Artificial intelligence practitioners in the Government of Canada

Insights into the current state of our artificial intelligence capacity and how we can enable its growth

10/04/2019

Canada

Setting The Stage

Bringing together advances in computational power and data from sources new and old, the field of artificial intelligence (AI) is growing at a frantic pace. With its uncanny ability to drive a car, diagnose the early onset of disease or provide legal advice, AI is poised to transform our economies and societies.

Given our wealth of data and the high volume and transactional nature of our services, governments are particularly well positioned to benefit from the adoption of AI. It has the ability to increase the efficiency of our work, reduce costs, and improve the quality of services.

However, AI does not come without its share of challenges. From the need for new skills and systems to debates on what uses are acceptable for AI, the path ahead remains uncertain. What is clear is that the private sector is increasingly implementing AI innovation and setting expectations around service quality and experiences for our citizens. Without action, this increasing service quality gap could erode trust in government.

Our best bet to effectively navigate this new reality is by building experience and expertise. Without it, we risk not being able to see the opportunities or risks associated with AI and effectively harness it through internal capacity and support from private sector.

Charting a course with the help of AI practitioners

Context

There is a recognition that Artificial Intelligence (AI) has the potential to transform many facets of government for the better. In order to help realize this potential, the Clerk of the Privy Council has mandated The Task Force on Public Sector Innovation (TF-PSI) to advance and experiment with AI. As part of the TF-PSI, there is a cohort of analysts known as GC Entrepreneurs representing each of the member departments (18 in total) who have been dedicated to support the Task Forces' mandate.

Gap

Though the Government of Canada has a number of departments and agencies involved in AI-related work, *there is a limited understanding of the current GoC capacity and landscape as well as how to best develop, utilize, and grow AI across the GoC.*

Opportunity

As GC Entrepreneurs, we have the opportunity to work horizontally and provide a picture of the current state of AI capacity in the GoC.

Our goal was not only to document the what is done with AI, but to understand the who and the how

Approach
We conducted 25 interviews with teams representing 20 departments and agencies. These interviews reflect the experiences of approximately 350 AI practitioners.

Although several interviews were conducted, there was a high degree of consistency in what people told us: their stories, victories, and challenges.

"After four interviews I realized everyone was answering the same way. With 25 interviews done, it's a veritable choir."
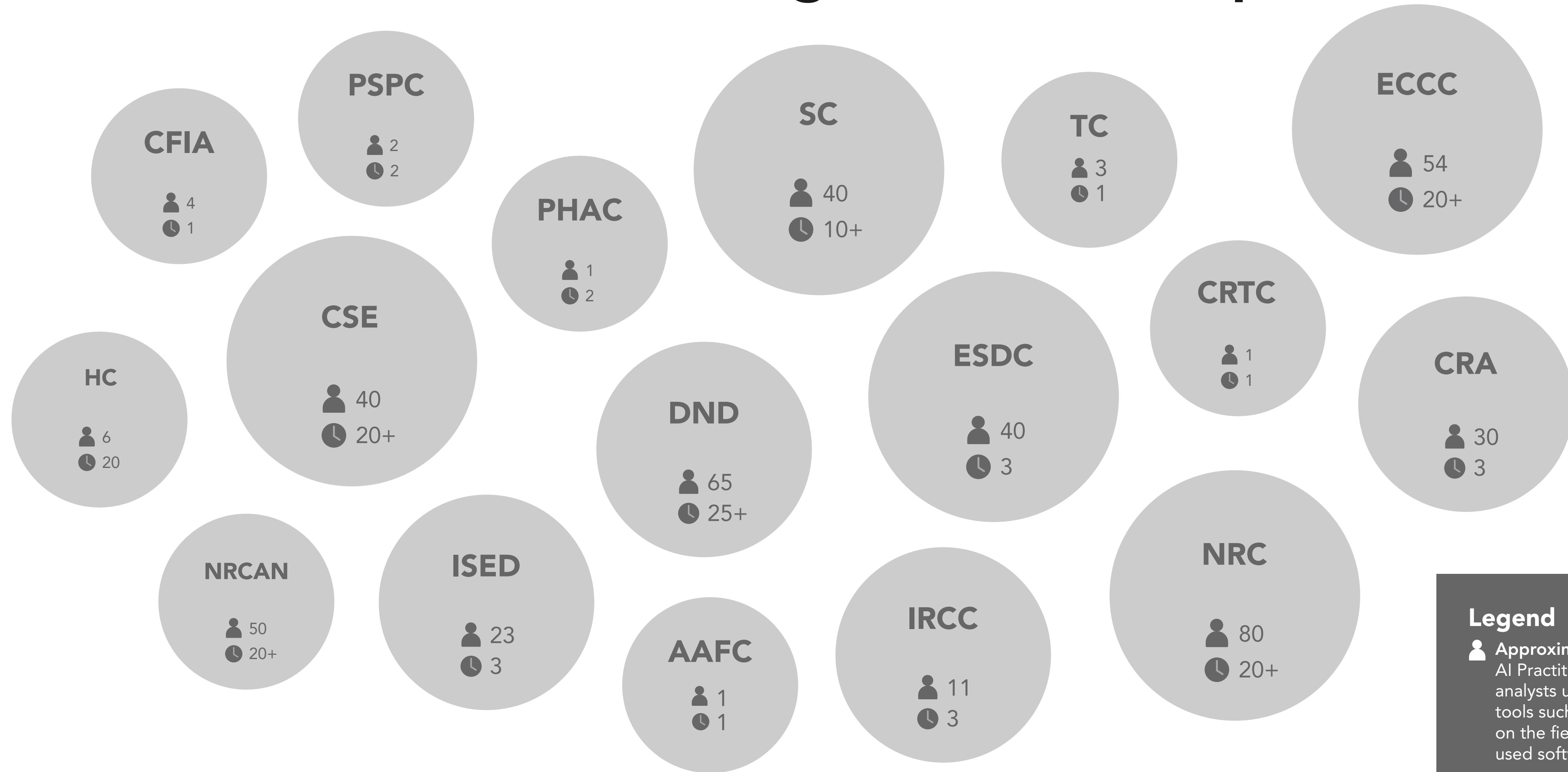*- GCEntrepreneur*

