GEOSPATIAL MATURITY INDEX REPORT

An Analysis of GIS Programs in North America

01 Introduction

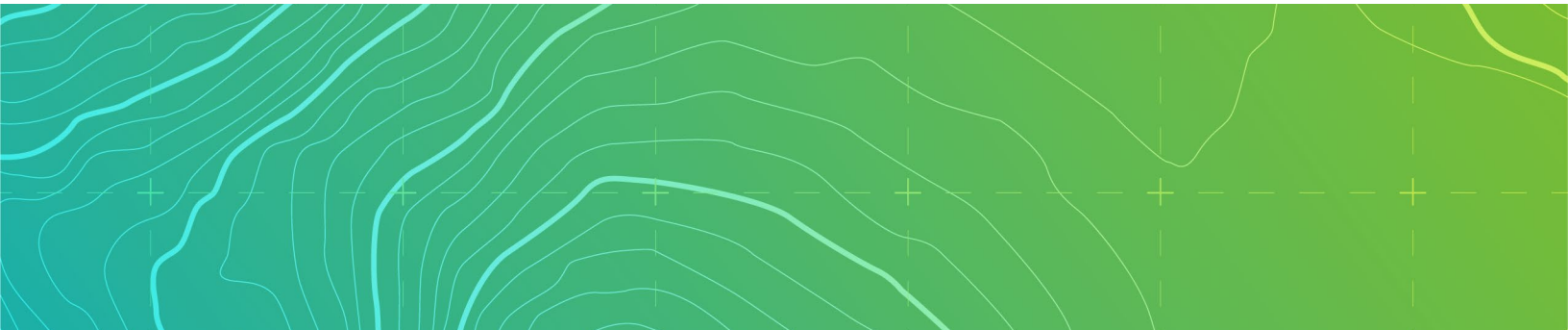
The 2020 Geospatial Maturity Index (GMI) marks the third year that PSD published its benchmarking study for GIS programs. The GMI survey is a tool for public sector organizations to measure the maturity of their GIS (geographic information system) programs and serves as a resource to guide participants in advancing their programs.

The survey is organized into three sections reflecting the core competencies of a GIS program:

READINESS - the Readiness section of the survey explores the capability of an organization to establish and sustain a GIS program, with funding and staff capacity, as well as buy-in from senior management and council.

IMPLEMENTATION - the Implementation section examines the availability of tools, processes, and data to support robust GIS programming.

IMPACT - the Impact section of the survey measures the benefits that the GIS program has yielded for both the organization and the public.



The City of Calgary, Alberta was announced in 2018 as the most advanced GIS program (among 146 participating governments) for the first iteration of the Geospatial Maturity Index. In 2019, Calgary reclaimed its title as Top GIS program, beating out 126 other government participants, with an increased number of US survey respondents.

In 2020, the annual GMI survey was launched in the spring at the height of the first wave of the COVID-19 pandemic. Acknowledging the incredible pressure placed on governments to respond to the crisis, PSD extended the deadline to complete the GMI survey to the end of 2020. It is particularly relevant to note that GIS programs were and continue to be heavily engaged in the response to the pandemic, with geospatial data and mapping essential to understanding and communicating COVID-19 modelling, health care and vaccine distribution across communities, and the disparate impacts of the pandemic on certain populations (see more on this below).

Despite these significant capacity challenges, 90 governments across North America were still able to complete the robust 88-question survey for the 2020 GMI. This report includes the announced Top 25 GIS Programs in North America for 2020, a trend analysis of the 2020 survey results, and a glance at the achievements and challenges of some of our top participants.

