2020/04/Open-Smart-Cities.pdf https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/; https://osf.io/preprints/socarxiv/e4fs8/
10 The OECD defines government procurement as "goods and services bought by the government for consumption and investment but not for resale. Denis Audet, "Government Procurement: A Synthesis Report," OECD, 2002, https://www.oecd.org/gov/budgeting/43506020.pdf

procurement by government organizations of all sizes, from the very small to the very big, but also the procurement of goods and services of all kinds: depending on the context, it can include everything from the purchase of construction services by a local municipal government to the purchase of new computers by an international organization like the European Commission.

Public procurement is an important part of government activity, in part due to its substantial financial footprint. In Canada, across the various local, regional, and national government organizations, public procurement accounts for about 32% of total government expenditures and 13% of GDP.[11] These percentages are close to the OECD average and in line with similar countries like the UK, and significantly higher than the United States. With such a large financial footprint, governments are expected to carry out public procurement efficiently, with a high quality of service delivery, and with the public interest in mind.[12] As such, robust public procurement processes are a crucial part of this task.

General Government Procurement, OECD Countries

USA
9.29 (24.47)

France
14.41 (25.68)

OCED Average
12.77 (30.45)

Canada
13.38 (32.39)

UK
13.06 (31.98)

Germany
15.5 (35.46)

Israel
14.84 (37.55)
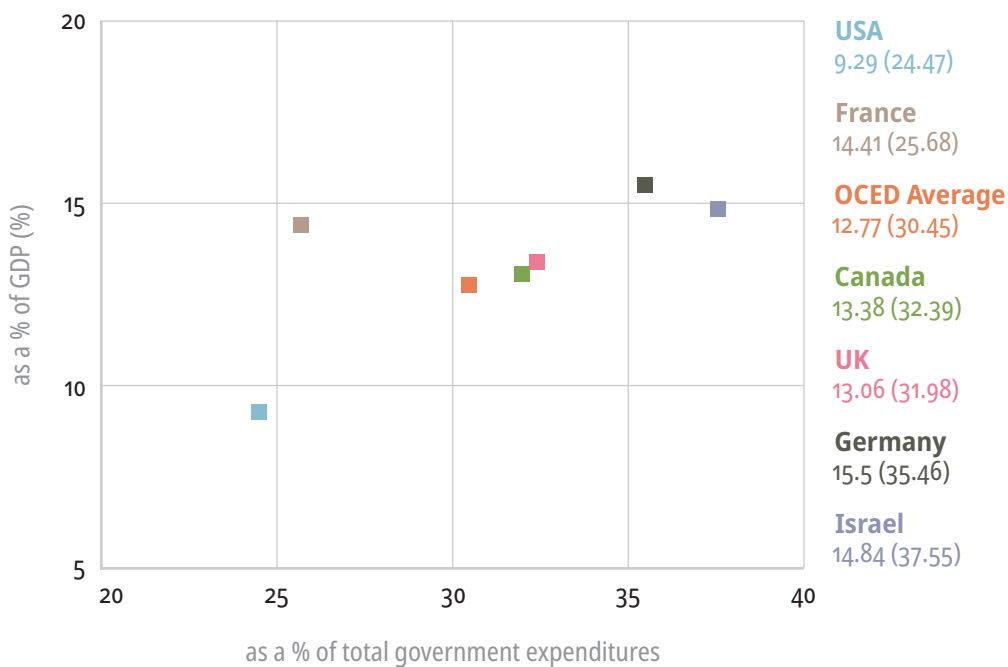
Figure 1. General Government Procurement as a % of total government expenditures and GDP. Includes spending by all units of central, state or local government. ICTC Analysis, 2020; OECD data, 2019, https://stats. oecd.org/Index.aspx?QueryId=94406.

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[11] *"Government at a Glance – 2019 Edition: Public procurement," OECD, 2019, https://stats.oecd.org/Index.aspx?QueryId=94406 - Data extracted on November 5, 2020*
[12] *"What is Public Procurement," OECD, 2019, https://www.oecd.org/governance/ethics/public-procurement.htm*

In addition to its financial footprint, however, public procurement is also important because of its fundamental role in tackling public policy problems, and its potential to address more than one problem simultaneously. There are almost no policy problems that can be tackled without some form of spending, and with spending being such an integral part of government activity, governments have realized how important it is to spend with purpose. This has given rise to strategic public procurement, or procurement strategies, which help governments ensure that public spending is performed through a certain lens or with a set of guidelines or goals in mind. At the federal level, the government has a Sustainable Development Strategy,[13] which among other things, outlines how the government will use public procurement to help advance the United Nations sustainable development goals. For example, public procurement can contribute to advancing Goal 9 of the strategy, which is to build resilient infrastructure and promote inclusive and sustainable industrialization; Goal 12, which is to ensure sustainable consumption and production patterns; and Goal 13, integrating climate change measures into national policies, strategies, and planning.

Some additional examples of strategic public procurement include SUSTAINABLE PROCUREMENT (procuring goods and services that have a positive impact on sustainability and the environment), DIVERSE PROCUREMENT (procuring goods and services from a diverse set of providers, including those owned and operated by women, members of an Indigenous Community,[14] members of a visible minority group, and/or members of the LGBTQ+ community), and CANADIAN PROCUREMENT (procuring from Canadian suppliers of goods and services in order to support local businesses and economies). For underserved and underrepresented groups, strategic procurement can provide new ways to participate in the digital economy.

Beyond these goals or guidelines, public procurement can be used strategically to spur economic development. In some ways, public procurement is just one of the many ways a government can initiate a PPP. As one interview noted, PPPs provide benefit to the economy by opening the full scope of opportunities in the public sector to the private sector and, in turn, bringing private sector resources to public sector problems in the form of innovative talent and solutions.

> "I love PPPs. I think they work great. I love how we approach them in Canada, the Canadian model. What works great from my perspective is—and this will sound a bit airy-fairy—I love being able to bring the innovation from the private sector and then use the fact that the public sector has so much impact on our lives to make lives better. Between the two, I can't impact people to the same extent working in the private sector alone."
>
> **Kenton White, Chief Scientist, Advanced Symbolics**

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[13] *"Departmental Sustainable Development Strategy: 2018 to 2019 Departmental Results Report," May 5th, 2020, The Government of Canada, https://www.tpsgc-pwgsc.gc.ca/rapports-reports/rrm-drr/2018-2019/smdd-dsds-eng.html*
[14] *"Procurement Strategy for Aboriginal Business (PSAB)," December 12, 2020, Government of Canada, https://www.aadnc-aandc.gc.ca/eng/1100100032802/1100100032803*

Public Procurement for Smart Cities in Canada: Types of Technologies

As discussed earlier, the Toronto Sidewalk Labs was but one model of a smart city in Canada—a wide variety of other projects are ongoing or have already been completed. To illustrate the diversity of technologies, city sizes, and types of projects that are ongoing in Canada, the following case studies each feature an excerpt from an existing public RFP. These projects use technologies that collect data, connect citizens, improve government services, and/or pursue planning to ensure the long-term security of a city's smart infrastructure.

SMART MOBILITY: DATA COLLECTION FOR PUBLIC TRANSIT PLANNING & IMPROVED SERVICE DELIVERY

City of Whitehorse: "Transit Real-Time Passenger Info and Electronic Payments System"

"This technology benefits riders, non-riders, and the City itself in terms of operations, safety, and rider satisfaction. These benefits can provide operational improvements, as well as play an important role in providing effective communication between the transit system and riders so that riders could be informed of any impacts to service and mitigate service risks."

RFP 2019-093; Closed October 24, 2019

PLANNING SERVICES FOR SMART INFRASTRUCTURE: IOT ENERGY NETWORK SECURITY CONSULTING SERVICES

Town of Bridgewater: "Internet of Things (IoT) Security Consulting Services for Energize Bridgewater Program"

"The Primary objective of this RFP is to provide a standardized (NIST, ISACA, COBIT or equivalent) security vulnerability and risk analysis with recommendations to guide the Town of Bridgewater's design of an IoT network to monitor energy usage in residential housing. The risk and vulnerability assessment will include (but not be limited) to the following:

1. The physical security of IoT devices
2. The transfer of data through an edge gateway to the EMIS
3. System integrations between the EMIS and systems hosted by the Town
4. The Energize web portal"

RFP2020-08, August 2020

SMART GOVERNMENT: PLATFORM FOR OPEN DATA AND VIRTUAL PUBLIC ENGAGEMENT

City of Vancouver: "Provision of a Digital Engagement Platform"

"The City seeks a user-friendly platform that, at a minimum, does the following:

- Supports users of all/varied physical abilities to engage (i.e., meeting WCAG Accessibility requirements)

- Ensures transparency in the quality and strategic nature of each digital experience

- Provides a one-stop-shop engagement portal with the ability to show all engagement activities (closed, current, and upcoming) and the ability to report on summaries, opportunities to participate, and outcomes

- Updates quickly, and harmonizes reporting approaches

- Provides flexible and visual project pages with the ability to share information

- Is multi-media enabled

- Allows users to subscribe to updates on their channel of choice

- Can integrate engagement tools that include surveys, ideation, asset mapping, trade-offs, options analysis, voting, discussion forums

- Can serve as an archive for previous engagement findings

- Provides content in a manner that can be accessed and engaged with through multiple channels"

RFP No. PS20191175, August 2019

The Public Procurement Process

There are many ways of characterizing the various stages of the procurement process, some specific to public procurement and others more closely aligned with procurement in the private sector. Nonetheless, most follow a general flow that begins with assessing/identifying needs and researching suppliers, to purchasing the goods and/or services that will fulfill the specified need. Specific to public procurement, the OECD defines the procurement process as "the sequence of activities starting with the assessment of needs through awards to contract management and final payment."[15] In the absence of a more detailed definition from the OECD, Figure 2 provides a general overview of the procurement process discussed in this paper.
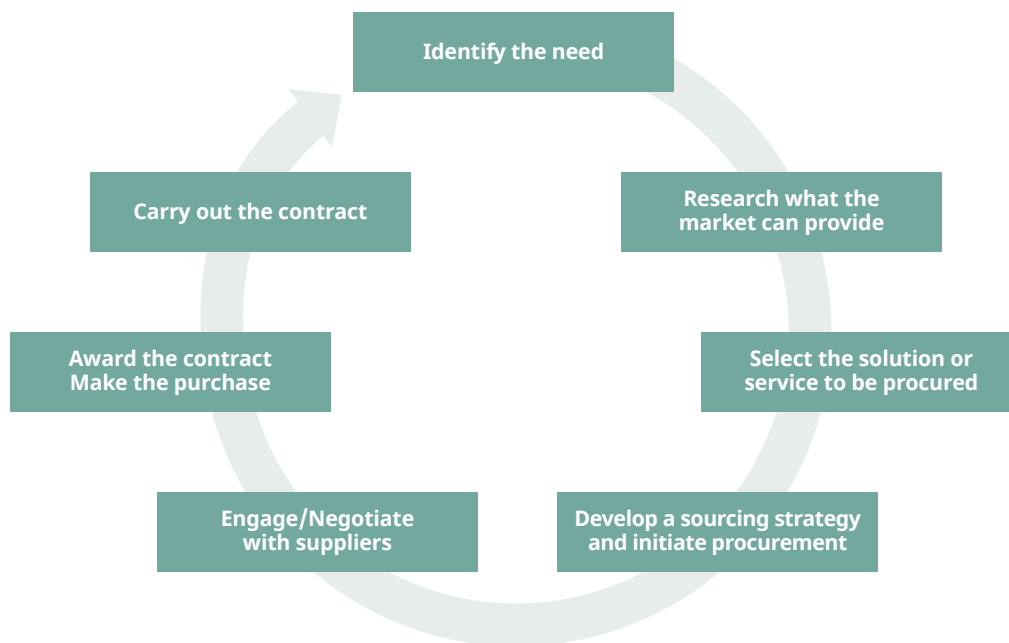
Figure 2. *The Public Procurement Process. ICTC, 2020. Adapted from Paul Davis, 2010 and Chris Blood-Rojas, 2017.*[16]

Understandably, not all procurement processes will follow this exact flow: some may address these steps in an alternate order, while others place a heavier emphasis on one portion of the procurement process than another. In part, this is due to the vast array of products and services a government can purchase: new computers for the local library; rail cars for a publicly owned light-rail system; custom software to automate the translation of government documents; or the installation of new electric vehicle chargers along a main transportation corridor.

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[15] "Public Procurement," OECD, 2019, https://www.oecd.org/governance/ethicsc/public-procurement.htm
[16] Paul Davis, "Procurement Process" 2010, https://www.researchgate.net/figure/The-Public-Procurement-Process-adapted-from-Gershon-1999_fig7_254584794 and Chris Blood-Rojas, "The 7 steps of a strategic procurement process," 2017, http://www.tradeready.ca/2017/fittskills-re-fresher/7-steps-of-a-strategic-procurement-process/

As such, the first section of this report provides a detailed overview of the many types of public procurement, the kinds of projects they may be most appropriate for, and the benefits and challenges associated with each. Included in this section are traditional forms of procurement—including solution-based requests for information (RFIs), requests for quotations (RFQs), and requests for proposals (RFPs)—and new forms, such as problem-, challenge-, or outcome-based procurement, pilot programs, and living labs. Section II delves into more specific trends observed in smart city projects across Canada, including supplier trends, municipal approaches to IP and data, the degree of municipal involvement in projects, and measures to ensure positive social impact.

The findings in this report come from a variety of data sources: a review of the existing literature on innovative public procurement, 29 key informant interviews with relevant stakeholders (such as municipal procurement officers and smart city technology companies), three smart cities technology taskforce engagements, and two complimentary datasets (one consisting of 46 smart city RFPs, and the other, of 23 federal funding programs that have supported smart city projects). A more in-depth discussion of these sources and their intentions is found in the methodology section of the report.

When a city moves to acquire a new good or service, procurers may or may not already have a solution in mind. For example, a team that wishes to improve the energy efficiency of their City Hall might ask any of the following questions, each of which might lead to a different type of public-private partnership and procurement process:

SECTION ONE
PROCUREMENT TYPES, BENEFITS AND CHALLENGES

1. Who is best suited to conduct an LED retrofit to our specifications?

2. Could an LED retrofit come with "smart lighting" features to further improve energy efficiency?

3. What type of energy efficiency solution would provide the best return on investment?

4. Can we create an energy efficient building and support local innovators at the same time?

From both the procurer's perspective and the applicant's perspective, each question presents different opportunities and challenges. For example, if the city receives an array of different answers to question three, will they have the necessary background and expertise to appropriately evaluate the proposals in house? If not, they may have to spend additional resources on external consultants. Alternatively, if the city moves ahead with question one and asks only for known solutions like LEDs, a company that offers an unfamiliar new technology may never get to pilot their solution—or even propose it, for that matter.

The smart cities ecosystem offers unique challenges: unlike other procurement areas, where solutions are well known and established technologies (e.g., selecting a provider for office printers), new and emerging technologies might come with a steep learning curve for procurers (e.g., figuring out whether a city has or can generate adequate labelled data for a machine learning application). In addition, the status and maturity of smart cities across Canada varies significantly, from some

cities working hard to get basic broadband infrastructure to their communities, to others piloting autonomous vehicles. Municipal budgets and the resources available to local innovators also have a significant impact on procurement goals. Accordingly, the smart city ecosystem employs a variety of procurement types to different ends.

The following section outlines types of procurement and pre-procurement, before moving to the challenges and benefits associated with each. Apart from public procurement, there are also stand-alone private sector projects. That is to say that some smart city projects may be entirely led by the private sector without public sector involvement. Some famous examples are ride-sharing tools, or last-mile transport programs facilitated via smart phone apps. Some advantages of private sector projects include the ability to act unilaterally, the absence of an application or approvals process, and fewer project partners, which can reduce coordination risk and speed up project timelines. That said, there are challenges as well: there may be less public oversight and consultation, and companies may lack funding and insight into public sector problems and opportunities.