AI at work in the Government of Canada

An example from Employment and Social Development Canada

In 2017, ESDC ran a public consultation around the theme of poverty reduction where they received over 800 responses. They were able to quickly (three weeks) develop a scalable and reproducible AI to identify themes and patterns in the responses which aided their analysis. They estimate the AI saved around nine weeks of work for a full time employee who would have had to read each response individually and produce results that would have been difficult to replicate.

Government of Canada
# Artificial Intelligence Landscape

CFIA
👤 4
🕐 1

PSPC
👤 2
🕐 2

PHAC
👤 1
🕐 2

SC
👤 40
🕐 10+

TC
👤 3
🕐 1

ECCC
👤 54
🕐 20+

HC
👤 6
🕐 20

CSE
👤 40
🕐 20+

DND
👤 65
🕐 25+

ESDC
👤 40
🕐 3

CRTC
👤 1
🕐 1

CRA
👤 30
🕐 3

NRCAN
👤 50
🕐 20+

ISED
👤 23
🕐 3

AAFC
👤 1
🕐 1

IRCC
👤 11
🕐 3

NRC
👤 80
🕐 20+

Legend

👤 **Approximate AI Practitioners**
AI Practitioners are defined as analysts utilizing the latest in AI tools such as machine learning on the fields most commonly used software (e.g., R, Python).

🕐 Approximate number of years department or agency has been conducting AI related work

AAFC: Agriculture and Agri-Food Canada   CFIA: Canadian Food Inspection Agency   CRA: Canada Revenue Agency   CRTC: Canadian Radio-television and Telecommunications Canada
CSE: Communications Security Establishment   DND: National Defence   ECCC: Environment and Climate Change Canada   ESDC: Employment and Social Development Canada
HC: Health Canada   IRCC: Immigration, Refugees and Citizenship Canada   ISED: Innovation, Science and Economic Development Canada   PHAC: Public Health Agency of Canada
PSPC: Public Services and Procurement Canada   NRC: Natural Resources Canada   NRCAN: Natural Resources Canada   TC: Transport Canada   SC: Statistics Canada

The GoC has untapped potential to benefit from AI
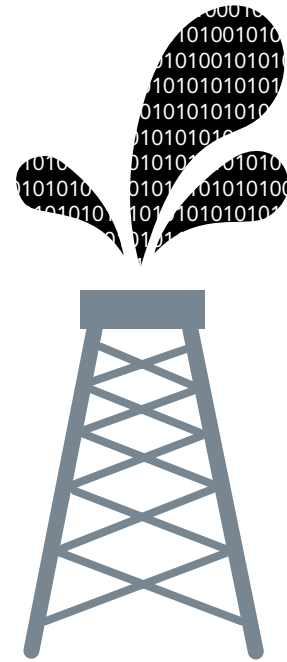
The GoC has a wealth of data that can benefit from AI.