The Value of Geospatial Information

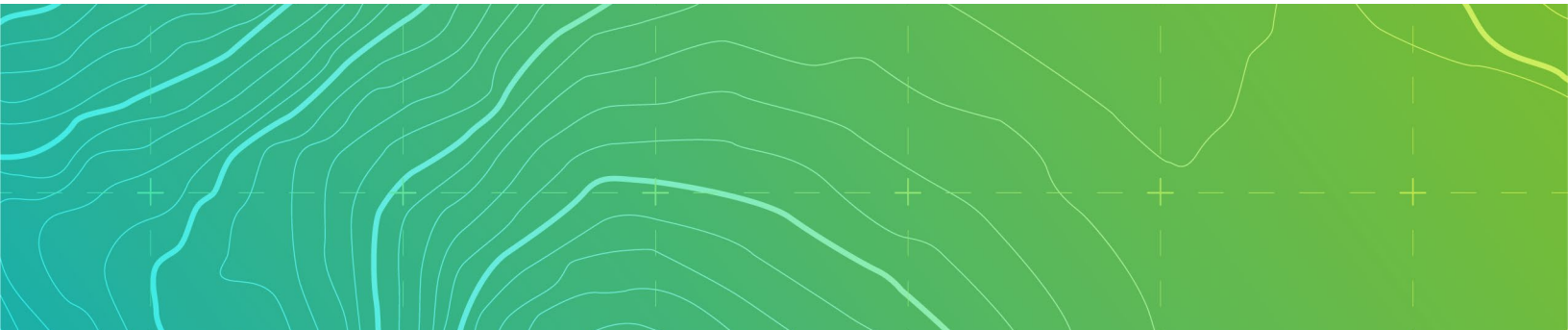
Geospatial information is an incredibly valuable resource to most organizations. Geospatial data drives product placement decisions in the retail sector, it enables powerful visualizations of real estate and investment patterns in the financial services industry, and it serves as the backbone for moving goods and people efficiently in the transportation sector. In government, the stakes are even higher, with geospatial data enabling local governments to target maintenance where there are mapped risks for infrastructure vulnerability or for public health agencies to deploy education and services in the communities that need it most.

$21 BILLION – Value of geospatial technologies to Canada's GDP

19,000 – Jobs generated in Canada as a result of geospatial technologies

$695 MILLION – Value of open geospatial data to Canada's GDP

Source: Canadian Geomatics Environmental Scan and Value Study (2015) published by Natural Resources Canada



02 North America's Top 25 GIS Programs

A total of 90 organizations completed the 2020 GMI survey, spanning nine Canadian provinces, one Canadian territory, seven US states, and one Australian state. For the third year in a row, the City of Calgary, Alberta was named the Top GIS Program in North America, receiving an overall score of 96.3% on the 2020 GMI survey. First-time GMI participant, City of Irvine, California, catapulted to second place, followed by the District of North Vancouver, British Columbia, in third, climbing up from 6th place in 2019.

RANK	SCORE	ORGANIZATION	PROVINCE/ STATE	ORG. SIZE
1	96.30%	City of Calgary	AB	1001+
2	93.12%	City of Irvine	CA	1001+
3	92.59%	District of North Vancouver	BC	501-1000
4	92.06%	City of Burnaby	BC	1001+
5	91.01%	King County GIS Center	WA	1001+
6	89.95%	Strathcona County	AB	1001+
7	89.42%	District of Kitimat	BC	201-500
7	89.42%	City of Leduc	AB	501-1000
9	88.89%	City of Winnipeg	MB	1001+
10	85.71%	City of Mississauga	ON	1001+
10	85.71%	County of Newell	AB	51-200
12	84.66%	City of Edmonton	AB	1001+
12	84.66%	Halifax Regional Municipality	NS	1001+
12	84.66%	Ville de Montréal	QC	1001+
15	83.60%	City of Grande Prairie	AB	501-1000
15	83.60%	City of Longview	TX	501-1000
17	83.07%	Grey County	ON	1-50
18	82.54%	Durham Region	ON	1001+
19	82.01%	City of Round Rock	TX	1001+
20	80.95%	Municipality of Chester	NS	51-200
21	80.42%	Miami-Dade County	FL	501-1000
22	78.31%	Toronto Police Service	ON	1001+
22	78.31%	City of Seattle	WA	1001+
24	77.78%	City of Waterloo	ON	501-1000
25	76.19%	Region of Peel	ON	1001+