TYPES OF PROCUREMENT FOR SMART CITIES

TYPE OF PROCUREMENT	DEFINITION, ADVANTAGES AND CHALLENGES
Traditional or Solution-Based	Includes traditional, solution-based RFPs, RFIs, and RFQs, whereby the city initiates a procurement process for a specific technology or solution and the private sector responds with bids. **ADVANTAGES** • Familiarity, mutually understood procedures • Competitive and transparent—predefined evaluation criteria and specifications are used when proponent selection cannot be made solely on price **CHALLENGES** • The city needs to know what solution they want • Private sector participation requires a significant time and dollar investment, and often, applicants must have former project experience to qualify • The process has rigid rules and, according to some, can be slow and inefficient
Problem, Challenge, or Outcome-Based	Problem-based procurement makes use of traditional procurement mechanisms (RFPs, RFIs, and RFQs) but with a twist. Instead of identifying a solution, the RFP, RFQ, or RFI references a particular problem that needs to be solved. The private sector then responds with relevant approaches and/or solutions. **ADVANTAGES** • The city does not need to know what solution they want before issuing an RFP, RFQ, or RFI, which limits the amount of research they need to do and allows for procurement of leading-edge technology

- The private sector can respond with a range of solutions. This in effect, allows the city to crowdsource possible solution ideas

CHALLENGES

- Private sector participation requires a significant time and dollar investment. Applicants might need former experience

- It can be more difficult for cities to evaluate RFPs consistently

- The process can still have relatively rigid rules and can be slow and inefficient in some cases

Non-Competitive or Sole Source	Partnership falls outside of need to create an RFP, such as contract amount or unique IP/product offering, depending on procurement office guidelines. City and company form partnership without undertaking competitive process. **ADVANTAGES** • It is efficient for both parties **CHALLENGES** • It is non-competitive, which could obscure transparency and limit competition
Pilot Programs, Living Labs, and other Municipal Challenges for Startups and SMEs	The city runs a challenge-based "call for pilot proposals" focused on a specific theme or with certain goals or objectives. The challenge may result in a formal RFP, yet usually begins with something less formal, like in-kind contributions from the city or a memorandum of understanding, for example. **ADVANTAGES** • The city does not need to know what solution they want • The private sector can approach the city with a range of solutions • The informal/pilot aspect allows the city to test out new solutions without committing to a formal contract—in other words "try before they buy" • Companies get a chance to test new solutions in a real-world environment and gain feedback. Solutions usually are not expected to have a long history of use in other cities **CHALLENGES** • Private sector participation requires a significant time and dollar investment • The city will not necessarily provide funding to startups for their solutions, and when it does, compensation may be minimal (for example, in contributions or, in some cases, up to $5,000 per pilot) • Piloting new technologies can pose a risk to the city and/or the partners • Agreements may last for only a short period of time

Provincial and/or Federal Funding Programs	Provincial and federal funding programs are usually centred around a specific theme, sector or challenge. These programs make funds available to cities and private sector partners to engage in smart city projects. **ADVANTAGES** • Calls for proposal are usually quite broad and therefore enable a wide range of projects. Similarly, they do not usually require the use of a specific technology, meaning that the tech does not need to be known in advance • Enable access to large funding pools from government • Usually result in some form of positive social impact **CHALLENGES** • Potentially long approval processes • The increased number of project partners can create coordination risk • Sometimes odd requirements or rules can restrain activity
Municipal-Academic Partnerships	These are partnerships between municipal governments and academic institutions. Usually, the academic partner provides some form of problem solving and/or technical skills to the city, while the city provides access to public-sector opportunities. **ADVANTAGES** • These types of partnerships capitalize on local academic talent and provide interesting experiences for students, researchers, and professors • They can also reduce costs for the city **CHALLENGES** • These kinds of partnerships can address only a limited range of problems

TRADITIONAL, SOLUTION-BASED PROCUREMENT: CHALLENGES

"Standard procurement processes are restrictive. They take time and lack the flexibility required to change and adapt specifications to the reality of the problem they are trying to solve. Searching for the right partner through a competitive RFP process may not even make sense when looking for a solution that does not exist yet. As a result, some cities end up purchasing technologies that are out-of-date or out-of-scope."

Jeremy Devray-Benichoi, VP of Customer Success, UrbanLeap[17]

[17] Jeremy Devray-Benichoi "Smart Procurement for Smart Cities," February 11, 2019, Meeting of the Minds, https://meetingoftheminds.org/smart-procurement-for-smart-cities-29894

Previously, we offered a set of examples of questions that cities might ask when procuring a solution. In traditional procurement, a city might be asking the first two questions below in the form of a RFP, RFI, or RFQ, to which the private sector would respond with applications tailored to fit the city's request in a competitive process, resulting in a contract.

1 **Who is best suited to conduct an LED retrofit to our specifications?**

2 **Could an LED retrofit come with "smart lighting" features to further improve energy efficiency?**

3 What type of energy efficiency solution would provide the best return on investment?

4 Can we create an energy efficient building and support local innovators at the same time?

TRADITIONAL, SOLUTION-BASED PROCUREMENT

Example of City of Montreal, "Acquisition of intelligent speed displays," RFP 20-17997.

"The intelligent speed displays are programmable, with the ability to collect statistics and modify their parameters remotely, from the offices of the Ville-Marie borough, by internet connection. Data extraction must be able to be done via a web interface (http://). The data must remain accessible and be stored for a minimum period of three (3) years on a domain or interface.

The data extracted from the speed displays must have the option of being represented in graphical form.

The displays are plugged into the City's electrical boxes which are only lit at night.

The smart speed displays are powered by batteries and, depending on the case, solar energy in places where the electrical connection to the City's electrical boxes is not possible. They must therefore be equipped with batteries sufficient to maintain the functionality of the speed displays in the event of a lack of electricity or solar energy. The SUPPLIER must consider that the displays are therefore powered by battery, or solar energy, during the day and by electric energy at night. The SUPPLIER must therefore provide in his tender, at least 10 speed displays powered by solar panels and 40 powered by electric power.

The length of the cabling between each intelligent speed display and its solar panel must be adjustable in order to position the solar panel at a variable distance from the display, depending on site conditions.

Intelligent speed displays must have a setting that allows messages and numbers to be displayed simultaneously. They must also have flashing lighting to warn users who do not respect the prescribed speed limits.

The size of the displays must be large enough to ensure visibility of at least 150m."

In addition, the RFP specifies that there must be a minimum of two colours in the display, letters that are 30cm in height, and various other design and installation parameters.

Traditional procurement has faced significant criticism in the smart city ecosystem for privileging older technologies and established companies. As we will see in this section, small, new, and emerging technology companies face numerous challenges with traditional procurement, as do municipal departments. Nevertheless, many of the frustrating attributes of traditional procurement (including the length of the process, strict RFP criteria, and experience requirements) are side effects of an effort to spend public funds in a responsible, fair, and transparent way. Many smart city projects require municipalities to be comfortable with trial and error, a role not usually regarded as appropriate uses of public funds at a local level. The tensions inherent in using the city as a "lab" play out in procurement, partnerships, data ownership, social impact, and all the other themes discussed in this paper. The following challenges with traditional procurement were raised by interviewees and focus group participants. They reflect the perspectives of the various stakeholders in the public procurement process.

Traditional RFPs, Startups, and Small Companies

> "One of the hardest parts about being a small company that sells to cities is obviously the procurement process."
>
> **Tara Pham, Cofounder, Numina[18]**

Many challenges related to traditional procurement are disproportionately experienced by startups and under-resourced companies.

It takes a lot of time and money to locate relevant RFPs, particularly when municipalities are using siloed or paywalled bids and tender sites. Small companies and startups with niche product offerings might not "have the experience and time to enter into the traditional procurement environment," one interviewee said. This interviewee noted that Ontario has about 450 municipalities, two-thirds of which use their own separate bids and tender sites.

AN INTEGRATED BIDS AND TENDER SITE FOR CANADA: OUR COMMITMENT UNDER CETA

It is worth noting that this challenge will be at least partially mitigated in the coming years due to Canada's obligations under the Comprehensive Economic Trade Agreement (CETA), the international trade agreement between Canada and European Union. Under CETA, Canada is required to create a free single-point of access (SPA) for qualifying public procurement opportunities at the municipal, provincial/territorial, and national levels.[19] The SPA, which is currently being designed by the federal government in consultation with regional governments, will begin its testing phase in the first few months of 2021. From then until 2022, the federal government will work with other jurisdictions to integrate regional procurement opportunities into the SPA. That said, the obligation applies only to contracts above a certain threshold value—approximately CAD $340,600 for goods and services procured by cities and around CAD $8.5 million for construction services.[20] For context, approximately half (47% of those with a public contract value) of the RFPs in ICTC's smart city RFP dataset were below the threshold amount. Interestingly, some of the procurement offices interviewed in this study have attempted to mitigate the issue of siloed bids-and-tenders sites by working with regional technology institutes, accelerators, and other organizations to make relevant RFPs available to small and emerging technology companies.

Responding to RFPs is a long and specialized process. Interviewees noted that in addition to finding procurement opportunities, understanding and responding to RFPs also requires a specialized skillset. While some larger companies may have entire teams of people dedicated to writing RFP bids and others may have specific staff with the right know-how, not all companies will have the same resources when approaching an RFP. New companies, for example, will not have past experience to rely on during the application process, and smaller companies will not have as much time, capital, or human resources to devote.

In interviews with small technology companies competing for RFPs, accessibility and capacity were raised as important barriers, with one interviewee noting that larger companies might be able to afford a team to monitor and reply to RFPs. In this study's investigation of procurement records, for those RFPs with publicly listed and confirmed awardees and contract amounts, smaller companies were likely to get substantially smaller contracts, as illustrated by Figure 3.

[18] "After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?

[19] "Canada-European Union Comprehensive Free-Trade Agreement (CETA)," September 15, 2017, Government of Canada, https://buyandsell.gc.ca/policy-and-guidelines/policy-notifications/PN-122

[20] "Comprehensive Economic and Trade Agreement: What you need to know about CETA," 2020, Federation of Canadian Municipalities, https://fcm.ca/en/resources/comprehensive-economic-and-trade-agreement#:~:text=Under%20CETA%2C%20the%20thresholds%20for,procurement%20obligations%20do%20not%20apply.

Exploring Smart Cities Procurement: Company Size and Contract Amount
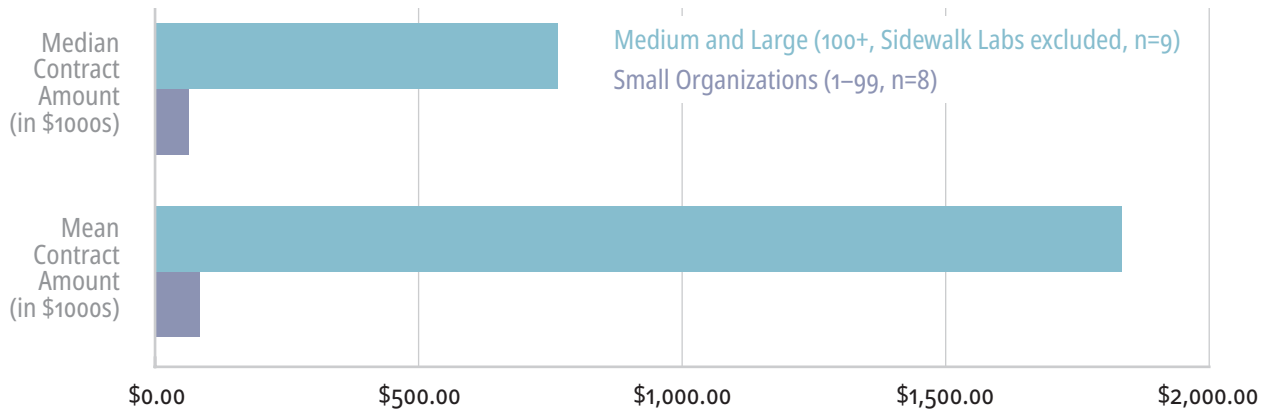
Figure 3: Mean and Median Contract Amount by Awardee Size, ICTC RFP Dataset 2020, Sidewalk Labs contract excluded from this analysis (significant outlier in contract size).

The fact that small companies in this dataset received, on average, smaller contracts is not particularly surprising—nevertheless, it may be one of several indicators that RFPs are not particularly accessible for small and new applicants. Another way to model this issue is by how complex the application process is for inexperienced proponents. While RFP document length is an imperfect proxy for accessibility, it offers perspective on what companies face when trying to win contracts. Excluding addenda and other externally attached documents, the RFPs in the dataset ranged in size from three pages to 134 pages, with a median of 31 and a mean of 39. Perhaps unsurprisingly, page count trends upwards along with population in urban centres. Figure 4 shows both mean and median RFP page counts. While the mean of 65 pages for cities with over 500,000 people is pulled down by several shorter documents, the median of 94 pages effectively illustrates the length and complexity of many RFPs.

Length of RFP Document by Population of Issuer (or Location)
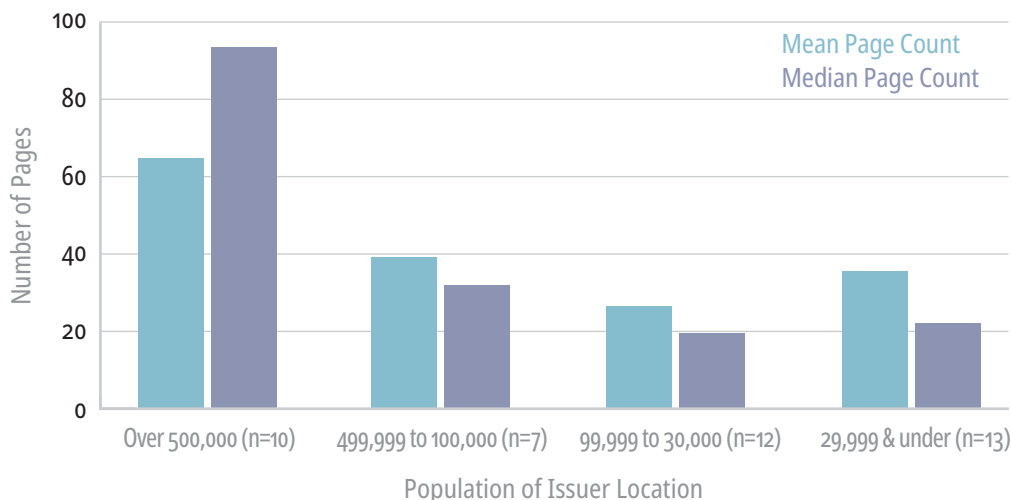
Figure 4. Length of RFP document by population of issuer (or location) based on 2016 Census. ICTC RFP Dataset, 2020.

A third way to examine the question of accessibility for smaller and emerging technology companies is according to the size and foundation date of the companies that win RFPs. In this study's collection of RFP data pertaining to smart cities, the mean age of successful companies was 26.8 years, with a median of 25 years.[21] Furthermore, median size was 95 years, with a mean of 9,347 employees.[22] In other words, companies successful in receiving contracts for smart cities projects—often new and emerging technology projects—were on average 26.8 years old and had a significant range in the number of employees. Figure 5 is a scatter plot that illustrates the relationship between the age of the companies being awarded smart city contracts in this dataset and company size, where available. A clear relationship between size and age exists, with younger companies also likely to be small.