Our government data sets, including operational (e.g. back office processes data), human resources data, and client services data, in conjunction with public data, such as social media, hold enormous potential.

Help!

Once the potential of AI begins to be realized in departments and agencies, the demand far outpaces supply.

This speaks to the overwhelming potential for these tools to impact the way we work in government.

The proliferation of AI is enabled by senior management support.

Chief Data/Information Officers provide clout and influence that help overcome institutional barriers, such as data access.

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The ecosystem for learning and making use of AI is self-sustaining

AI capacity is emerging across a number departments and agencies thanks to staff acquiring these skills during their personal time.

These passionate employees are applying these skills to their work, resulting in increased effectiveness.

**Learning AI is done with free online resources.**

AI practitioners have all relied on the vast and ever growing online learning resources, such as courses, blogs, academic literature, and message boards. They also expect to continue to use these resources for their future learning needs.

Developing and implementing AI solutions is done on freely available open source software.

AI software like R and Python are the same tools being used and supported by academia and leading AI companies such as Element AI in Montreal and Google.

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AI practitioners are passionate to modernize GoC processes and improve services
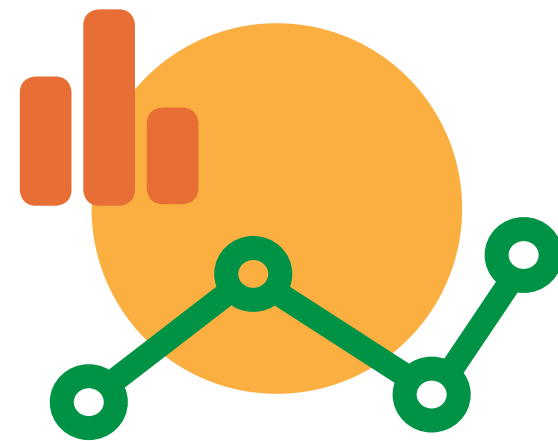
A strong foundation in mathematics and statistics is all you need.

AI practitioners come from a broad field of disciplines such as: Computer Sciences, Mathematics, Physics, Economics, Actuarial Sciences, Statistics, Operations Research (OR), Linguistics , Psychology, Epidemiology, Biostatistics, Engineering, Atmospheric Sciences.

Once teams are established and recognized, the pace of learning grows exponentially, increasing the scope and possibilities of AI solutions.

Large AI teams are collaborating with global leaders in AI, such as academics and Element AI Inc., which are based in Canada.

We are uniquely positioned to tap into Canada's world class AI superclusters to provide us with an undeniable comparative advantage over other nations looking to develop their AI capacity and make use of AI solutions.

The GoC has the potential to quickly adapt to and benefit from AI

but...

adoption is being slowed by a number of barriers. However, many of these are within its control

AI growth is being stunted by a siloed culture and a lack of understanding
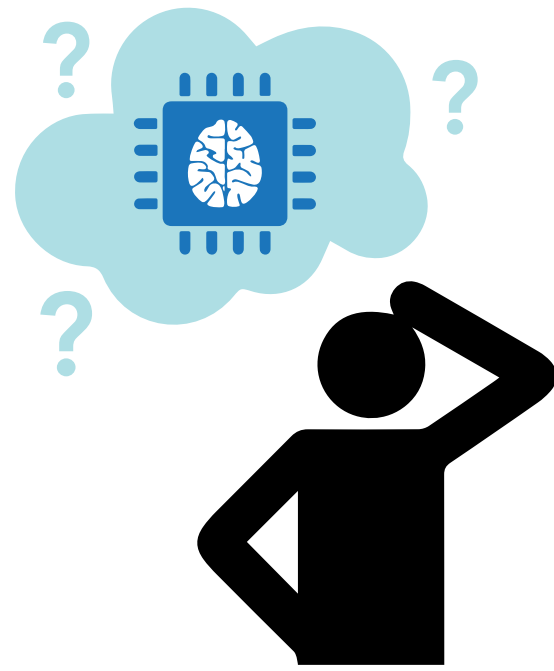
The general knowledge of AI and its potential applications inside the GoC is poorly understood.