Western Canada dominated the GMI ranking this year, with 10 of the 15 top GIS programs located in British Columbia, Alberta, and Manitoba. The United States also increased its representation, doubling its number of governments in the Top 25 from three in 2019 to six in 2020. King County, Washington jumped from 16th in 2019 to 5th in 2020, while the City of Longview, Texas (15th), the City of Round Rock, Texas (19th), Miami-Dade County (21st), and the City of Seattle (22nd) made their first appearance in the Top 25. The most improved organization was the City of King City, Oregon, rising 52 spots from 78th in 2019 to 26th in 2020, just shy of the Top 25 listing. With fewer than 50 staff in the whole organization, and a GIS team of one, King City punches above its weight in terms of capacity. The City has adopted a GIS Strategic Plan, geospatial data is prioritized in their Open Government Plan, and a data security policy is in place pertaining to GIS data.

Top Performing Organizations by Type

#1 City of Calgary AB

Canadian Local Government

#2 City of Irvine CA

American local government

#30 USDA Forest Service

Provincial/State/Federal Agency or Dept

Despite the top performing GIS programs being confined to local governments, more non-municipal government organizations are participating in the GMI, demonstrating the broad application and importance of geospatial data across the public sector. The top performing provincial/state/federal agency or department in the 2020 GMI was the United States Forest Service who ranked 30th. The Forest Service is an agency of the U.S. Department of Agriculture, embracing the power of geospatial information to analyze and visualize data pertaining to the country's 154 national forests.

The United States Forest Service offers a dynamic GIS web viewer for exploring hiking trails, camping sites, and more across national forests and grasslands.

The size of an organization roughly translates to improved geospatial maturity, with 21 of the top 25 governments in the GMI having more than 500 staff. Larger organizations tend to have access to greater financial and human resources to build their GIS departments, but there are outliers. The District of Kitimat, BC earned the highest rank (3rd) among organizations with greater than 200 staff but fewer than 500; the County of Newell, Alberta achieved the highest rank (10th) of those organizations with more than 50 staff but fewer than 200; and Grey County, Ontario earned the top spot among respondents with fewer than 50 staff. These small but mighty local governments prioritize GIS programming, recognizing the value of geospatial data in achieving greater efficiency and improved outcomes for service delivery across the organization.

Top Performing Organizations by Staff Size

1. City of Calgary, AB: Ranking: 1st | Score: 96.3%

The City of Calgary's Geospatial Business Solutions (GBS) Division continues to push the limits of what GIS programs can be and how they can support and enhance government services. In 2020, Calgary ranked first in both the implementation and impact sections of the GMI maturity assessment and eighth in the readiness section. The outputs of the GBS division in terms of data analysis, mapping services, dashboard generation, and technical support are astounding. The capacity of the team is so advanced, they can offer services on a fee recovery basis to external organizations. For example, they provide emergency dispatch data compilation and mapping services to the Canadian Pacific Railway Police Service, they serve as a contractor for orthophotography acquisition for southern Alberta through the Southern Alberta Imagery partnership, and they provide 911 dispatch mapping services under contract for Calgary and the surrounding region. During the pandemic, Geospatial Business Solutions continues to provide robust GIS support to the Calgary Emergency Management Centre (CEMA).

Calgary's GBS Division is centrally managed within the Deputy City Manager's Office (Corporate Analytics & Innovation), providing direct support to GIS power users throughout the organization. Calgary has an approved GIS Technology Plan, a Digital Strategy that covers GIS data, a formal Geospatial Community of Practice, project managers to guide GIS projects across the organization, and comprehensive proprietary and open source GIS technology to support program outputs. Embracing new solutions, Calgary has also implemented machine learning to help automate data analysis.

Calgary's GBS team supports continuous GIS learning throughout the organization and partners with universities, non-profits, businesses, and local utilities for knowledge sharing and joint project development. All public inquiries and feedback related to GIS are initiated by contacting the City's

311 support hotline, which are then routed to GBS for follow up. The GBS team uses a Request Intake Program workflow to respond to all external requests so that they are tracked and citizen requests are followed up on quickly and accurately.