Awardee Size (No. Personnel) and Age at Application (Years)
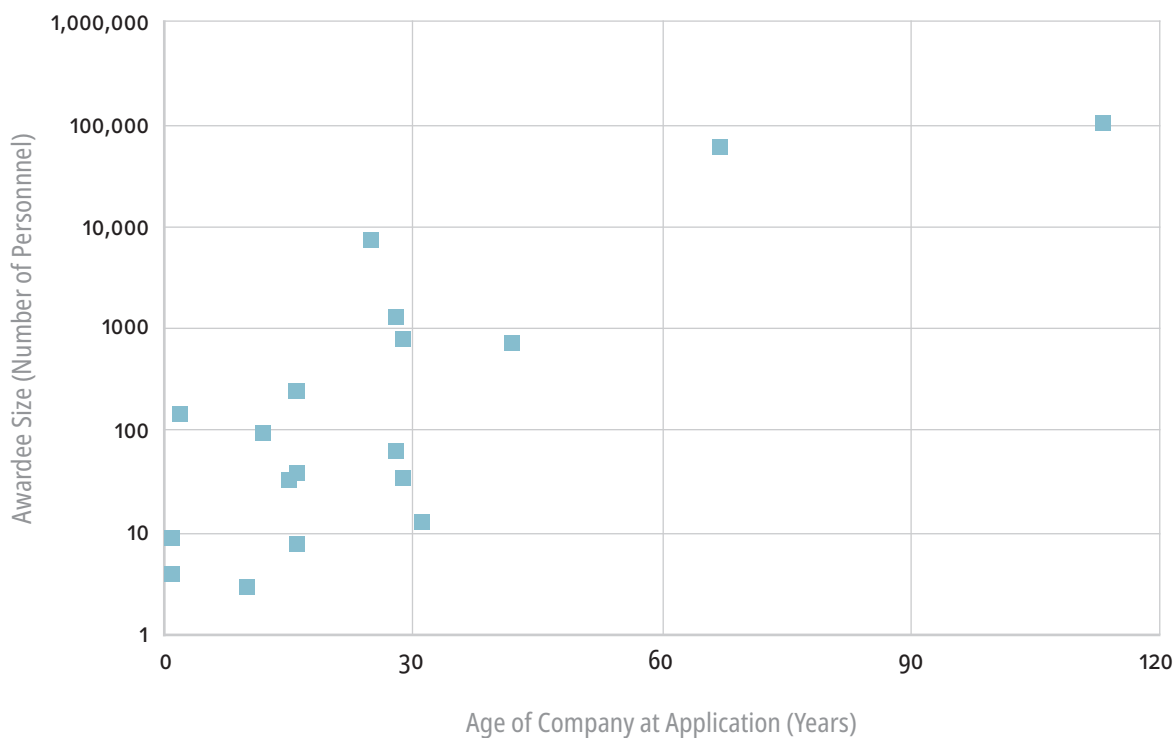
Figure 5: Age and size of company at receipt of contract (n = 19). Note that the y axis uses a logarithmic scale.

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[21] Based on a comparison between the company's listed founding year (where available) and RFP posting year. Both datapoints were available for 19 cases in this study's body of RFPs.

[22] The significant discrepancy between median and mean in company size results from two outliers on the upper end of this range, both well-established utility and IT companies. In addition, it points to a need for future research to compile a larger dataset for analysis, perhaps by reaching outside of the Canadian context (see methodology).

The most recently founded awardee was IRIS R&D Group, Inc. in 2018: importantly, the contract won by IRIS was unique, belonging to the Guelph Civic Accelerator Program (to be discussed later in this paper). The median founding year of companies in this dataset was 2007. Another young company, DropBike (2017) won an award from the City of Kingston to provide a "modern bike share system through a network of publicly accessible bicycles."[23] Interestingly, both the Guelph and the Kingston RFPs were short (28 and 31 pages, respectively) and objective oriented rather than solution oriented in their language. In addition, Kingston's RFP asks for a solution that requires little or no financial input from the city, and the IRIS R&D Group contract is $15,000.[24] Accordingly, these two contracts, despite both using RFPs for procurement, are part of a later discussion on challenge-oriented procurement, living labs, and the accompanying financial challenges that companies might encounter.

Turning to qualitative feedback from municipalities, one procurer commented that the long traditional procurement process effectively eliminated small local companies. Two other procurers also raised liquidity as a real issue for startups, both with regard to slow project kickoffs and long municipal pay periods (e.g., policy of payment within 60–90 days). Municipal budgeting, where annual budgets are planned a year in advance, can be difficult to work with for small or pre-revenue companies.

> "We've sort of overcorrected with anti-corruption laws to…favour really giant companies that can tolerate these extremely long procurement processes. And being a small company in that space…we operate in more than 20 cities and we're a total anomaly."
>
> **Tara Pham, Cofounder, Numina[25]**

Similarly, many traditional RFPs have experience-related bidder parameters that preclude new market entrants from participating. Bidder parameters help to clarify which companies are eligible to compete in an RFP process, and depending on the RFP and the applicable trade agreements, they can stipulate requirements related to firm ownership (like location of ownership) or experience level (like the required number of previous projects). Across the RFPs in the dataset, it was common for cities to require bidders and suppliers to provide a minimum of three references from their previous clients—and sometimes specifically public sector references that have used the proposed solution. Other procuring entities required bidders and suppliers to provide evidence of experience or references to other clients and projects (without specifying the type of reference or the number of references). Below are some examples from across Canada.

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[23] City of Kingston, "Supply and Operate a Kingston Community Bike Sharing System," RFP-F31-CS-REEI-2018-02.

[24] City of Guelph, "Civic Accelerator Program," RFP 19-100

[25] "After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?
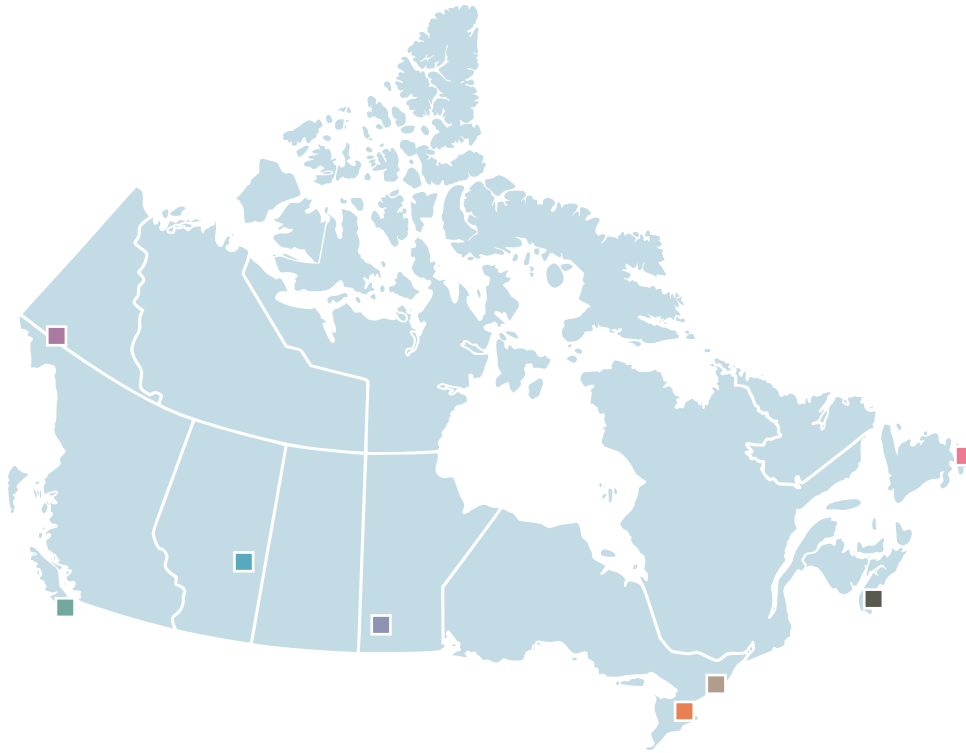
Figure 6. *Sample of cities that required a minimum of three references from bidders in smart cities projects. ICTC, 2020.*

City of Kingston, Ontario Community Bike Sharing System (RFP-F31-CS-REEI-2018-02); Electrical Vehicle Charging Infrastructure (RFP-F31-CS-REEI-2018-04)	*"Appendix B—A minimum of three references, preferably from the municipal or public sector. References shall be of recent projects of a similar scope or magnitude undertaken by the proponent. Each reference will include the name of the client, contact name, address and telephone numbers."*
The City of Whitehorse, Yukon Real-Time Passenger Info Electronic Payments System (RFP 2019-093)	*"The proponent must provide a minimum of three references which represent successful implementation and completed delivery of a system similar to what is requested in this RFP within the past two years."*
The City of Brandon, Manitoba Automated Fare Collection (RFP-108/19)	*"Provide three (3) references of previous clients that currently use the proposed solution. The City reserves the right to contact any references provided. Include scope, budget, and implementation."*
The City of Mount Pearl, Newfoundland and Labrador Digital Asset and Inventory Management Solution (RFP-19-030)	*"The City is open to partners of any size, large and small, and partners that range from well established companies to startups that are able to work toward our vision."* But *"preferably companies who have completed projects and provided services to Canadian clients."*

The Town of Richmond Hill, Ontario	"The evaluation of the respondent firm's experience and qualifications will be based on a minimum of three (3) reference projects completed in the past five years...which demonstrate the respondent firm's relevant experience in successfully delivering projects which are similar in scope, size, and complexity and are specific to the design, supply, and installation of outdoor lighting networks."
Smart Lighting (RFP-44-16)	
City of Victoria, British Columbia	" Provide a minimum of three (3) references from clients that the Proponent has served, particularly referencing projects that the Project Manager and key staff have worked on, highlighting similar previous experiences."
Electric Vehicle Strategy (RFP-20-072)	
City of Leduc, Alberta	"The Proponent must provide a minimum of three references from customers who have contracted with the Proponent for similar services in the past five years. At least one reference from a publicly operated organization is desirable."
Smart Traffic Feasibility Study (AB-2019-04705)	
Town of Bridgewater, Nova Scotia	" Provide three references for any work done by your firm in the past three years that is similar in nature, complexity, and size to the requirements specified in this RFP."
IoT Security Consulting Services (RFP2020-08)	

Traditional RFPs and New and Emerging Technologies

Company size is one aspect that might influence an applicant's ability to find and apply for RFPs: another consideration is the type of solution being offered. While new, small companies and startups might not have the staff, time, or expertise to make bids, emerging technology product offerings encounter a different set of challenges. The following section summarizes insights from former PPP members (on both sides of each partnership) on the challenge of writing a good RFP for a relatively unknown technology or allowing two different product offerings to compete for the same bid.

Emerging technology companies might be "written out" of RFPs or disadvantaged in scoring. RFPs can exclude useful technology solutions either explicitly (by calling for a specific technology) or implicitly (via unintentional narrowing of criteria). One interviewee noted that even when an RFP was written to focus more on outcomes than solutions (to be discussed in a subsequent section), elements of an old or out of date solution could still be inadvertently included in scoring. In this example, an RFP procuring a market research solution might claim technology neutrality but then evaluate proposals on their market research survey questions, not considering that some tools might employ natural language processing and sentiment analysis rather than a public opinion survey.

Some municipalities also find traditional RFPs to be ill-suited to proposals for new technologies: new technology is uncertain and difficult to justify to colleagues and citizens. From the municipal perspective, one interviewee noted traditional procurement that specifically requests a new or emerging technology solution also

has its challenges. There might be fewer qualified applicants, and those companies that do place bids might be less likely to have tested their application. In addition, the competitive bidding process might incentivize companies to make promises that are difficult to deliver on. In this way, cities might consider RFPs for new, less-established technologies to be high-risk, with less opportunity to vet a company's track record and former projects.

Similarly, potential issues with legacy system integration and other unforeseen issues in implementing new technologies might cause difficulties for cities who have made an up-front commitment to purchase an out-of-box solution but end up with a solution that does not function as they had anticipated. For reasons such as this, municipalities might have a hard time measuring and forecasting the tangible benefits resulting from emerging technologies, disincentivizing municipal decision-makers from pursuing projects that are relatively new and unknown.

Siloed procurement efforts from different municipal departments are often incongruent with smart city projects, which often require collaboration between several teams (e.g. IT, data, and business development teams). Smart city projects often entail using a technology to solve a social or business problem, yet if procurement processes originate solely from within IT departments (or any other department for that matter), they may not reflect the original, interconnected business needs of the many departments involved. Similarly, if a procurement process originates from within a department that is relatively cut-off from other departments within the city, the process may perpetuate piecemeal, siloed projects that are a poor use of municipal funds.

Both private and public sector interviewees voiced frustration with interdepartmental silos becoming replicated in the traditional procurement process, precluding the ability to plan and collaborate holistically as a municipality. For joint projects, interdepartmental structures can create "unclear ownership of projects if efforts are split between different business units." Another interviewee noted that even when collaboration does occur, which department pays what amount for the solution might become an issue—for example, if a company is collecting data that is jointly used by waste disposal services, parks and urban spaces, and public engagement teams, joint purchases become complicated.

Companies might need to take on additional burden to educate procurers about their product and help municipalities with adoption readiness. Several private sector interviewees described a lengthy negotiation process of attempting to secure an opportunity, explaining why their product was a good fit despite not quite matching the RFP, and then helping a procurement office adjust their criteria for future procurements. One focus group participant noted that emerging technology companies "are like the preacher in the desert," while another habitually recommended to governments that they hire companies as consultants to map out

a technology adoption strategy and draft an appropriate RFP. "Readiness" work (AI readiness, IoT readiness, or autonomous vehicle readiness) might be needed before a traditional procurement process can even begin.

In fact, a handful of RFPs in this dataset commissioned "readiness" work: for example, Victoria requested consultancy services to help inform an electrical vehicle strategy, while Ottawa acquired educational services to help inform city staff about AI. Readiness work could also include drafting a municipal data strategy, planning for system integration, and addressing infrastructural needs. However, as illustrated in Figure 7, some adoption readiness work may not make it into the traditional procurement process. Traditional procurement might write out iteration and collaboration entirely; or, in cases where municipal departments are open to collaborating prior to the RFP draft, smaller or under-resourced companies might be disproportionately incapable of taking on this additional work.

> "Coming from that tech company perspective, I can say a lot of our job when we sell to cities is actually education."

Tara Pham, Cofounder, Numina[26]

> "When I was in the mayor's office, it was a huge struggle that there was no bureaucratic equivalent to me who was thinking about [technology] issues. There is a definite lack of capacity there…I think we absolutely need people in government who understand how to work with technology. We need amazing technology partners who understand that the work of government is hard and that there are issues they might not have thought about when they first developed their products. [Companies need] to be willing to have a conversation."

Siri Agrell, Former Director of Strategic Initiatives, Office of the Mayor, City of Toronto[27]

Moving Away from Traditional Procurement: New Approaches

The traditional procurement process places the strongest emphasis on the final four stages of procurement, from posting the RFI or RFP to the completion of the contract. This is because many of the kinds of projects most suited to traditional procurement have been done before, meaning the needs are likely to be clear and the appropriate solutions well known. However, when procuring new or leading-edge technology solutions, like is the case with many smart city projects, it is the first three stages that tend to be most crucial. These stages—identifying the need, researching what the market can provide, and selecting the solution or service to be procured—are not as clear cut when it comes to new tech. The need may be entirely new (such as

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[26] "After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?tab=panel-transcript

[27] "After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?

requing an IoT solution to support data collection), and even where the need is not entirely new, the solution may be brand new or in some cases not yet exist. In many of these cases, new procurement processes that emphasize the first three stages more significantly are needed. The next section provides further insight into new approaches to procurement that help address these needs.
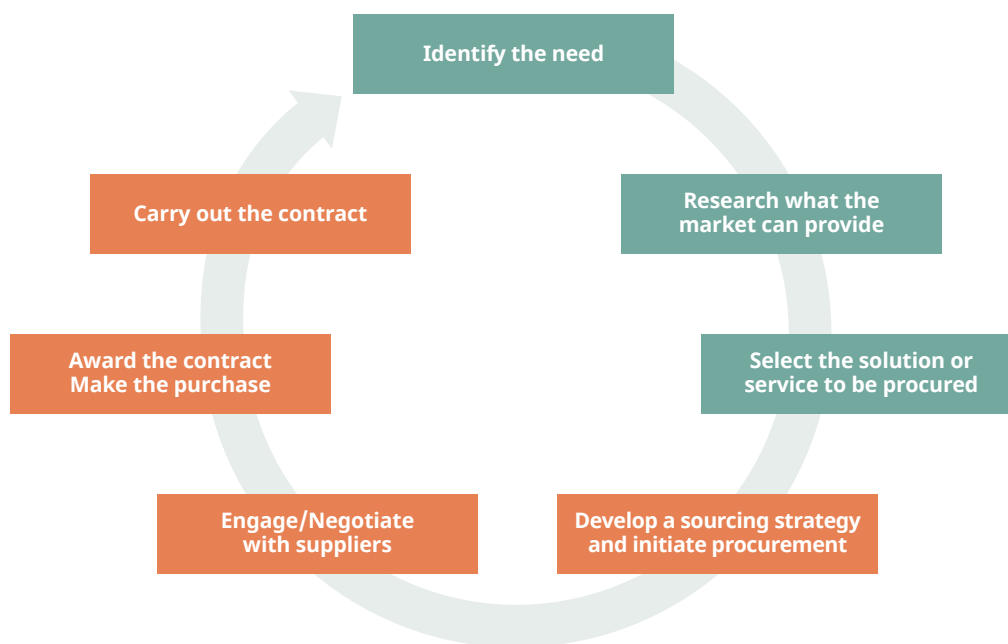
Figure 7. Traditional procurement places the strongest emphasis on the final four stages of the procurement process, from posting the RFI or RFP to the completion of the contract. ICTC, 2020. Adapted from Davis, 2010 and Blood-Rojas, 2017.