This results in missed opportunities to modernize our data and analytics, and improve workload management. This also leaves us at a disadvantage when dealing with AI vendors. In cases where AI tools have been developed, they are often met with skepticism and concern.

The culture around data focuses on data privacy and access instead of usability and analytics.

This limits collaboration both within and between departments and agencies, leaving the potential benefits of AI solutions locked away. New data managment approaches allow privacy and analytics to go hand in hand.

Communities of Practice of AI practitioners are fractured throughout the government.

Though there are a number of communities relating to AI, data, and data sciences on GCconnex/GCcollab, these have not been effective at building and supporting a community of AI practitioners.

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Our apprehensiveness and inexperience in adopting new technologies is limiting

Lengthy approvals for AI software are paralyzing the GoC's AI capacity to explore, develop, and implement AI solutions.

IT security reasons are often cited as the reason for the significant delays. It should also be noted that each department/agency's respective IT functions are independently approving the same AI software. Interestingly, nearly no AI practitioners work in their departments/agencies IT services.

Limited access to appropriate hardware is crippling the GoC's AI capacity to explore, develop, and implement AI solutions.

The procurement of high-end computers and servers can take upwards of eight months to a year. Server infrastructure is necessary to operationalize AI solutions.
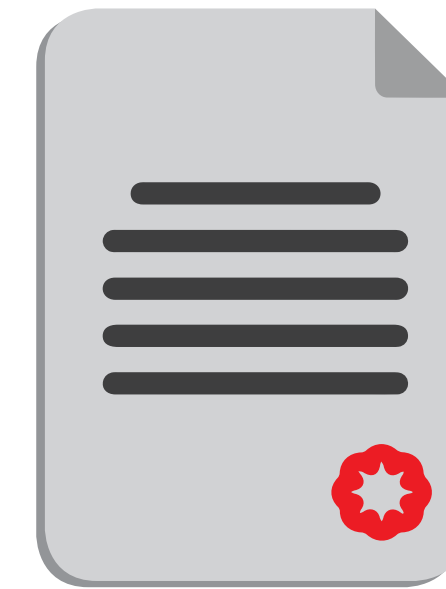
The potential for AI solutions is limited by the readiness and access to our data.

Many of the GoC data sets are not accessible or organized to be easily used for analysis.

AI practitioners are in short supply

GoC salaries are not competitive compared to private sector.

New graduates from recognized universities specialized in AI are being offered upwards of 150k to 200k dollars a year. These salaries are often limited to people who have completed formal university masters and Ph.D. programs in AI.

As AI practitioners grow in skill and experience, so do the challenges relating to the retention of these practitioners.

AI practicioners from well established AI teams are often solicited and/or recruited by the private sector.
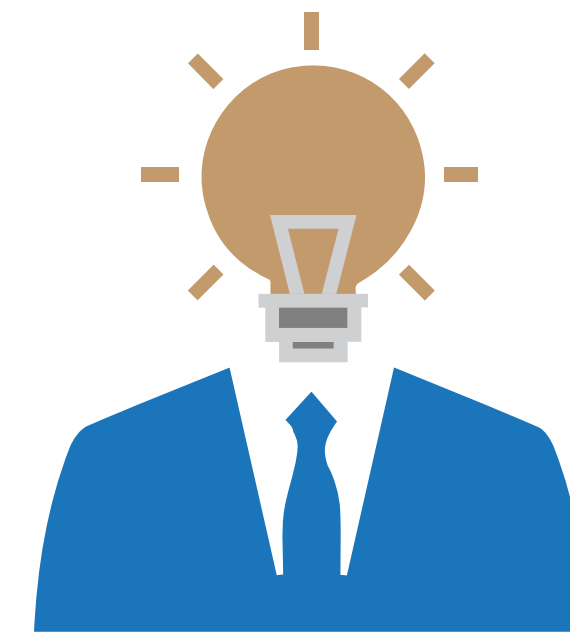
Getting the most out of AI tools requires a high degree of skill.

Experienced AI practitioners warn that without a high degree of mathematical maturity (e.g. competency, experience), the use of AI tools can lead to missed opportunities for us to learn from and understand our data.