What's next for GIS in Calgary? According to the GBS team, "in five years GIS will still be a distinct discipline, but it will be recognized as fundamental to corporate data-driven decision making. The continued growth of GIS in business units across the corporation will ensure consistent and authoritative cross-departmental data, information, and knowledge integrations will continually occur." The program's greatest challenge will be in integrating and supporting new GIS solutions into the existing business processes, programs, and industry-specific software. The GBS team will need to explain and demonstrate that the Configurable-Off-The-Shelf (COTS) GIS solutions they are deploying are not only easy to use, but can replace costly specialized programming. Calgary's advanced GIS program appears to be up to the challenge.

2. City of Irvine, CA: Rank: 2nd | Score: 93.12%

The City of Irvine, located in Orange County California, is the second most advanced GIS program in North America and the first U.S. GMI participant to crack the top three. Scoring second in Readiness, seventh in Implementation, and third in Impact, Irvine demonstrated maturity across all three core components of the GMI assessment. With approximately five full-time equivalent GIS staff, Irvine's small but nimble GIS team delivers big outcomes. The GIS team is located within Irvine's IT department, but GIS power users are supported throughout the organization, including Public Works, Finance, Parks & Recreation, Emergency Services, and Planning Services.

With a goal of becoming a centre for geospatial excellence, the City of Irvine adopted its GIS Master Plan and ensured that GIS data and programming are prioritized in the City's Official Plan, Strategic Plan, Open Government Plan, and IT Master Plan. Irvine uses commercial GIS software and mobile data collection tools synced with a cloud-based inventory. The GIS team recently launched a data hub on the City's website as a dashboard for interactive park maps, a building permit finder, a child care center map and more. Next, Irvine's GIS team is looking to build out advanced 3D public facing web applications, and in time, data collection using drones.

3. District of North Vancouver, BC: Rank: 3rd | Score: 92.59%

The District of North Vancouver (DNV) is not new to the GMI's top performing list. After securing the third place ranking in 2018, DNV dipped slightly to sixth place in 2019. In 2020, DNV reclaimed third place for the GMI, with an even result across all categories of the geospatial assessment, scoring sixth in Readiness, fourth in Implementation, and fifth in Impact. DNV's GIS program is centralized within the IT department, with between 6 and 10 full-time equivalent staff powering the District's GIS outcomes.

DNV has a GIS Strategic Plan in place to guide departmental priorities, and geospatial data is leveraged throughout other corporate plans to support both broad and specific goals, such as KPIs related to development, traffic, housing, community health, and the environment. In addition to regular internal training provided to GIS staff, DNV offers periodic workshops with other departments to update staff on new GIS capabilities and to community groups as requested. According to DNV's GIS team, "staff awareness and appreciation of GIS' abilities has led to increased demand for GIS applications and service." The District's in-demand GIS team plans to look at new application development, enhanced 3D modelling and BIM capabilities, augmented and virtual realities, and hardware upgrades (like drone technology) in the years to come.

The reach of the GMI is also expanding beyond North America, inspiring GIS programs around the world to start benchmarking their performance. Starting in 2020, a Global Trailblazer will be recognized each year for participating in the GMI from a newly represented region of the world. The goal is for that Trailblazer to serve as an ambassador for the GMI, encouraging other public sector organizations in that country or region to start benchmarking their geospatial maturity. The 2020 Global Trailblazer is Cassowary Coast Regional Council, located in Queensland, Australia.