ORGANIZATIONS AND EVENTS FOR EDUCATION, COLLABORATION, AND ADOPTION-READINESS

In response to the challenges raised by traditional procurement, several organizations have taken on the challenge of facilitating public-private conversations to help slowly pave the way for broader adoption of smart cities technologies. Industry associations, civil society organizations, and other types of collaborations have worked together to share knowledge about technology adoption, prepare cities for procurement, and advocate for their members. Similarly, events allow cities to learn from each other's projects and adjust RFPs accordingly.

Even when companies and industries are pursuing formal RFPs, relationship building is key to forming partnerships, raising awareness of a particular technology (so that traditional RFPs are written better in the future) and bridging siloes between different sectors, departments, and technologies. Networking and relationship-building events allow technologists to collaborate, cities to compare notes, and all parties to form partnerships that work for them.

"What we're doing today is quite different from what we were doing even 10 years ago, where you could work in a siloed technology and have predefined solutions, and businesses would just have to accept that. Now, it's more user driven or client defined, but the client doesn't necessarily know what the technology is capable of." — Raj Thukral, Head of Engineering at APXData Inc.

TRADITIONAL PROCUREMENT: IN SUM

- Traditional procurement is an established form of procurement involving a solution-based RFP, RFI, or RFQ, to which the private sector responds with bids. It aims for transparency, competitiveness, and low risk for the procurer (respecting public funds and guaranteed ROI)

- Traditional procurement offers some challenges for smart cities technology companies

- New and small companies may not have the staff, time, or expertise to seek out, identify, and apply for appropriate RFPs. In contrast, some larger competitors may have staff dedicated to finding procurement opportunities

- Siloed municipal bids and tender websites, or those behind paywalls, add further to RFP inaccessibility for small companies. Other communication forms, such as working with regional accelerators or institutes, can help municipalities attract smaller companies

- Emerging technologies might also be disadvantaged in some RFPs. They may be "written out" if a more established solution is requested

- Cities might consider emerging technologies as high risk if companies are incentivized to make big promises, lack previous experiences, or have products that are difficult for municipalities to evaluate

- Emerging technology companies often take on a role of educating public sector partners about their solution

CHALLENGE-BASED PROCUREMENT

"What some of the big organizations that we're dealing with now are looking for [is] to focus on an opportunity, a problem or an outcome, and then invite the technology and data streams that are required, working backwards to make the most efficient, effective, creative tech procurement decisions. To look at the vast array of technology available for procurement at the moment is really daunting for anybody. Challenges that incorporate paid demonstration projects are a great way for even cities to discover how they can be more impactful with what's coming, what's possible."

Myrna Bittner, CEO, RUNWITHIT Synthetics

"Governments and tech companies move at different paces. We need people in government who understand how to work with tech, and tech partners who understand the challenges and nuances of policymaking. We also need better procurement processes that articulate the problem being solved rather than prescribing the solution."

Canadian Urban Institute[28]

As discussed in the previous section, traditional procurement (where a public sector organization knows what solution it wants and issues an RFP) poses several challenges for small companies, startups, and emerging technology companies. These challenges include accessibility (finding and knowing about RFPs if they are in siloed postings), resources (competing with companies that might have departments dedicated to responding to RFPs), experience (winning a first or second contract as a startup company), and knowledge (cities writing RFPs that exclude emerging technologies).

Challenge-based procurement identifies a problem or pain-point that the public sector is encountering and encourages applicants to respond. In the example of a city trying to improve energy efficiency, question three best embodies the approach taken by challenge-based procurement.

1   Who is best suited to conduct an LED retrofit to our specifications?

2   Could an LED retrofit come with "smart lighting" features to further improve energy efficiency?

3   **What type of energy efficiency solution would provide the best return on investment?** (Problem: how do we most affordably make our building more energy efficient?)

4   Can we create an energy efficient building and support local innovators at the same time?

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[28] "After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?

By its nature, challenge-based procurement best addresses the problem of **knowledge,** where procurement offices eliminate emerging technologies due to a lack of familiarity. If a city is not aware of certain technologies that could help solve a problem, then challenge-based procurement avoids writing those technologies out of the RFP process by choosing not to address the required "solution." In this way, challenge-based procurement is often more friendly to emerging technology companies than traditional procurement.

PRO: Challenge-based RFPs allow emerging technology companies to offer solutions that procurers might not know about or understand.

CON: Procurers may have a difficult time evaluating proposals for technologies they do not fully understand, or fairly and impartially comparing proposals for radically different solutions.

The challenge of understanding the technology being proposed and comparing it to others can be fixed by consulting third-party expertise, building internal capacity, and developing standard evaluation criteria that don't rely on a standard technology (e.g., references, climate friendliness, or job creation). This might add cost for a municipality. In addition, "pre-procurement" (discussed in the next section) is one way for cities to test out a solution for effectiveness before they commit to purchasing it.

> "I think the responsibility does lie with government to articulate what the problems are they're trying to solve because I think that a lot of tech people are guessing. But fundamentally, a lot of the issues are below the surface. [Government is not] very good at explaining that 'this is the problem we're having that we need to fix.' I think now is a great opportunity. And governments are starting to do that."

> **Siri Agrell, Former Director of Strategic Initiatives, Office of the Mayor, City of Toronto[29]**

However, challenge-based procurement still faces several of the same challenges that traditional procurement does (accessibility, resources, and experience, as discussed above) that might disadvantage small companies and startups. For example, a city might still want an emerging technology to provide a certain number of references to demonstrate that they have successfully delivered their product or service in the past, and this type of policy is both understandable from the municipal perspective and poses a challenge for startups trying to win their first contract. In addition, challenge-based procurement might still be posted in a siloed bids-and-tenders site, or involve a long and complex process that some startups may not have the expertise to navigate. To overcome this issue, several cities that opt for challenge-based procurement adopt other practices to help disseminate their RFPs more widely, connect with new companies, and encourage applications from startups.

[29] *"After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?tab=panel-transcript*

Challenge-Based Procurement: Case Studies

Digital Mount Pearl: Mount Pearl, NL

The City of Mount Pearl began using challenge-based procurement in 2019 when it launched a broad, challenged-based RFP (19-030) under the Digital Mount Pearl smart city initiative.[30] The single RFP for "various IT systems" described in detail the many challenges experienced by city departments, including the Corporate Services, Human Resource Management and Payroll, Financial Management, Infrastructure and Public Works, Community Development, and Customer Service Departments. To date, the RFP has resulted in several smart government projects, including software to update its approaches to asset and human resource management. Unlike with traditional RFPs, the City adopted a highly open approach, explicitly highlighting its openness to adapting the way it does business (based on the solutions provided), and welcoming "partners of all sizes...that range from well established companies to startups."

The Civic Accelerator Program: Guelph, ON

The Guelph Civic Accelerator Program began in 2016 with two main goals: re-orienting the procurement process to focus on city challenges in place of solutions; and making the city's resources available to companies in order to co-experiment, co-prototype, and co-create potential solutions. Despite using an RFP, the procurement process under the Accelerator Program is in no way traditional. Instead, it involves a prolonged problem definition phase, with a dedicated team to assist departments in defining problems, in addition to a prolonged solution identification and development phase led by a close partnership between the company and the city. This close partnership between the company and the city is what sets the Guelph Civic Accelerator Program apart from other approaches to challenge-based procurement where the company alone identifies, develops, and provides the solution.[31]

The Municipal Innovation Exchange Challenge: ON

The Municipal Innovation Exchange (MIX), inspired by previous work at the MaRS Discovery District and in the City of Guelph, is an approach to challenge-based procurement that seeks to generate increased spill-over effects for the local area. The program is coordinated between three cities: Guelph, London, and Barrie. Each pursues its own independent challenge-based procurement processes and then shares the resulting solutions, valuable insights, best practices, and lessons learned.[32]

Many of the municipalities engaging in challenge-based procurement for smart cities, such as those discussed in the above case studies, are using their experiences as learning opportunities. Across Canada, a wide variety of organizations are trialling novel procurement mechanisms, assessing their strengths and weaknesses, and developing standards for assessment and performance metrics.[33] In addition, other types of processes added on to challenge-based procurement, including "pre-procurement" mechanisms (as will be discussed in the subsequent section) that can help mitigate some of the problems of challenge-based procurement.

[30] "Digital Mount Pearl," 2020, City of Mount Pearl," https://www.mountpearl.ca/government/digital-mount-pearl/
[31] Cassie Caitlin, "The Civic Accelerator: A Guelph Experiment," June 1, 2017, http://brookfieldinstitute.ca/report/the-civic-accelerator-a-guelph-experiment/
[32] "Municipal Innovation Exchange," October 16, 2020, City of Guelph, https://guelph.ca/city-hall/open-government/municipal-innovation-exchange-mix/
[33] Rachel Bloom, et al., "Open Smart Cities in Canada: Assessment Report," April 2018, Open North and Carleton University

CHALLENGE-BASED PROCUREMENT: IN SUM

- Challenge-based procurement provides an outcome, rather than a solution, for companies to design bids for

- Unlike traditional procurement, challenge-based procurement is less likely to exclude emerging technology solutions

- Nevertheless, experience requirements, lengthy and siloed RFP processes, and other challenges are still associated with challenge-based procurement

- Cities might encounter difficulties in evaluating and fairly comparing proposals if they are not familiar with the proposed technologies

- Cities across Canada are adopting novel approaches to challenge-based procurement and studying outcomes

- Some cities are making challenge-based procurement more accessible to small companies and startups through innovative practices like "pre-procurement," to be discussed in the next section

INNOVATIVE PRE-PROCUREMENT: ADDRESSING COMMON CHALLENGES

As discussed in the previous section, challenge-based procurement can solve one common problem that traditional procurement might encounter: a municipality's lack of knowledge of emerging and applicable technologies. By offering an open competition that identifies a challenge or outcome rather than a solution, the field of play is opened to many smart city technology companies that might otherwise be "written out" of the procurement process. Nevertheless, challenge-based procurement comes with a twin challenge for public procurers: how do they evaluate proposals for technologies that they are not familiar with, or fairly compare solutions that offer different tools and metrics for success? Innovative "pre-procurement," such as pilot projects and living labs, go some way toward solving this problem by "de-risking" complex technology purchases.[34] By allowing an emerging technology company to trial its product in an urban space before moving to contracting, municipalities get a chance to "try before they buy," as one interviewee put it. In our example of a municipality seeking to improve its energy efficiency, a city running a pilot program or living lab might ask question number 4:

1 Who is best suited to conduct an LED retrofit to our specifications?

2 Could an LED retrofit come with "smart lighting" features to further improve energy efficiency?

3 What type of energy efficiency solution would provide the best return on investment?

4 **Can we create an energy efficient building and support local innovators at the same time?**

Unlike challenge-based procurement, innovative pre-procurement practices often precede the use of traditional RFPs or negate them altogether. For example, living lab approaches rely on less formal partnerships and more on mutually understood arrangements, including small grant programs, in-kind contributions, and Memorandums of Understanding (MOUs), which give project partners more flexibility and the freedom to experiment early on without long-term financial commitments. In the study's collection and investigation of RFPs, 59% specified a contract length of a year or more, while 33% specified three years or more. Contracts of this length represent a significant commitment on the part of the procuring organization (e.g., the municipality, city, district, etc.), with respect to time and financial resources.

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[34] Caitlin Cassie, "The Guelph Civic Accelerator: A Public Procurement Experiment Case Study," May 2017, Brookfield Institute, https://brookfieldinstitute.ca/wp-content/uploads/GuelphCivicAccelerator_CasesStudyReport_BrookfieldInstitute.pdf

At the same time, these other, informal approaches to smart city projects are more heavily focused on the earlier stages of the procurement process, as outlined in the sections above. In many ways, the informal partnership agreements are how the city goes about identifying their needs, researching what the market can provide, and selecting the service to eventually be procured. For example, in cases where the required smart cities solutions have not yet been developed, cities can work with companies during the research and development (R&D) and refinement process, providing access to the relevant datasets, municipal infrastructure, and/or other city-owned resources. With R&D projects, cities may negotiate some stake in the project or get something in return, such as early-access to the technology once its developed or licence rights to the resulting IP. Conversely, in cases where the smart city solution has already been developed but the business case for the city has not yet been made, pilot projects or other short-term agreements can give partners the opportunity to test out the new technology, assess the potential return-on-investment, and receive feedback from local residents.

This remainder of this section provides a case-study analysis of several innovative approaches to pre-procurement that are in use across Canada. Importantly, innovative pre-procurement also comes with its own set of challenges around IP and data ownership, the social impact of using a city as a "lab," and the potential for companies to incur costs with no guarantee of a formal partnership, all of which will be discussed in the second half of this study.

Pre-Procurement Case Studies

Innovation Pilot Program in the City of Ottawa

The City of Ottawa's Innovation Pilot Program began in 2016 with the goal of "finding and experimenting with new and innovative approaches to delivering city services."[35] Since then, it has enabled a wide variety of smart city pilots, including smart government solutions, specialized infrastructure solutions (e.g., for people with visual impairments), and more recently, unique solutions aimed at solving new challenges related to COVID-19.[36] The programs begin with a call for technology solutions in response to an identified city challenge: a recent example is "technology innovations that will accelerate Ottawa's ability to get the workforce back to work and safely resume business operations."[37] The caveat is that the call is only open to companies with technologies that are trials ready and not available elsewhere on the market (or where limited substitutions exist). The upside for these companies is that, despite not receiving any financial compensation, they are provided "a real-life testing environment" and an opportunity to receive valuable feedback from the city and the public.

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[35] "City announces eight projects for municipal innovation pilot program," June 22, 2016, Ottawa Business Journal, https://www.obj.ca/article/city-announces-eight-projects-municipal-innovation-pilot-program

[36] 'City selects pilot projects to support Ottawa's economic recovery," July 15, 2020, City of Ottawa, https://ottawa.ca/en/news/city-selects-pilot-projects-support-ottawas-economic-recovery

[37] "https://ottawa.ca/en/business/get-help-starting-or-growing-your-business/programs-and-projects/innovation-pilot-program

Mount Pearl: Walking Before We Run with Pilot Projects

While larger cities like the City of Ottawa may have formal programs to guide their use of pilot projects, many other cities run pilots on a more ad-hoc basis. The City of Mount Pearl, for example, "calls" for pilot proposals simply by letting businesses know that they're open to new ideas: "At the City of Mount Pearl, our two favourite words are 'Pilot Projects.' ...We are open to using pilots wherever possible, aligning with our digital transformation vision, of course."[38] To date, the city has partnered with several local companies based in Newfoundland and Labrador to incorporate new technology solutions into recycling, trail and activity maintenance, waste management, road usage, and more.

Summerside's Living Lab

The City of Summerside defines its Living Lab as "a real-life test and experimentation environment where users and producers co-create innovations."[39] It seeks to encourage research, development, innovation, and commercialization through the following principles and activities: "**Co-Creation:** co-design by users and producers; **Exploration:** discovering emerging usages, behaviours and market opportunities; **Experimentation:** implementing live scenarios within communities of users; and **Evaluation:** assessment of concepts, products and services according to socio-ergonomic, socio-cognitive and socio-economic criteria."[40] A core aspect of Summerside's Living Lab is what both parties—the public and private sector—can bring to the table. The City offers access to virtual and physical assets that innovators need to develop, deploy, and test solutions. In return, the City (and its residents) gets access to leading edge solutions for their infrastructure and service delivery challenges.[41] Within this broad partnership framework, there is substantial room for variation: partnerships may be informal, relying primarily on MOUs, in-kind contributions, and shared learning outcomes. Depending on the public sector partner, they may also involve co-ownership in the resulting IP or shared equity in the project's deliverables.