Only the most skilled and multifaceted analysts are emerging in this current environment.

Nearly all AI practitioners are proficient in mathematics, have passion for AI, are risk takers, have a strong vision for the future and are persistent in bringing AI tools to their workplace.

Recommendations

The following recommendations can be the next steps on the path to enable the growth of AI capacity in the GoC

Create a solid foundation on which AI can thrive

Create a group of AI practitioners to lead a number of AI initiatives across the GoC

This group could:

- Provide expert advice for other AI practitioners
- Conduct demonstration projects across the GoC
- Provide advice for policy and legal initiatives
- Gather existing and develop educational material/courses to increase general understanding amongst employees
- Collaborate with the Canada School of Public Service (CSPS) to develop educational material specific to the application of AI in GoC
- Support existing Communities of Practice (CoP) on AI and data science
    - Develop networking opportunities/workshops
    - Develop coding challenges
    - Build links between internal and external CoP
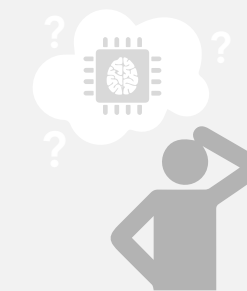   - Increase visibility of the growing list of projects underway in the GoC

Wealth of Data   High Demand   Senior Support

Poorly Understood   Privacy/Access focused   No Community

Untapped potential

Stunted by silos and lack of understanding

# Educate and show value and resources will flow

Have a group of AI practitioners serve as a sounding board for AI procurement

This group will develop expertize to explain, evaluate cost, and set standards/expectations regarding intellectual property to ensure we are getting value for money.

Conduct a case study of how AI was implemented in the GoC with a particular focus on the human element.

Interviews point to this being a critical yet poorly understood step in the evolution and adoption of AI in the GoC.
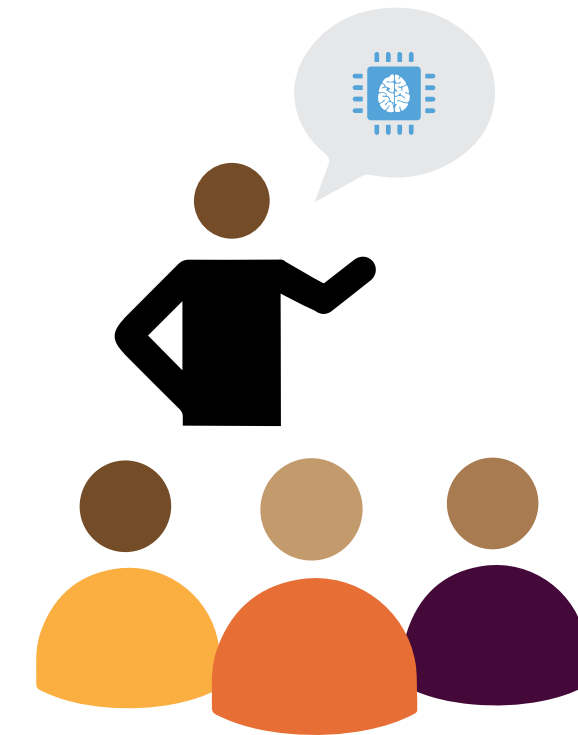
Hold discussions across the GoC facilitated by people knowledgeable in AI to identify the potential for AI in their organizations.
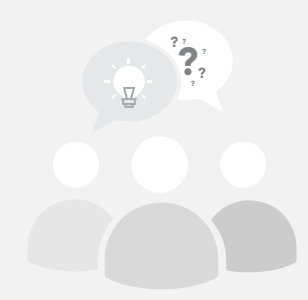
Wealth of Data   High Demand   Senior Support

Poorly Understood   Privacy/Access focused   No Community

Untapped potential   Stunted by silos and lack of understanding   16

Ensure AI practioners have the tools and resources they need

Consult with CIO's and CDO's across the GoC to determine a way to improve access to AI tools (software and hardware)

Support Chief Information/Data Officers to:

- Build on existing efforts such as the GoC Data Strategy to improve access to data
- Ensure that the applicability of AI is considered while developing and maintaining our data
- Develop agreements between departments on IT security assessments of software packages to increase access to the latest tools
- Have AI tools, such as Anaconda, available through all departmental IT desktop support groups
- Explore procurement opportunities for specialized hardware. (e.g. A central cloud space for AI work with the latest software and a safe environment)
- Facilitate access to server infrastructure to test and implement AI solutions (including for Protected B information)
- Build on lessons learned from departments' active in AI to scale their innovative practices in accessing software and hardware
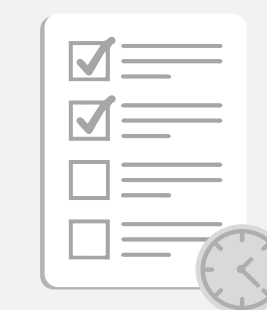
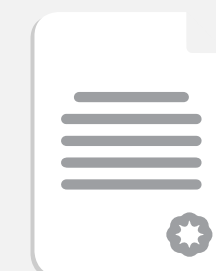Self-Driven Learning

Free Resources
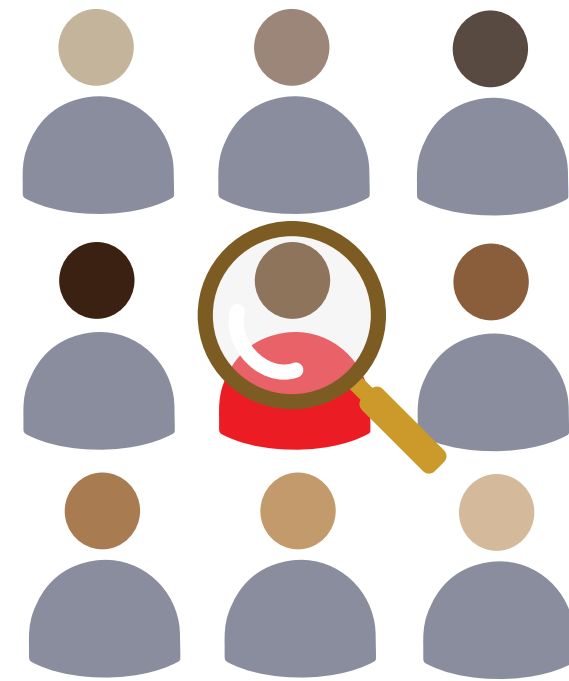
Open Source

Lengthy Approvals

Access to Hardware

Access to Data

AI has a strong learning ecosystem

Our apprehensiveness and inexperience

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Find internal potential and build our bridges

Departments and agencies identify existing, potential, or future AI practitioners within their organizations and provide them with time to learn, resources to develop, and a license to experiment.
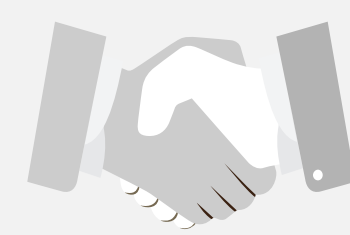
Build relationships with academics, private sectors, and other governments to increase competent staffing opportunities and create stronger relationships with these institutions for learning purposes.

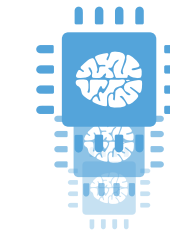Proximal Skills   Amplified Learning   Connected   Uncompetitive Salaries   Retention   High Degree of Skill   Superstars
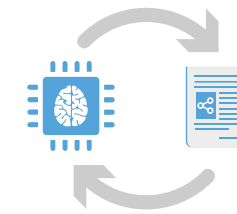
AI practicioners are passionate   Highly competitive market   18

Moving Forward
Potential Paths

1

AI capacity in the GoC continues to grow despite its challenges. We remain on the sidelines and allow this field to grow organically albeit stunted by the various barriers identified above.

2

To increase the speed of adoption of AI, we establish an ad-hoc group of AI practitioners from across the GoC. This group will further the work presented above and develop potential solutions. This group will report to the TF-PSI on their progress and make recommendations as needed.

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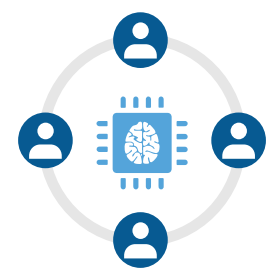
To increase the pace of adoption further, the GoC could establish a multidisciplinary team of AI practitioners, data experts, and policy analysts to work for all departments and agencies.

For more information and additional insights, don't hesitate to contact us!

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