2020 Global Trailblazer:

Cassowary Coast Regional Council, Australia

GMI participation: **1st year**

Population of region: **30,000**

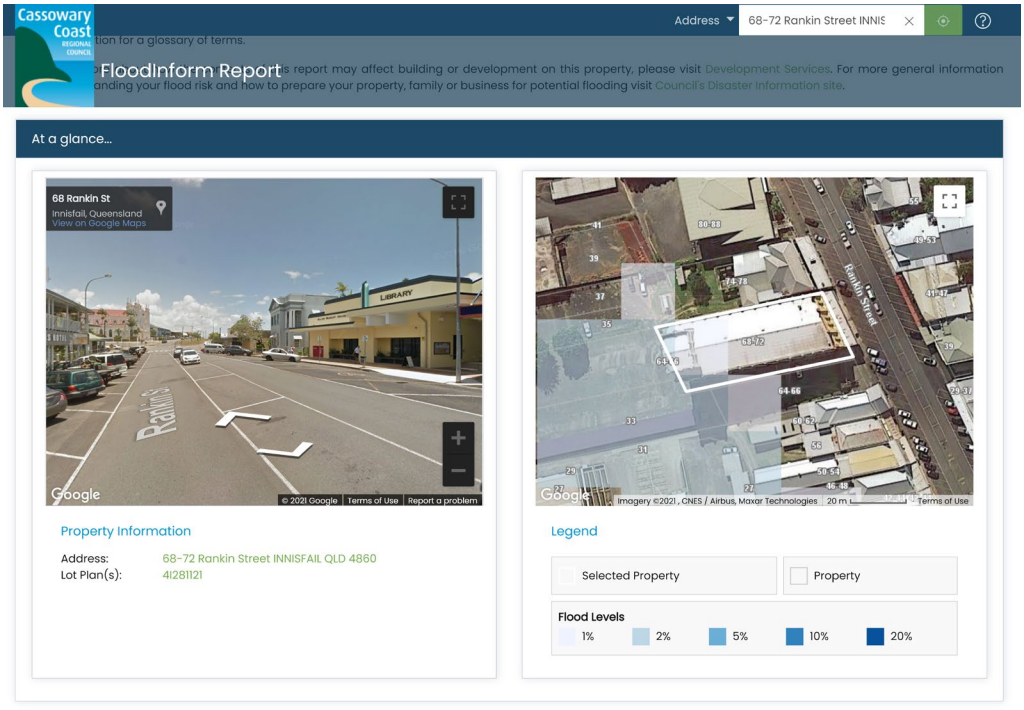
Size of GIS department: **2-5 staff (Spatial and Asset Information Services)**

Structure of GIS program: **Centralized (within IT department)**

Departments using GIS data/systems:

- **Asset/Infrastructure Management**
- **Public Works & Engineering**
- **Parks & Recreation**
- **Planning Services**
- **Finance**
- **Customer Service**

Next GIS priority: **Finalize first GIS Strategic Plan**

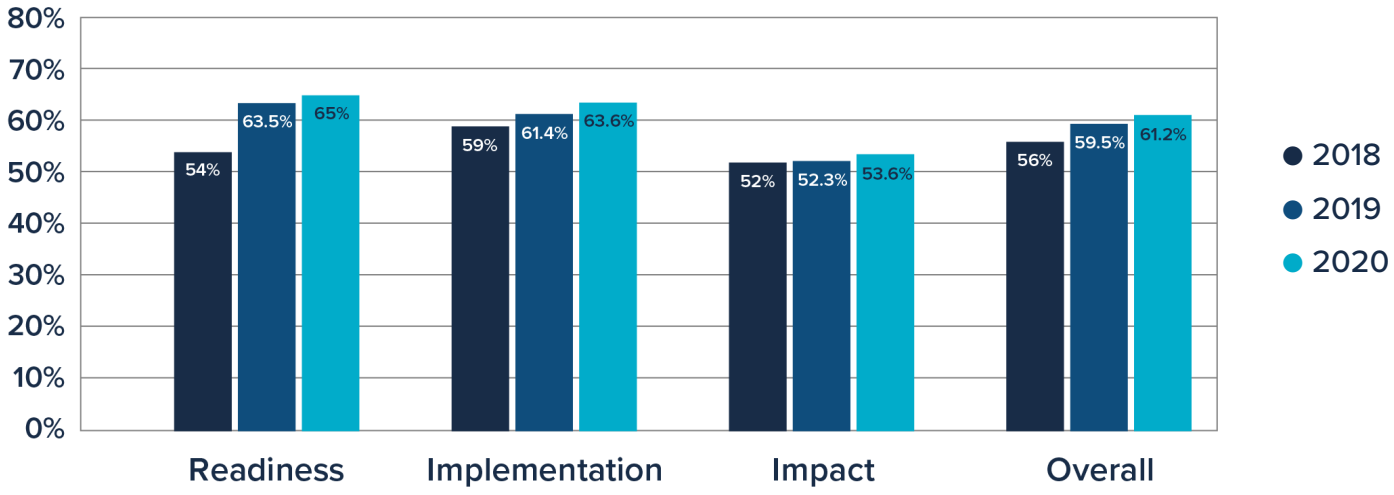


Navigate interactive maps of Cassowary Coast to view road network and flood mapping data and reports for regions and properties.