Living Labs in Calgary

The City of Calgary's living lab offers "city infrastructure for companies, researchers and individuals to test and try ideas and products in a real-life environment."[42] The city has offered land for drone flight areas, provided venues for augmented reality demonstrations, opened its botanical gardens to IoT agricultural centres, and run autonomous vehicle pilots. Unlike Summerside, however, the City of Calgary's Living Labs program features a formal application process with a standardized intake form, requiring companies to identify the asset they wish to utilize, the risks associated with the project, and alignment with Calgary's economic development goals.[43]

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[38] *"Digital Mount Pearl," 2020, City of Mount Pearl," https://www.mountpearl.ca/government/digital-mount-pearl/*
[39] *"Digital Mount Pearl," 2020, City of Mount Pearl," https://www.mountpearl.ca/government/digital-mount-pearl/*
[40] *"Digital Mount Pearl," 2020, City of Mount Pearl," https://www.mountpearl.ca/government/digital-mount-pearl/*
[41] *"Living Lab," 2020, City of Summerside Economic Development Department, http://www.bigpossibilities.ca/living-lab*
[42] *"Living Labs," City of Calgary, 2020, https://www.calgary.ca/general/living-labs/living-labs.html*
[43] *Ibid.*

Evidently, there is a high degree of variation across the many innovation approaches to procurement and pre-procurement that can be found across Canada. Specifically, the case studies provided differ in two interconnected ways: how market-ready the smart city solution is at the start of the PPP and the degree of involvement on the part of the city in the development of the smart city solutions. Perhaps unsurprisingly, these two characteristics are intertwined. If a smart city solution is not yet fully developed or market ready by the time the public sector gets involved in the project, the city has more opportunity to contribute toward its development. Likewise, if the solution is "ready to go" by the time the public sector gets involved, the private sector partner may only need an opportunity to test the solution in a real-world environment. Figure 8 depicts the placement of some of the case studies discussed in this paper along those two continuums, incorporating some of the challenge-based procurement examples previously discussed.

Degree of involvement on the part of the city in solution development
Degree of market readiness of the solution
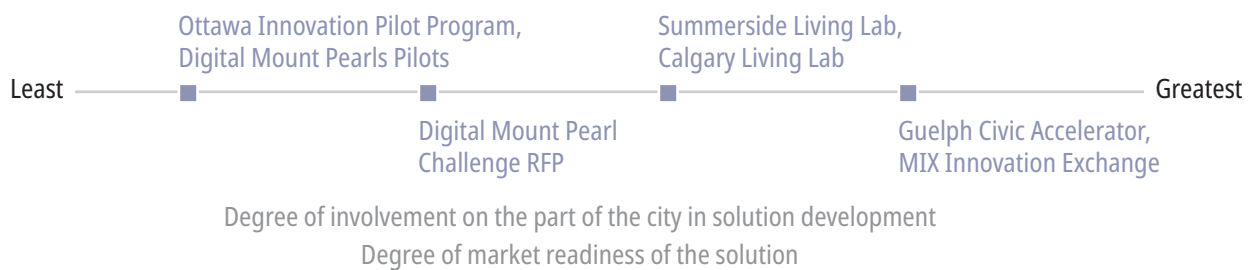
Figure 8. *Case studies vary with respect to many variables, including how involved the city is in developing solutions and how market ready the relevant solutions are.*

INNOVATIVE PRE-PROCUREMENT: IN SUM

- Innovative pre-procurement involves a partnership prior to a contract, with varying degrees of formality. Examples include accelerators, "living labs," or MOUs. Cities often provide support and municipal resources, short of significant financial investments, to support startup emerging technology companies

- Innovative pre-procurement allows cities to "try before they buy," reducing the risk associated with a city procuring an unknown emerging technology solution

- In addition, startups are provided with an opportunity to leverage some resources for R&D to make their product adoption ready and capable of winning over a potential client

- Nevertheless, pre-procurement might be risky for a startup company if financial liquidity is a must-have, as these systems do not always guarantee a financial return

NON-COMPETITIVE PROCUREMENT

In addition to traditional procurement, challenge-based procurement and innovative pre-procurement, many smart cities projects go through a "sole source" process. This can happen in several ways:

Companies that have undergone "pre-procurement" (such as a pilot program) might be able to scale up and secure a contract with a municipality without having to undergo a competitive process. For example, one focus group member discussed participating in a pilot program that moved directly to a larger contract. In addition, one municipal interviewee noted that it would work closely with "living lab" participants to build needed services and then move into a formal partnership.

A larger project might be broken into several pilot projects to avoid the RFP process. One private sector respondent commented that if a city and a company wanted to bypass traditional RFPs, they might be able to break a larger project up into several pilot projects to ensure that each falls under the dollar limit for sole-source procurement. The same interviewee commented that this was usually the case if there was an internal proponent at the city who knew the company, was sure the city wanted the company's offering, and wanted to skip directly to contracting.

A small sole-source contract might include other ways for a company to make money. While the living labs process offers city resources to small companies growing their application, larger companies can take advantage of a similar type of partnership. An interviewee who previously worked in the public sector noted the example of a large Canadian city hiring a payment system that, while free to install, would have given the company a percentage of each transaction.

Sole-source procurement might be justified in a case where a company's product offering is highly unique. Some regulations allow cities to pursue sole-source procurement when a company offers a solution that nobody else can. Accordingly, smart cities and emerging technology companies are sometimes able to use their unique IP to secure contracts.

Smart city technology companies might be subcontracted by a company who originally won an RFP. For example, one interviewee noted that their company had formed partnerships with larger utility technology companies and now worked on projects with the larger company's municipal projects.

PROVINCIAL AND FEDERAL FUNDING PROGRAMS

Finally, outside of the aforementioned approaches to smart city RFPs and pre-procurement partnerships, there are also countless provincial and federal funding programs that are relevant for smart city projects. These programs vary widely with respect to the funding entity (e.g., various government departments, crown corporations), funding recipient (e.g., academic, private sector, and/or public organization; province or municipality), grant purpose (e.g., economic development, carbon reduction, infrastructure modernization), type of funding arrangement (e.g., grant, loan, etc.), and range of covered expenses (e.g., all expenses, just R&D expenses, etc.). Though some are better known or widely used than others, the number of funding programs that have supported smart city-type projects in Canada is truly vast. Within the federal government alone, ICTC identified more than 25 funding programs that have supported smart city projects at some point over the last four years. Across these projects, the federal contribution ranged from $5,000 to $451,694,410.

Though these funds benefit cities of all sizes, including large cities like Calgary, Toronto, and Montreal, it is clear that many smaller cities without the earmarked funds from innovation rely heavily on grant programs to pursue smart cities projects. This is evident in the funding program dataset but was also reiterated by interviewees from smaller and more remote cities of approximately 10,000–15,000 in size. More than one interviewee noted that one of the largest barriers for smart city developments is budget limitations, which has many municipality relying heavily on grants to fund the projects.

> "For a lot of smart city projects, what actually works is when departments are willing to put in resources and have skin in the game. When government works with companies, it's very easy to say, 'Come work with us!' But if there's no real opportunity at the end for companies, then cities are essentially wasting their time. The MIX program was fortunate to have [provincial] funding because it allowed the cities to allocate some initial funding for the startup to collaborate with them and explore a future purchase."
>
> **Karen Gomez, Smart Cities Consultant**

Interestingly, interviewees from smaller companies and startups also expressed the importance of grants and other funding programs for smart city work. Others highlighted important differences between certain Canada and US-based funding programs.

"Programs from the federal government, such as SRED and IRAP, focus on commercialization and how governments can use procurement to help commercialize innovative technology. In the US, it's a slightly different approach, where the cities say, 'These are the technologies we would like to have' or 'This is what I'm looking for." And then companies bid to provide that. The advantage with the US approach is that a lot of the private sector works hard to provide the public sector with what they want, but it lacks that spark of the private sector developing what the public sector never knew it wanted. I like that in Canada."

Kenton White, Chief Scientist, Advanced Symbolics

Importantly, several stakeholders noted that these funding programs were more important than ever during the COVID-19 pandemic of 2020, as municipal budgets were strained by a reduction of revenue (from sources such as public transit, parking, and increased costs).
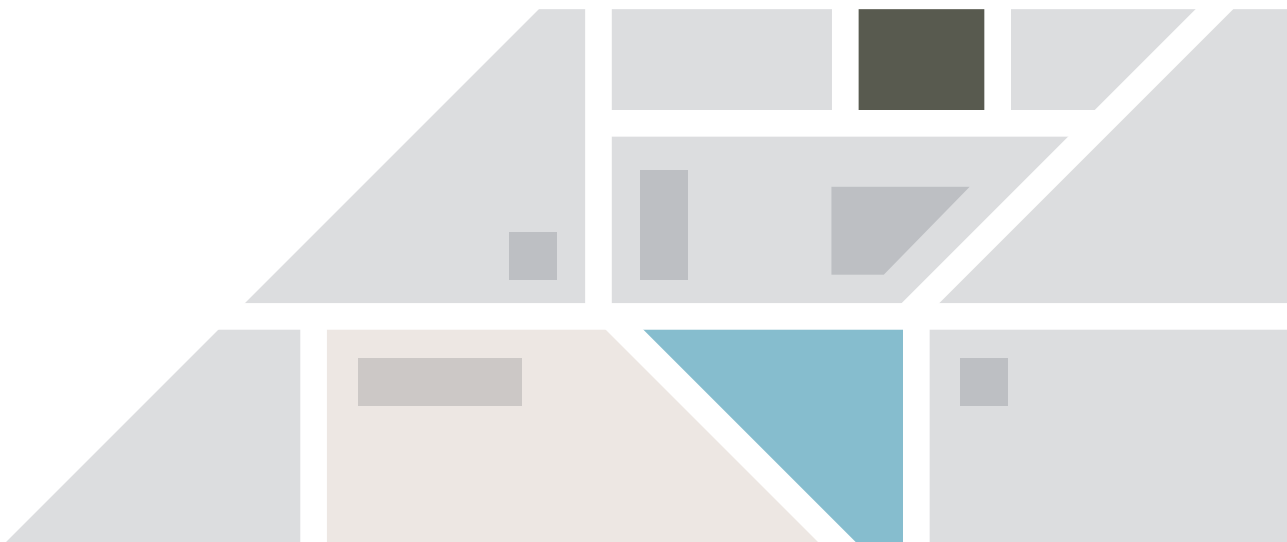
"In essence, the Civic Accelerator turned the city into a research and development lab for civic tech companies."

City of Guelph[44]

SECTION TWO
CITY AS LAB: INTEGRATING DATA GOVERNANCE, IP, AND SOCIAL IMPACT INTO PROCUREMENT

In the first section of this paper, we discussed traditional procurement, challenge-based procurement, innovative pre-procurement, and other solutions for companies trying to enter partnerships (including grant programs and sole-source procurement). Smart cities procurement has its fair share of challenges: the graphic below illustrates that there is no perfect form of procurement for all stakeholders in the smart city ecosystem. Competitiveness and transparency result in accessibility challenges for new and innovative companies. Signing a contract to procure an emerging technology might be risky for a city unfamiliar with the solution while signing an in-kind MOU for R&D in an urban space might leave a small company without the financing to scale up. Federal and provincial funding programs can play some role in filling this gap, by helping cities finance the companies working in their spaces.

44 *"Municipal Innovation Exchange (MIX)," October 16, 2020, City of Guelph, https://guelph.ca/city-hall/open-government/municipal-innovation-ex-change-mix/*

INTENTIONS OF PROCUREMENT MECHANISMS	Competitiveness & Transparency	Accessibility for Emerging Tech Companies	Accessibility for Startup Companies	Low Financial/ Political Risk for Procurer	Low Financial Risk for Proponent
Traditional Procurement (proven solutions)					
Traditional Procurement (novel solutions)		In select cases (if soliciting an emerging technology)		In select cases[45]	
Challenge-based Procurement					
Innovative Pre-procurement: in-kind contributions	In select cases (e.g., competitive pilot program)				
Innovative Pre-procurement funded by provincial or federal program	In select cases (e.g., published grant competitions)				
Sole-source procurement			In select cases		

In this section, we discuss several key components of each of these procurement forms that have not yet been discussed: IP, data ownership and governance, and social impact statements contained in RFPs and contracts. This section is informed by RFP document analysis (see Appendix) as well as interviews with companies and municipalities.

While innovative pre-procurement, or grant funding for small R&D projects, promises a learning opportunity for all parties, even these mechanisms come with challenges. The "smart city" concept as a whole embraces the idea of "city as laboratory" in many ways (even a traditional procurement process might involve experimental data collection). Most smart city technology PPPs, by their nature, involve discussions of IP (for example, a company's proprietary program) and/or the collection of citizen data.

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[45] For example, interviewees spoke about the risks inherent in procuring leading edge tech without the necessary technical experience that is needed to do so. One interviewee provided a telling example of a project that their department had undertaken, where the delivered solution was not what city staff expected it would be, yet the associated RFP was also not technical, nor detailed, enough to have requested the features they wanted. They were left with a solution that did not meet their needs, despite having spent a significant portion of their budget.

In part because of this, cities might be more or less involved in a smart city project, desiring to build internal capacity or retain control over some component of a contract. In addition, smart cities technology projects might include social and ethical parameters, requirements to hold consultations with the public, or other stipulations designed to forestall negative impacts from urban experimentation.

INTELLECTUAL PROPERTY AND DATA COLLECTION: PRIOR, DURING, AND AFTER PPPS

> "Coming from that tech company perspective, I can say a lot of our job when we sell to cities is actually education. Many of the cities that we work with, especially smaller cities, which maybe don't have data, dedicated data, scientists on staff or technologists... they're actually looking to us for answers about our best practice practices and privacy."
>
> **Tara Pham, Cofounder, Numina**[46]

The intangible economy—sometimes referred to as the *knowledge economy*—is the share of an economy based on the production, ownership, and sale of intangible assets, such as data and IP. Over the last 30 years, with the rise of Information and Communications Technology (ICT) and other sectors that rely heavily on science and knowledge-based innovations, the overall importance of the intangible economy has risen for all businesses and public sector organizations.[47]

Companies and cities might come to a partnership, each with their own pre-existing intangible assets, IP, software, hardware, and institutional knowledge. In addition, new IP might be created during a partnership, particularly when a company is contracted by a city to design a new system rather than provide a pre-existing system. Finally, data might be collected during the process. These three categories are not always mutually exclusive: for example, if a company is offering a machine learning solution, data collected throughout the course of a project might be used to train and therefore become part of their model. Questions of IP and data ownership might be clear-cut or highly complex, and stakeholders with varying levels of experience will need to deal with them appropriately.

[46] *"After Sidewalk, What is the Future of Smart Tech for Canadian Cities," May 11, 2020, Canadian Urban Institute, https://canurb.org/citytalk-news/cities-in-the-time-of-covid-19-after-sidewalk-what-is-the-future-of-smart-tech-for-canadian-cities/?*

[47] *Alexandra Cutean et al., "Bolstering Growth: The Next Frontier for Canadian Startups," ICTC, 2020, https://medium.com/digitalthinktankictc/bolstering-growth-44707bb09bb0*

DATA AND INTELLECTUAL PROPERTY CASE STUDY: MONTRÉAL

The city of Montréal is partnered with smart city accelerator InnoCité MTL, a program that supports emerging technology startups through their testing phases. In an Open North case study of this work, the authors comment upon several challenges inherent in smart city PPPs, including siloed data management, procurement of software rights, and municipalities' reasons for wanting detailed data from partnered companies

"Requests for Tenders (RFTs) by the municipality often include specific requirements that do not easily align with existing software services. Montréal's smart city accelerator, InnoCité, addresses this issue by making the software lightweight and by implementing a Software as a Service (SaaS) model. While these solutions are innovative, the city organization is still working out how to negotiate conditions in user agreements to enable municipal staff to exert complete control over the data generated by outsourced systems and to ensure that these can be archived for the future. Montréal is also working to change requirements in building permit contracts, which will require that builders disclose detailed data related to traffic construction and closures. Disclosing detailed geospatial information about traffic closures and construction helps city government improve mobility, which is a key goal set forth by the Montréal Smart and Digital City Strategy. Central IT's call for tender template does not standardize language about access to data, formats, standards, and privacy. Instead, each borough determines what is in their best interest and they structure their own RFT templates. The budget for the smart city projects is decentralized and sources of funding for projects are specified in the smart city action plan."[48]

Intellectual Property

Conversations about IP ownership span all types of PPPs, including all discussed forms of smart cities technology procurement. With regard to traditional and challenge-based RFPs, for example, just over half of the RFPs collected for analysis in this study had a relevant IP statement recorded, though many RFPs made no mention of IP ownership.