03 The Future is Mapped: North American Trends in GIS

In a year where GIS practitioners were called upon to help governments navigate a global pandemic, GMI participants still managed to implement new technologies, processes, and plans to build geospatial capacity in their organizations. The overall GMI score among survey respondents for 2020 was 61.2%, up from 59.5% in 2019 and 56% in 2018. Average scores improved steadily across all three areas of geospatial competency, indicating that GMI participants are taking a strategic approach to performance improvement and investing evenly in program capacity, systems, and measurement. The impact section of the survey still yielded the lowest average score for respondents, once again demonstrating the challenge governments face in measuring the impact of their GIS programs and services, both internally and externally.

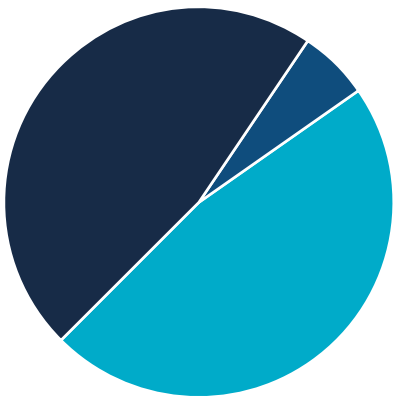
90
2020 GMI Participants



Participation by Organization Size (Number Of Staff):

- 1-50: 9%
- 501-1000: 14%
- 51-200: 28%
- 1000+: 27%
- 201-500: 22%

Participation by GIS Program Structure:



- Centralized: 47%
- Decentralized: 6%
- Hybrid: 47%

Mapping a Pandemic

A vast majority of GMI participants reported on the impact COVID-19 had on GIS programs in 2020, with most describing a transition to remote work but with many also providing examples of how their GIS teams were engaged to directly assist with the pandemic response. In March 2020, after a State of Local Emergency was declared in Calgary, resources from the City's Geospatial Business Solutions (GBS) team were rapidly redeployed to provide support. Some of the solutions developed by the GBS team included:

- A COVID-19 Metrics Dashboard to capture initial COVID-19 and business unit data
- An Inbound Logistics Dashboard to help visualize and report on the status of COVID-19 related supplies and PPE
- Dashboards for Critical and Non-Critical Agencies to visualize metrics using colour-coded pie charts, maps, and lists
- A Situational Awareness dashboard to provide an overview of trends related to City services, citizen concerns, and mental health

In the United States, King County, Washington offers a robust monthly GIS training program for both GIS staff and staff across the entire organization. In-person course materials were quickly repurposed for online content, allowing King County's GIS team to continue training during the pandemic via Zoom. For the City of Seattle's GIS team, projects were refocused on the City's COVID response including data development, map creation, app development, and presence at the Emergency Operations Center. Likewise, for Miami-Dade County's IT department "GIS became the core system to analyze and develop some of our COVID-19 strategies and receive and provide information from the community."

GIS Master Plans

Technology Plans, Strategic Plans, Master Plans – they come in all shapes and sizes, but the creation of a plan for a GIS department or team provides clarity related to program objectives and the key performance indicators that will be used to measure progress. Many GMI participants have used the framework of the Geospatial Maturity Index itself to help identify strategic objectives, using the results of the annual maturity assessment as part of their ongoing performance measurement. In 2020, 29 GMI participants reported having a GIS plan in place, with 21 additional governments currently developing their plans. Among most respondents with a plan in place or in development, the trend is toward developing GIS strategic plans in-house or in partnership with an external consultant. The development of GIS plans was primarily requested by senior management or councils, but in many cases, GIS staff also identified the need for a plan and initiated the project.