For those RFPs that did discuss IP, most procurers (municipalities) claimed immediate ownership of all IP, data, and other products created in the process of the contract. That said, even among these, most cities were conscious that pre-existing IP (or background IP) belonging to the contractor should remain the property of the contractor, and included this as a provision. Other RFPs, such as the Civic Accelerator Program in Guelph, explicitly gave all IP to the contractor.

Some cities had standard IP and data clauses across multiple projects. For example, the City of Brandon's RFPs all included data provisions such as a requirement to locate all data hosting and cloud equipment in Canada. Similarly, the City of Kingston used a broad clause for multiple smart city projects, which stated that the "title and IP interest to the work described in [the] RFP and any part thereof vests in the City upon delivery and acceptance thereof by or on behalf of the City."

In interviews with municipal workers, two respondents suggested that using one IP statement across the board might reflect a lack of affordable legal aid. In other words, if a city is not able to design distinct IP agreements on a contract-by-contract basis, it may use one IP statement that has been cleared for all of its procurements. Understandably, not all municipal procurement departments have the in-house legal

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[48] Tracey Lauriault, Rachel Bloom, Carly Livingstone, and Jean-Noé Landry, "Open Smart Cities in Canada: Environmental Scan and Case Studies," April 2018, Open North, https://osf.io/preprints/socarxiv/e4fs8/

expertise to navigate the complex field of IP law. On the other hand, cities with more funding reported having an experienced lawyer regularly draft clauses related to data and IP in RFPs and contracts.

Interestingly, one interviewee from a "living lab" municipality noted that they made decisions about IP ownership on a case-by-case basis:

> "We could share the IP with the company 50/50, we could give all of the IP to the company but share in the net profit, sometimes we might not try to keep any of the IP at all, especially if we have no plans or no way to do anything with it. If we don't have the engine to drive it, grow it, and push the sales, there is no point for us, and there is no point in taking the IP away from the company. That's the type of discussion we get into with each contract and we're very flexible."

Anonymous Interviewee, Municipality

In the table below, several different examples of IP clauses are provided. When retaining IP from the arrangement, some cities make explicit and additional provisions for cloud-based solutions.

Complete contractor ownership	Guelph: Civic Accelerator Program	"The contractor owns all IP with a licence provided to the city for the duration of the agreement with an option to request a service licence post-contract completion." RFP 19-100
Provision of alternatives	University of Saskatchewan: E-Tendering System	"The Supplier shall grant USask a licence OR the right to use all intellectual and other property including engineering or architectural drawings and/or software provided or developed in the performance of the Work under this Contract." RFP-CP-216652
Complete City Ownership of IP created during project	District of North Vancouver Network of Seismic Sensors	"District owns all of the IP that comes out of the project without payment by the District therefore (apart from the contract amount). Contractor shall ensure this is the case at no extra cost." RFP.054.18
Complete City Ownership of IP created during project: physical and cloud alternatives	Whitehorse: Real-Time Passenger Info & Electronic Payments System	"The City prefers an on-premise solution that is installed and configured to run in the City's server environment. However, if the solution being proposed is cloud-hosted, the City requires that the solution will allow the City to retain ownership of all data created, including all existing and current personal customer, staff and membership information, modified or managed through the use of the system." RFP 2019-093

From the proponent or company perspective, most interviewees noted that they desired to retain ownership over anything they create. Particularly for smaller companies, IP was seen as an integral part of developing and scaling their product; as such, they would avoid any project that requested that they forfeit the rights to their solutions. One interviewee noted that requests to retain IP was sometimes based on a misunderstanding at the municipal level: if a municipality wanted access to de-identified data collected, the interviewee had no problem providing it, but this was often mixed in with a request for the company's proprietary software or code. In other words, some companies were happy to provide software-as-a-service and any data collected during a project but unwilling to provide a copy of a program on a city's server in perpetuity.

INTELLECTUAL PROPERTY IN SMART CITIES PROCUREMENT: IN SUM

- Not all RFPs address IP, which might lead to mid-project ambiguity

- Cities may or may not have internal capacity to draft appropriate IP statements. Some re-use statements for all procurements; others have access to legal aid

- In general, companies are able to retain IP that existed before a project's launch but are asked to forfeit IP for products developed as part of a PPP

- In general, companies will avoid RFPs that ask them to forfeit rights to their pre-existing products or services

- Some companies prefer SaaS arrangements to retain the use of their software. Some cities prefer local installation and eventual municipal control

Data Collected During the Course of a Project

When considering data ownership provisions, it is important to remember the wide range of potential data being collected during smart cities projects. Data could mean a single, low-power sensor registering "on" and "off" in a parking space. Alternatively, it could mean data attached to names, faces, or other identifying information prior to aggregation and de-identification. Many of the projects examined in this study's RFP dataset fall somewhere in between: for example, real-time tracking of public transit vehicles may or may not be identifying (depending on the solution) but could nevertheless be sensitive.

Over half of the RFPs analyzed (54%) provided no comment on data ownership or management.[49] A further 30.4% claimed data ownership for the city, while the remainder either granted data to the proponent or were unclear. While many RFPs indicate the need to comply with federal and provincial privacy legislation, such as FIOPPA, FIPPA, or PIPEDA, some RFPs also include unique, additional considerations related to data and data privacy.

High-Level Questions

Some RFPs included simple, high-level questions for proponents, such as those posed to suppliers by the University of Saskatchewan:

> "How data is handled and stored? Where the system stores data and how it supports USask obligations in this regard? How data is transferred pre- and post-contract (data migration)?"
>
> **(RFP-CP-216652)**

Similarly, the City of Kingston asked suppliers to detail the use of personal data in their business models:

> "Please describe the specifics of your proposed community bike sharing system and proposed business model(s) including but not limited to: Aggregated user data to be captured and shared with the City."
>
> **(RFP-F31-CS-REEI-2018-02)**

Clarifications

Some data-related statements sought to clarify data ownership under various conditions, such as the aforementioned clarification provided by the City of Whitehorse in their smart city RFP about the use of cloud storage solutions.

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[49] *Importantly, not all of the projects would require such a provision.*

Data routing and the physical location of data storage

Many of these additional considerations were focused on data routing and the location of physical data storage equipment. Specifically, they often sought to keep sensitive data in Canada and prevent it from leaving Canada. For example, the City of Brandon includes the following requirements and questions in all the RFPs read for this study:

Does the solution have any cloud computing? All cloud-based solutions used by the City must be kept within Canada. The Service Provider must keep the City's data and the software the City is using and running in a Canadian Data Centre only. If Yes, answer the following:

a. Describe who hosts the proposed solution and the location.

b. What industry certifications does the hosting facility have?

c. What physical security measures are in place?

d. What online security measures are in place?

e. How often are penetration tests conducted on the proposed solution? Indicate who conducts the tests. Include a copy of the last penetration test report in the Proposal response.

f. What Service Level Agreements (SLA) are provided for service performance and usability.

g. What penalties are in place if the SLA is not met?

h. How will the City be notified when the SLA is not met?

i. Where is backup data stored, in what format and how would it be recovered if needed.

j. What business continuity measures are in place?

k. Describe how the following will be handled in a hosted solution.

l. Describe who hosts the proposed solution and the location. All solutions used by the City must be kept within Canada. The Service Provider must keep the City's data and the software the City is using and running in a Canadian Data Centre only.

m. What industry certifications does the hosting facility have?

n. What physical security measures are in place?

o. What online security measures are in place?

p. How often are penetration tests conducted on the proposed solution? Indicate who conducts the tests. Include a copy of the last penetration test report in the Proposal response?

q. What Service Level Agreements (SLA) are provided for service performance and usability?

r.   What penalties are in place if the SLA is not met?

s.   How will the City be notified when the SLA is not met?

t.   Where is backup data stored, in what format and how would it be recovered if needed?

u.   What business continuity measures are in place?

(For example, RFP-179/19)

Similarly, the City of Mount Pearl included the following clause in smart city RFPs:

"If proposing a cloud-based solution, advise where data centres are located. Also describe your Business Continuity and Disaster Recovery methodologies. "Does the solution require the use of a 3rd party database server?"

(RFP-19-030)

BC Hydro clarified that "Unless BC Hydro otherwise directs in writing, [the] Contractor must not store personal information outside Canada or permit access to personal information from outside Canada." **(RFP 1391)**

Privacy by Design

The City of New Westminster in its Advanced Metering Infrastructure project also included some provisions related to privacy by design, with a unique request that the design of the software reflect the legal data privacy requirements and enable audits.

"Personnel Security – The City requires that physical machines are adequately secure and that access to these machines as well as all relevant customer data is not only restricted, but that access is documented.

Application security – The City requires the Respondent ensure that applications available as a service via the cloud are secure by implementing testing and acceptance procedures for outsourced or packaged application code. The City also requires application security measures be in place in the production environment."

(NWRFQ-19-01)

While not the same, Mount Pearl made a similar ask when the city requested best practices for keeping data technically separate among project partners.

"Your recommended best practices in areas where multiple stakeholders share common core requirements but also have unique requirements and require their data to be kept separate from each other."

(RFP-19-030)

Some also required encryption, such as the City of Edmonton, which required "encryption on all personally identifiable information (PII) data transmissions." **(RFP no. 928920)**

Ability to Conduct Audits, Investigations

BC Hydro also included provisions to enable them to conduct impromptu audits or investigations of their private sector partner's personal information management practices.

> "In addition to any other rights of inspection BC Hydro may have under the Agreement or under statute, BC Hydro may, at any reasonable time and on reasonable notice to Contractor, enter on Contractor's premises to inspect any personal information in the possession of Contractor or any of Contractor's information management policies or practices relevant to its management of personal information or its compliance with this Schedule and Contractor must permit, and provide reasonable assistance to, any such inspection."
>
> **(RFP 1391)**

Data-Related Clauses in RFPs: Perspectives from Respondents

In addition to the evidence gathered from RFPs, interviewees, both municipalities and companies talked about data as a distinct topic from IP related to software or hardware products.

Several private sector respondents working with sensors or cameras noted that they explicitly avoided collecting certain kinds of personal data because of they knew they would be stepping into an unclear regulatory landscape. One interviewee noted that data ownership depended on the contract type: in a SaaS model, operational data and data being used to improve a program (health of sensors, functioning of system, training data) might be company-owned, whereas some data might pertain to municipal buildings, assets, products, or citizens and therefore be owned by the city. Importantly, this company typically reserved the right to access some data in aggregate if it was being used to train their machine learning model. In another form of contract, however, the data itself might be the product being delivered, with rights forfeited to the city.

Two interviewees noted that, while their contract had required them to delete municipal data upon completion of the project, having further access to it would have been useful. In addition, they kept metadata and derivatives of the data (in the form of a machine learning model that had been trained on municipal data) but deleted the original dataset because their contract never explicitly outlined ownership of metadata and derivatives. They noted that they preferred working with

municipalities that might be open to co-ownership of data, allowing them to keep de-identified data and re-use it for new products and services:

> "Increasingly, IRIS R&D is exploring whether some images (with no personal information) could be retained by the company because they could be re-used. For example, a new use case is graffiti-identification, but the company has to collect new data to train the AI instead of referring to past data used to train for different use cases. It has been surprising that some municipalities are open to having those discussions."
>
> **Karen Gomez, Smart Cities Consultant**

Interestingly, one private sector respondent said that they had to collect personally identifying information (PII) as a part of their service but only delivered aggregate, de-identified data to the city:

> "Usually it happens not during procurement but after, in the middle of the project. What happens is we start getting something really, really interesting—let's say we're measuring something critical of the department we're working with—and they want to know "Who's saying that? If I know who's saying it, I can help." It's couched in positive terms. We always say no. You don't need to know that it's Mary over here with the issue, just that some people have the issue. "So how can you fix it?" We get asked that a lot. I think that's really unique to us, though, because we deal with personal data and our research is very public-opinion focused."
>
> **Kenton White, Chief Scientist, Advanced Symbolics**

Municipalities too noted that IP was typically much more clearly defined than data ownership in PPPs. One interviewee noted that they were generally happy to share aggregate anonymized data and had always done so whenever companies asked; however, they were just starting to realize "the financial value of [their] data—the amount of time, effort, money, and organizational processes that went into collecting it."

Similarly, when municipalities did acquire data from their PPPs, knowing what to do with it, how to integrate it with other datasets, and how to keep it relevant and timely (let alone conduct analysis) remained a significant hurdle for many respondents. Cities found themselves relying on further consultants to manage the large-scale project of integrating data from their various projects, protect privacy and security, and turn a consolidated dataset into a useful project for municipal decision-making or citizen engagement. Other cities, further along in this process, reported their progress on municipal data warehouses or data centres with low licensing requirements for universities and small companies.

DATA OWNERSHIP IN SMART CITIES PROJECTS: IN SUM

- Data ownership and IP may require different treatment in procurement and contracting

- Many RFPs currently do not address data ownership, leading to mid-project ambiguity

- Some RFPs pose questions pertaining to data rather than offering governance models. Others clarify data storage needs (e.g., data must be stored in Canada, with minimum security standards)

- Several RFPs included a privacy-by-design mandate, while others allow the public sector partner to investigate or audit the proponent's information management practices

- Existing data ownership clauses may not address metadata or training data, causing ambiguity for companies whose IP (e.g., a ML program) has been trained on data owned by the public sector

- Data co-ownership (of de-identified data) is helpful for some startups that can repackage data for new services

- Most stakeholders prefer not to collect PII; however, when collected in a PPP, PII should be stripped from a dataset before it changes hands

- Many municipalities are currently building internal capacity to manage their data effectively once collected (e.g., integrating multiple datasets, arranging licensing for startups and researchers)

DEGREE OF MUNICIPAL INVOLVEMENT IN PROJECTS

IP and data ownership help provide some indicator of how involved a public sector partner intends to be in a smart cities project. If a city is looking to retain IP and data, it might suggest that the city intends to take over and run a project after a company's services are no longer needed. This section discusses the degree to which municipalities are involved in smart cities projects, what involvement from municipalities might look like, and different stakeholders' perspectives on the pros and cons of high-involvement partnerships.

Municipalities might contract a company to do any of the following:

- Design
- Build
- Finance (rare)
- Operate
- Maintain a product or service

Municipality involvement in projects varies throughout these stages. Municipalities might consider the following, among other questions:

a   Do we intend to build internal capacity?

b   Do we intend to run and operate this program ourselves?

c   Do we instead desire a SaaS agreement that runs without our intervention?

d   Do we need to be involved in the design phase of this project?

e   Do we need to establish checkpoints and provide feedback throughout this project's implementation?

In the RFPs analyzed for this study, each case was coded from "low" municipal involvement (where a proponent completes their contract with little to no intervention or supervision) to "high" municipal involvement (where a contract includes frequent check-ins, training of municipal personnel, or significant supervisory checkpoints). Figure 9 illustrates this range by province. Perhaps unsurprisingly, in this dataset, municipalities in larger provinces take high-involvement, high-capacity roles in their partnerships.

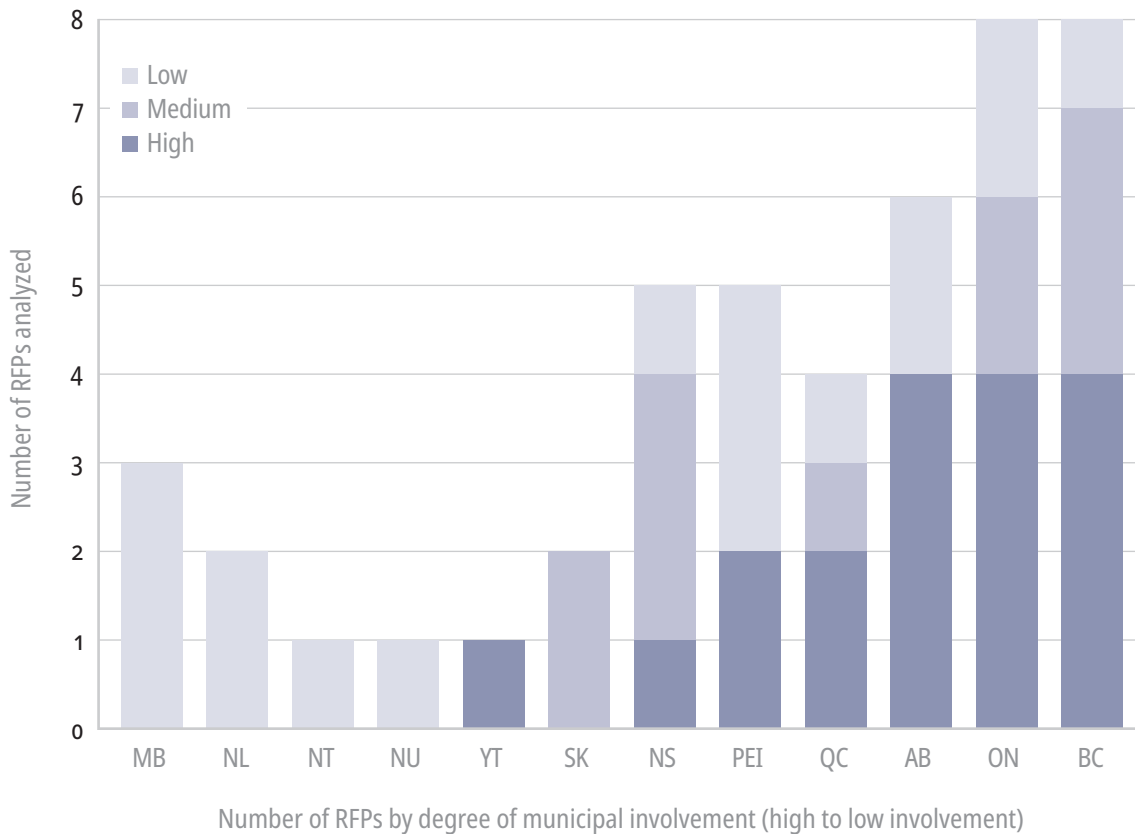**RFPs Analyzed, by Province and Degree of Municipal Involvement**

Figure 9: RFPs analyzed by province and degree of municipal involvement. ICTC RFP Dataset, 2020. n = 46.

Qualitative respondents in this study had a variety of preferences for the ideal degree of municipal involvement in PPPs for smart cities. Perspectives for and against high municipal involvement were raised.

The Case Against High Municipal Involvement

Private sector: The degree to which a municipality expects integration with their own systems and capacity-building services might impact scalability, as well as the amount of effort a vendor has to exert. One private sector interviewee noted that they preferred SaaS models because they allowed them to scale easily, keep their IP, and bring the same service to many clients. However, they also noted that this stance might depend on the type of technology being offered and which municipal department a company was working with (for example, some cities might have different policy on cybersecurity decision-making and who could or could not run core security functions).

Public sector: Contracting out a service also means avoiding some of the red tape that would occur at a municipal level. A public sector respondent noted that they appreciated contracting external services because it allowed projects to proceed more nimbly, with faster response-times when project updates or changes were not encumbered by municipal decision-making processes.

Public sector: Building internal capacity and integrating legacy systems is time consuming, expensive, and might provoke a brain drain. Internal capacity was one of the most frequently commented-upon pain points by municipalities. Not all technologies are easily accessible to employees with basic tech literacy, and extensive capacity-building may be necessary.

The case for high municipal involvement

Public sector: Using municipal talent might improve cost-effectiveness. Training municipal employees to be able to run a service might help a municipality to stay within its budget. This is particularly the case for projects that do not require significant internal capacity-building to run.

Private sector: Municipalities bring new and important data to a project, as well as different values and expectations than public sector partners. Municipalities may have access to key datasets (for example, transit use data) that has a significant impact on a project's success. Furthermore, one private sector interviewee noted that public sector involvement brought "passion" to their work and motivated their company to create a product that would make a real difference.

Private sector: Public sector oversight is important to safeguard public funds, but municipal support in navigating that oversight is appreciated. One company discussed the importance of having public sector staff available to support small and new companies with reporting and auditing requirements, typically more stringent for PPPs than for B2B agreements.

MUNICIPAL INVOLVEMENT: IN SUM

- As witnessed by the wide variety of data and IP ownership arrangements, municipalities may be more or less involved in a smart city project

- A contract could include any of the following services: designing, building, operating, maintaining, or (rarely) financing an initiative, and the municipality might desire to take over at some stage in the process

- In the RFPs analyzed for this study, municipalities in larger provinces took high-involvement, high-capacity roles in their partnerships

- Municipal involvement in the form of system integration can impact how scalable a project is. Private sector duties may be nimbler, with less red tape, and building internal capacity at the municipal level is a time-consuming undertaking

- However, using municipal talent can improve cost-effectiveness, allow access to new and better data, and bring important oversight to a project

SOCIAL IMPACT AND ETHICAL PARAMETERS IN RFPS

Smart cities might be sites of urban experimentation, particularly in "living lab" or pilot program scenarios. Accordingly, for some smart cities projects, the social impact on people living in an urban space might be unknown and difficult to foresee. While iteration is a core component of a responsible approach to urban experimentation (in other words, rapid and effective responsiveness if any social harm is perceived), some PPPs try to mitigate negative social harm via some form of social impact statement or ethical parameter before starting a project. These statements may range from a high-level, general commentary on ethics, to quite specific needs and guidelines. The following discussion examines the RFPs collected for this study and outlines different types of social impact statements.

All RFPs must follow relevant privacy and accessibility legislation, such as FIPPA or the Accessibility standards for customer service and Ontario Regulation 429/7. But some go above and beyond these legislative and regulatory requirements. In terms of social impact-type statements, 27 (59%) of the RFPs did not have anything relevant to record. Those that did (41%) touched on topics like diversity, equity, inclusion, reconciliation, environmental stewardship, and sustainability.

General Commentary

Parkland County includes commentary on the importance of connectivity and the broader, related goals of the RFP, which are to increase social and digital inclusion for residents.

> "Several years ago, Parkland County started a broadband strategy to allow for better connectivity for residents, businesses and producers in Parkland County. Over the years, this has grown to include 20 towers and some fibre infrastructure to be built and operated by Parkland County. The main purpose of Smart Parkland is to support creating opportunities for increased social and digital inclusion for residents."
>
> **(P191115SI)**

The University of Saskatchewan asserts that proposals should be in alignment with the USask mission, values, and vision, which includes academic freedom; collaboration; commitment to community; different ways of knowing, learning, and being; diversity, equality, and human dignity; excellence; a healthy work and learning environment; Innovation, curiosity, and creativity; openness, transparency, and accountability; reconciliation; and sustainability (RFP-CP-216652).

Optional Statements of Guidance for Proponents

Several statements were actionable but optional, allowing bidders to determine for themselves whether it was appropriate to include mention of social impact topics in their proposal.

Environmental and Accessibility Statements

In Richmond Hill, suppliers are asked to avoid the use of colour, plastic inserts, and unnecessary packaging.

> "The Council of Richmond Hill is committed to protecting the environment and seeking innovative and cost-effective ways to do business." "In the interests of the environment, please avoid the use of colour, plastic inserts and unnecessary packaging."
>
> **(RFP-44-16)**

For Kingston's bike sharing system RFP, the city noted that they had "preference for a system that is accessible for those without a credit card or mobile phone." The city also requested environmental and sustainability statements as part of their city plans.

> "Environmental Statement - Provide information on any of your company's environmental-related policies or efforts that would be included as part of the completion of this project."
>
> "Sustainability Statement - The City of Kingston is a community partner to the Sustainable Kingston Plan and as such is committed to instituting practices and procurement decisions that support our shared goals for community sustainability. City staff will seek to assign preference to respondents who propose services aligning with the goals of sustainability so that due consideration for environmental implications may be combined with the conventional aspects of price and performance. Describe how your company and/or project methodology includes considerations for the goals of sustainability."
>
> "Your submission should include a copy of your company's environmental and or sustainability related policies if available, which will reflect any actions taken or plans made which contribute to the goal of meeting the needs of present generations without compromising the ability of future generations to meet their needs."
>
> **(RFP-F31-CS-REEI-2018-04)**

Brandon had similar comments on digital accessibility for their customer notification system.

> "The customer notification system should take rider engagement to the next level and be fully accessible, utilizing multiple media options such as but not limited to email, smartphone, with the ability to provide up-to-the minute notifications to riders to enhance their total transportation experience."
>
> **(RFP-124/19)**

Equity and Non-Discrimination

In Victoria, equity is identified as a key lens that must be included in the development of an EV strategy.

> "Equity will be a key lens through which future EV policies and actions are delivered. With this approach in mind, evaluation of policies and scenarios should include measures of community access to EV charging and recommendations that support maximizing equitable access to EV charging."
>
> **(RFP-20-072)**

In Guelph, suppliers are warned that if their solution relies on public participation, it must be fairly conducted in a non-discriminatory way.

> "If the solution relies on public participation, it has to be inclusive and ensure that factors such as socioeconomic status, homeownership, or race, don't unfairly benefit some streets and neighbourhoods over others."
>
> **(RFP 19-100)**

Including Social Impact in Evaluation Scores

In one Vancouver RFP, companies were asked to indicate how they contribute to social value and economic inclusion (see example below). In another, 5% of the proposal evaluation criteria was reserved for "aboriginal content."

> "In the space below, indicate the Proponent's company profile with regards to social value and economic inclusion supporting equity, diversity, inclusion and reconciliation, including social/environmental certifications, workforce diversity and/or if owned/controlled by an equity-seeking demographic (including but not limited to non-profit, cooperative, Women, Indigenous Peoples, Ethno-cultural People (minorities, newcomers, immigrants), persons with disabilities or LGBTQ+ people)."
>
> **(RFP No. PS20191175)**

In Kelowna, environmental stewardship, social responsibility, and sustainability accounted for 10% of the proposal's total score. Other "formal policies and strategies in use [for social responsibility]" are also discussed.

> "Environmental Stewardship, Social Responsibility, and Sustainability - 10% of score. They may include formal plans and actions of, but not limited to, Green House Gas reduction. Which may include, but is not limited to, encouraging staff to carpool, office lighting retrofits, reduced office paper use, using less office heating or cooling, low emission vehicles, etc. Describe any "green" initiatives, programs, memberships, or certifications that relate to your company or to your products or services and describe how this impacts your ability to be more environmental and sustainable which reflects on the City, as your customer. Describe any [current formal polices and strategies for social responsibility]. This may include, but is not limited to, hiring of traditionally hard to employ [people], utilizing social enterprise as suppliers, community involvement, donations to local charities, etc."
>
> **(RFP T20-046)**

Saskatoon highlights the importance of working with Indigenous people, communities, and businesses, and allots a portion of the evaluation to accommodate this.

> "The City of Saskatoon is committed to working with Indigenous people, communities, and businesses throughout Saskatchewan to promote the procurement of goods and services from Indigenous individuals and businesses. To this end, the following will be evaluated:
>
> • Indigenous Person Hours included in proponent's proposal (3); or
>
> • Indigenous Ownership (1); or
>
> • The extent of Indigenous Persons training and development; including scholarships, apprenticeships, or skills training (1)
>
> A proponent wishing to be evaluated and awarded scores for Indigenous participation (Indigenous Person Hours, Indigenous Ownership, or Indigenous Engagement) should provide the City of Saskatoon with a completed Indigenous Participation Form. The City of Saskatoon may request such proponents to provide additional information in its sole and absolute discretion."
>
> **(RFQ-20-0290)**

Similarly, an RFP from Nunavut reinforces a regulation related to Inuit, local, and Nunavut labour:

> "One of the priorities of the GN is to ensure that Inuit, Local, and Nunavut businesses supply materials, equipment and services, and that Inuit, Local and Nunavut labour are used to the fullest extent practical on any GN contract. Therefore the NNI Regulations applies to this Request for Proposals. To receive the benefits of this Policy, proponents must identify cost components for Inuit and Nunavut content, including the names of any subcontractors, suppliers, and the residency of project team members or other labour proposed to carry out the work. Consideration will also be given for the proponent's Inuit Firm or Nunavut Business status. Prior to rating, proposed pricing may be adjusted in accordance with the NNI Regulations for the amount of work to be done by Inuit, Nunavut and Local businesses and residents. Cost components must be clear; therefore, proponents are encouraged to complete and submit the NNI Incentives Application Form attached to this RFP. Instructions are provided to guide proponents on what level of detail to include. Also refer to the Instructions to Proponents for more information. Failure to complete and submit this form with appropriate detail will result in a denial of NNI adjustments."

(RFP #2018-29)

SOCIAL IMPACT STATEMENTS: IN SUM

- In addition to minimum guidelines under the law, some RFPs include social impact statement requirements to encourage socially and environmentally positive applications. Less than half of the RFPs read for this paper (41%) included a social impact parameter

- Some statements are quite general and high-level. Others provide more actionable guidance for applicants or explicitly include social impact in evaluation criteria

- Common social impact topics included environmental sustainability, accessibility, equity and non-discrimination, and inclusion of Indigenous personnel or Indigenous-owned businesses

While traditional procurement is a well-known and well-tested method for competitive, transparent PPPs, smart cities technologies pose several new challenges that make them harder to procure in traditional ways. Challenges like legacy system integration, siloed municipal departments, and a lack of internal capacity all make it difficult for cities to procure smart cities technologies using a highly traditional, solution-based RFP process.

Instead, smart cities technologies require innovative approaches to public procurement. The first step that can be taken in this direction is to tweak traditional

CONCLUSION

RFPs to make them more accessible to startups and emerging technology companies. For example, Canada can work toward an integrated bids-and-tenders site (our commitment under CETA) and replace siloed and paywalled alternatives. In addition, smart city technology RFPs can pose a question instead of a solution, ensure that parameters do not "write out" emerging technologies, and support local businesses and startups via tailored experience requirements and active dissemination methods.

In addition, innovative "pre-procurement" allows cities to trial new technologies in a low-risk way. By offering municipal services or facilities, many cities have developed low cost "living labs," pilot programs, or accelerators to help startups without risking a long and expensive contract. In other words, cities are able to "try before they buy"; importantly, however, provincial and federal grant funding helps these same methods lower the risk for pre-revenue companies that need financial investment.

Nevertheless, PPPs have significant room to mature with regard to IP guidelines, ownership and collection of data and PII, collaboration and municipal involvement, and social impact parameters. Innovative procurement and pre-procurement alone will not solve certain challenges. Cities need to ensure that they are offering well-defined and fair IP guidelines, clear and privacy-aware data governance systems, and that they are building internal capacity to define and manage IP and data effectively. In addition, social impact parameters are not currently present in all RFPs, but a consideration of public wellbeing is essential to any project that takes a "city as lab" approach.

OVERVIEW

The findings in this report are based in a review of the existing literature on innovative public procurement, 29 key informant interviews with relevant stakeholders (including municipal smart cities leads, municipal procurement officers, and smart city technology companies), and two complimentary datasets (one consisting of 46 smart city RFPs, and the other, of 23 federal funding programs that have supported smart city projects). In addition, this paper incorporates findings from three focus group-style engagements with the ICTC Smart Cities Technologies Taskforce.

APPENDIX I
METHODOLOGY AND LIMITATIONS

SECONDARY DATA SOURCES

Literature Review and Secondary Data Scan

At the introduction to this project, a scan of existing literature on smart cities and smart city procurement was conducted, with a focus on the Canadian context. The literature review and secondary data scan assisted with identification of research priorities, interviewees, and case studies.

RFP Dataset and Document Analysis

There are a number of databases available for use across Canada to search procurement opportunities at the municipal level. Many are operated by municipalities themselves, containing only those cities' respective procurement opportunities, while others are operated at the provincial or territorial level and contain an aggregate list of municipal procurement opportunities in the region. Using these databases, ICTC collected 46 RFPs from across Canada that pertained to smart cities projects, as defined in the introduction of this report. Some examples include the procurement of new electric vehicle chargers or the procurement of a bike sharing system. With the 46 RFPs, ICTC then conducted document analysis to collect certain data points (e.g., project length, project budget, stated bidder parameters, etc.) and identify common trends.