GIS Strategic Planning

- 32% Plan in place
- 23% Plan in progress
- 45% No plan

Plan Developed In-house vs Consultant

- 8% Consultant
- 34% In-house
- 58% In-house + Consultant

Building the GIS Team

Robust GIS programs require skilled practitioners with diverse skillsets. As technology and organizational requirements change, GIS teams must adapt and engage in continuous learning. A growing number of GMI participants are working closely with their HR departments to build a pipeline of GIS talent. Eleven governments reported having all five of the following components in place:

1. Assessment of the required skills necessary to support the corporate-wide GIS program
2. Required skills have been shared with HR
3. Challenges in recruiting and retaining staff with required skills have been identified
4. A plan is in place to address challenges in GIS talent recruitment and retention
5. An evaluation framework is in place to determine the effectiveness of your GIS talent plan over time

When asked, "does your organization employ a sufficient number of staff to maintain your GIS program's current deliverables?" 24 participants responded no, with the remaining 66 indicating yes. When asked whether their GIS program has the staff to meet the future needs of their organization, the number of participants responding with "no" jumped to 53. Despite growth in GIS team capacity across the public sector, the demand for GIS services and support continues to grow, creating concern among GIS professionals about the ability to keep pace with that demand. Just 46% of respondents report having dedicated project managers to help guide GIS projects. Without full-time project managers, GIS projects may not be successfully implemented, or solutions could go underutilized by external teams.

Upgrading systems, processes, and data

Improving GIS technology and reviewing data management practices is a never-ending process. Many large GIS programs have the budget to implement automated systems and the capacity to build advanced solutions for business units and the public. Smaller teams must leverage capacity across departments and get creative with the implementation of open-source solutions to compliment existing technology.

The State of the Data

Percentage of GMI participants with the following geospatial data components in place:

- 88% Data is published in a dedicated environment for consumption and distribution
- 83% Data is maintained with a centralized managed production database
- 69% Data automatically populates in other business applications across the organization
- 64% There is a developed environment for GIS data testing
- 62% Datasets have undergone data modelling
- 54% Data versioning techniques are employed to indicate the age of the data in the dataset
- 38% Data security policy is circulated within the organization that pertains to GIS data
- 20% Automated analysis processes are in place (i.e. machine learning) related to existing GIS data

The State of Technology

Percentage of GMI participants with the following GIS systems in place:

94% Proprietary Commercial Software

89% GIS data collection software for use in the field

40% Cloud-based servers for GIS systems

- **25%** - Microsoft Azure
- **10%** - Remote Private Server
- **0%** - Digital Ocean
- **22%** - Amazon Web Services (AWS)
- **6%** - Google Cloud Platform
- **37%** - Other

Collaboration is Key

GIS programs across North American continue to develop new partnerships with each other and with other agencies, departments, and business units to share best practices and raise awareness of geospatial solutions. 76% of GMI participants reported having a formal partnership in place with external organizations including academic institutions, non-profit organizations, local businesses, other levels of government, and neighbouring municipalities. 28% of respondents had a formal GIS committee in place to help build collaboration across departments (compared to 25% in 2019), while 43% reported having a more informal community of practice in place. 74% had a designated representative to provide support to external business units within the organization for GIS inquiries.

Training is another critical component of enhancing the impact of a GIS program and its solutions and services. 71% of respondents have introduced formal GIS training to boost the skills of their internal team, while 53% also provide GIS training to staff in other departments. The City of Calgary offers e-learning modules for all City staff who want to learn about how to use GIS in the organization. Modules introduce users to how GIS is used at the City and how to access the software and data.

PSD | CITYWIDE

PSD Citywide empowers governments of all sizes with infrastructure asset management, budgeting, and GIS solutions. Our web-based software has been implemented by more than 500 municipalities across North America to modernize asset management, maintenance management, permitting, budgeting, and GIS. PSD created the GMI to assist with GIS program development, capacity building, and innovation in public sector organizations.

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