The following figure provides an overview of the number of RFPs selected for each province in Canada. While the research team was initially adopting a quota-sampling approach to RFP collection, the need for relevant RFPs caused a disproportionate emphasis on certain regions: nevertheless, the cases in this collection represent a wide array of project types, municipality sizes, and regions.

Smart City RFPs by Region of Canada
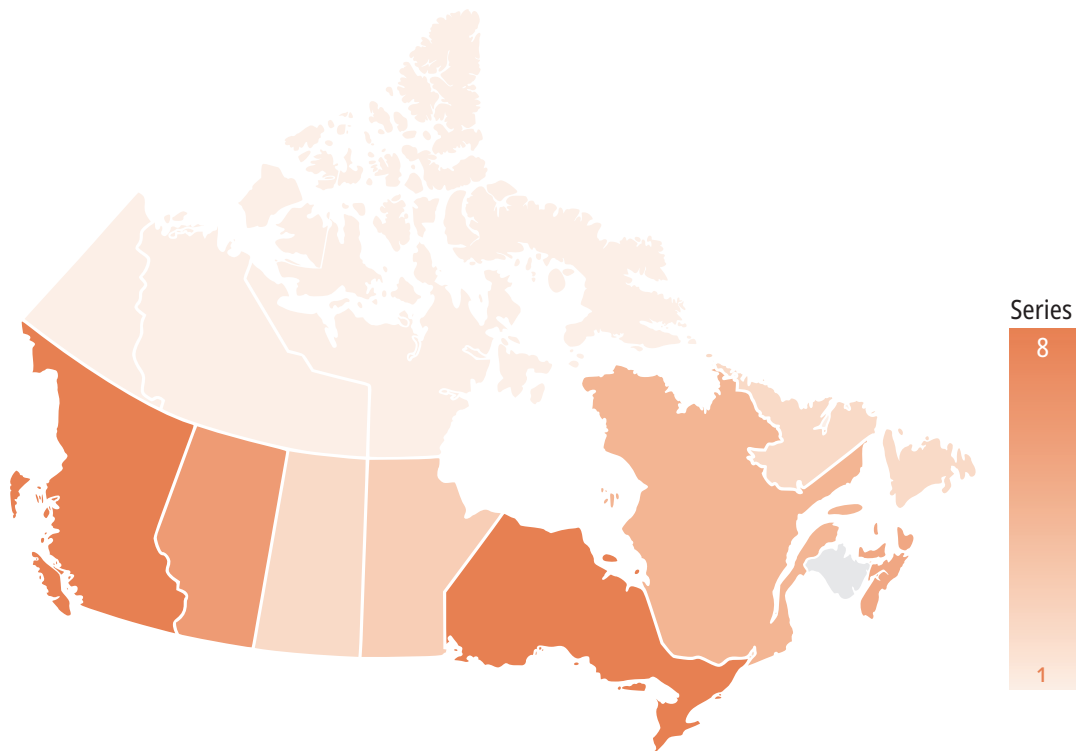
Programs Dataset

A variety of federal and provincial funding programs exist to support cities to procure smart cities technologies. The research team conducted a review to compile a list of 23 funding programs wherein the city was the principal applicant (i.e., this list did not include grants designed exclusively for private sector parties). Additional information about this dataset is included in Appendix B: Characteristics of the Datasets.

PRIMARY SOURCES

Key Informant Interviews

ICTC conducted 29 key informant interviews with 32 relevant stakeholders in the smart city procurement space (three interviews were conducted with pairs of stakeholders). First, interviews from 21 cities across Canada and their smart cities leads (often housed within IT departments) were conducted. Second, a series of exploratory interviews with smart cities technology companies were conducted, before turning to a side-by-side comparison of the experiences of municipal procurement officers and smart city technology company applicants.

Smart Cities Technology Taskforces

ICTC conducted three focus group-style taskforce meetings with smart city technology companies, before and throughout the course of this project. Smart cities taskforce members raised the topic of procurement independently as a key consideration in their work; accordingly, taskforce transcripts were analyzed to both help shape research questions and comment on technology company experiences. The smart cities technology taskforce had varying attendance, but 20 members were consistently present and contributed throughout the study.

Accordingly, between interviews and taskforce meetings, ICTC spoke with 52 research participants to inform this study. The following breakdown is an aggregate illustration of this group's regional dispersion, sectoral affiliation, and smart cities technology area.

The majority of research participants were from Ontario, in part due to the number of technology and policymaking hubs in the province. Alberta, British Columbia, Prince Edward Island, Quebec, and New Brunswick all had a moderate amount of participation (3 to 7 participants), while Newfoundland, Saskatchewan, the Yukon Territory, and Nunavut all had one to two participants.

Research Participants by Province (n=52)
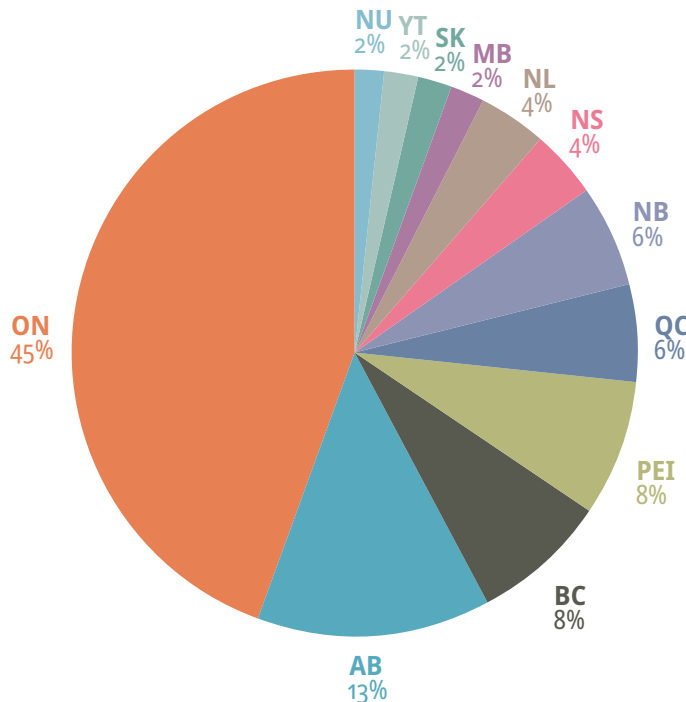
The study spoke with both the public sector (58%) and the private sector (38%), and a few academic/civil society research participants (4%). Each of these participants can be grouped into more specific specializations, as illustrated by the final chart. In the public sector, most participants belonged either to economic development and procurement offices or to smart cities, innovation, information or technology-related departments, with a few participants in sustainability and land use planning. In the private sector, participants were primarily from AI/ML, data analytics, IoT, cybersecurity, and Telecom and LoRaWan companies, with one blockchain-related participant and one in GIS/GPS. The "other" category of participants (8%) included researchers, communications officers, and people "between roles."

Research Participants by Sector and Specialization (n=52)
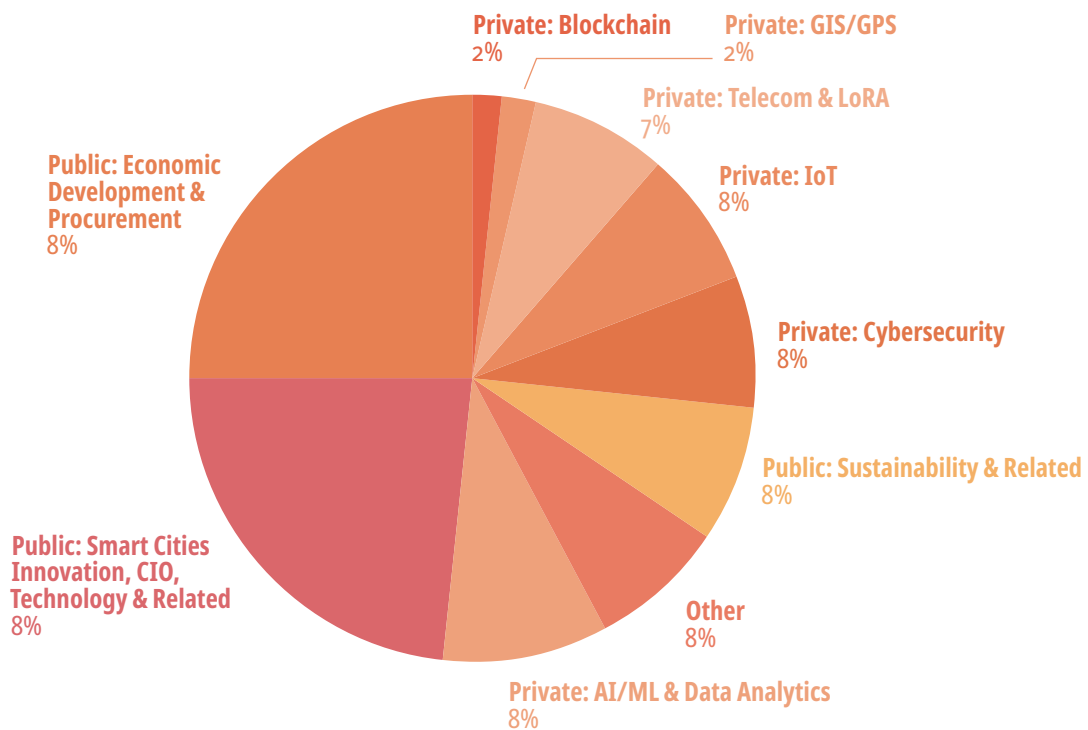
LIMITATIONS

The RFP dataset was collected using a non-probabilistic sampling method, and it features a limited number of cases. RFP document analysis led to further qualitative investigation in areas of interest, and trends within the dataset (for example, with respect to company and contract size) should not be taken to represent trends across Canada.

RFP DATASET

Section I. General Characteristics of the Dataset

This section contains general information about the dataset, including regional distribution and distribution by "area type" (classified by population and population density), "Smart City Pillar" (as classified by ICTC), and date of request.

APPENDIX II
CHARACTERISTICS OF THE DATASETS

Number of RFPs and ''Census Areas'' Included in the Dataset per Region

In terms of regional distribution, Ontario and British Columba together account for 35% of the RFPs in the dataset, followed closely by Alberta, Nova Scotia, PEI, and Quebec. Beyond the number of RFPS, Ontario and Alberta have the highest number of census areas represented in the dataset.


Legend:
- Number of RFPs
- Number of Procuring Entities
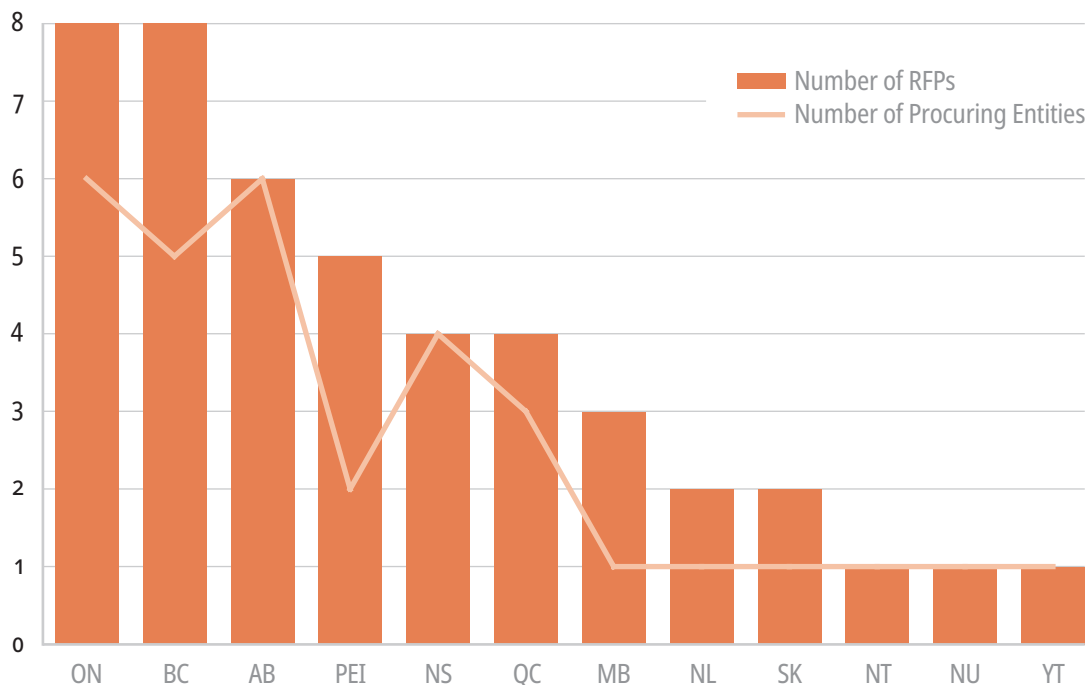
Distribution of RFPs by Area Size

Statistics Canada uses the terms "Population Centre" and "Rural Area" in place of "Urban" and "Rural" to classify Census Areas by size and types because the meanings of urban and rural vary too much across different communities.[50]

According to Statistics Canada, a **Population Centre** is as an area with a population of at least 1,000 and a density of 400 or more people per square kilometre. It lists three types of population centres: Small Population Centres (population of between 1,000 and 29,999), Medium Population Centres (population of between 30,000 and 99,999), and Large Urban Population Centres (population of 100,000 and over). A **Rural Area** is then described as an area where population is not concentrated but dispersed at a low density—in other words, an area that is not a population centre.

The distribution of RFPs by "area" size is quite varied. Population Centres account for 65% of the Census Areas, while Rural Areas account for 35%. Beyond that, there is near equal representation at either end of the spectrum between Rural Areas and Large Urban Population Centres, and a close number of Small and Medium Population Centres as well.
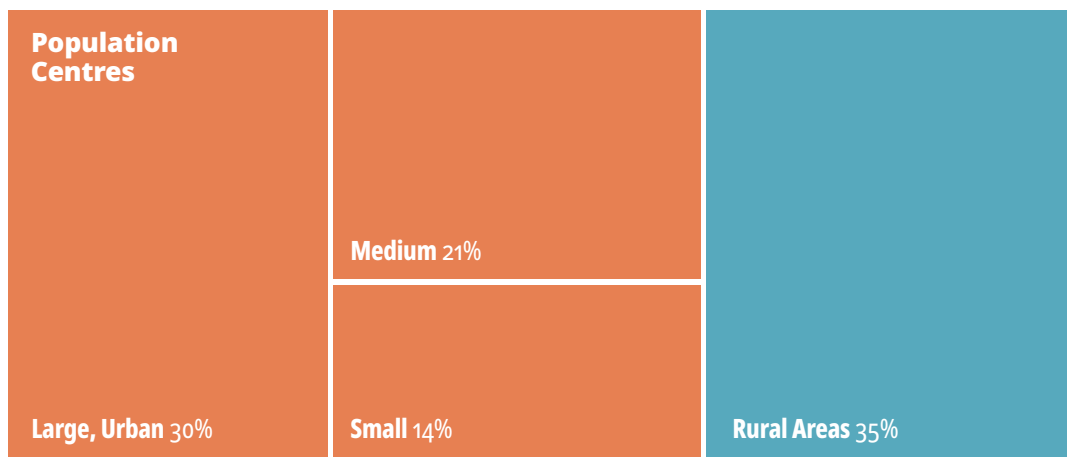
Distribution of RFPs Over Time

Interestingly, in the dataset, the older the RFP, the more likely it is to be posted by a larger, more densely populated Census Area. RFPs posted by Large, Urban Population Centres date back to 2012, but most were posted between 2016 and 2019, whereas for Medium Population Centres, RFPs date back 2017, yet most were posted in 2019. Finally, RFPS posted by Small Population Centres and Rural Areas were most

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[50] https://www.statcan.gc.ca/eng/subjects/standard/pcrac/2016/introduction

likely to be from 2019 or 2020. A couple reason for this uncertain could be that larger cities have more digital infrastructure to procure and/or procurement attracts more public attention, prompting them to post more years of RFP data on their municipal websites.