Modernizing SDI: Enabling Data Interoperability for Cumulative Effects Concept Development Study

Preliminary Results

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Modernizing SDI Workshop

Virtual | 10 November 2020

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- How can an ocean of environmental, foundational/framework, biological, socio economic and other data, from multiple different sources, and with varying levels of standardization, be readily consumable and integratable by scientists and citizens alike?

Modernizing SDI: Data Interoperability for Cumulative Effect OGC Concept Development Study

This CDS seeks to specifically identify emerging **standards-based solutions that can better enable data interoperability** of key environmental data. The scope of this CDS includes:

- Characterizing the **current state of spatial data infrastructures**: their use of current or emerging standards and advanced technology to enable data interoperability, understanding gaps and challenges
- Assessing the **availability and interoperability of geospatial data** across various regions or jurisdictions, specifically those needed for regional environment assessments or cumulative effects analysis, as well as the technologies and services currently leveraged
- Exploring and articulating practical means to achieve **modernized, intelligent, inferential, machine-driven solutions** that support and enable improved, efficient geospatial data interoperability

CDS sponsored by: Natural Resources Canada / Ressources naturelles Canada

CDS Objective and Use Case

Objective:

- The primary question: “How can an ocean of environmental, foundational/framework, biological, socio economic and other data, from multiple different sources, collected over time, and with varying levels of standardization, be readily consumed and integrated by scientists and citizens alike?”

- The overall objective: Consult community and inform federal, provincial, territorial and First Nations/Indigenous stakeholders, concerned with cumulative effects and regional assessments, how best to establish consensus and implement common, open standards-based, approaches that leverage emerging technological capabilities, leading to new levels of digital geospatial data interoperability.

Use Case: Cumulative Effects

- In a **cumulative effects analysis use case**, data is sourced from a range of jurisdictions, governments, sectors, domains, over time, and social/community contexts

- **Cumulative effects offers a complex but effective use case**. Data i**nteroperability is equally an issue in many other contexts, such as emergency response or preparedness, where data must interoperate quickly and easily across organizations and jurisdictions**.

Cumulative Effects

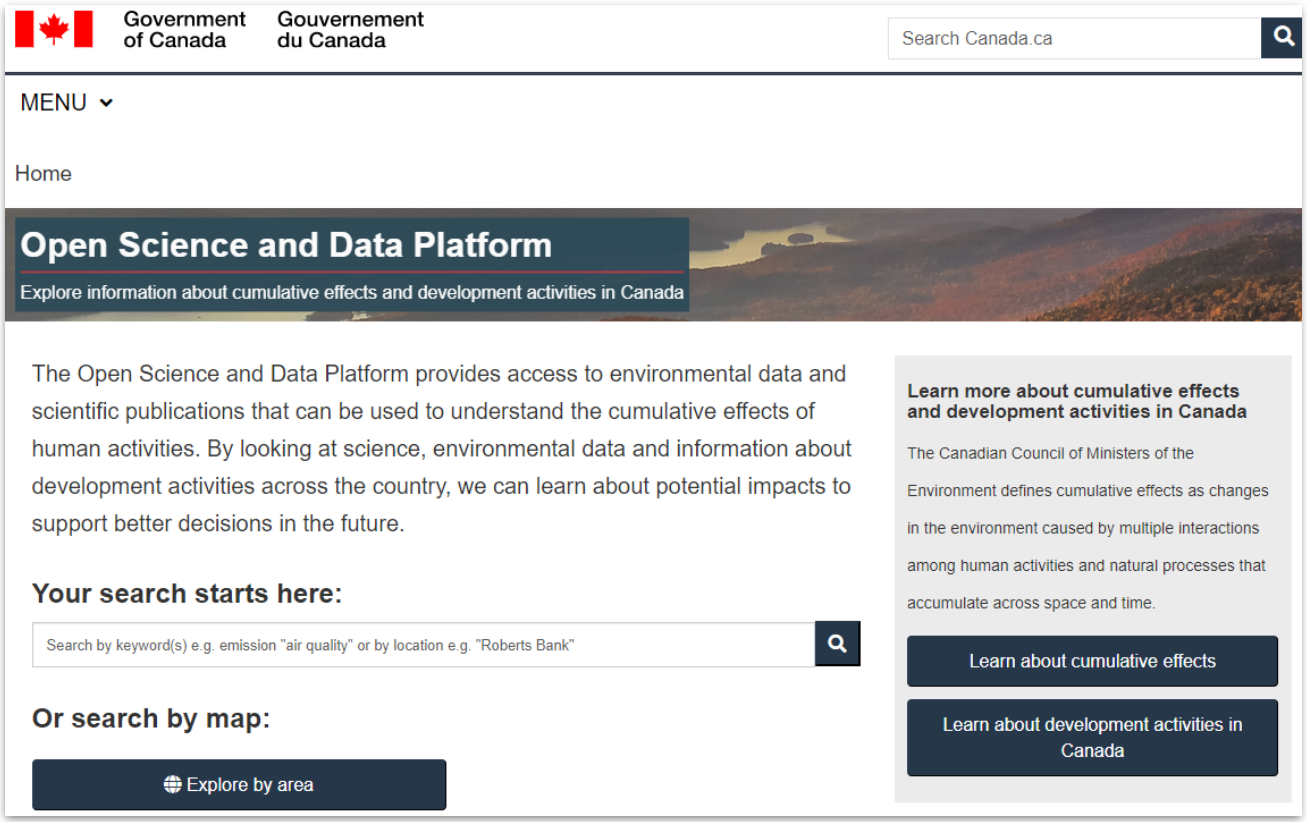
- **Cumulative effects** (**CE**) are defined as changes to the environment, health, social and economic factors caused by **multiple interactions** between **human activities** and **natural processes** that accumulate **across space and time**

- In Canada, approval of major development projects now requires an **impact assessment** that analyzes all possible **cumulative effects that could impact the environment and the people who live and work in it**, both over time and in combination with other existing or future projects

Modernizing an SDI

- In 2019, several Canadian federal departments with a stake in environmental impact assessment , led by Natural Resources Canada and Environment and Climate Change Canada, launched the **Open Science and Data Platform for Cumulative Effects** (OSDP)

- Canada's Federal Geospatial Platform (FGP) is a key delivery partner for the OSDP initiative, delivering federal, provincial and territorial geospatial data and web services critical for cumulative effects analysis available to the OSDP
- The FGP is the federal node of Canada's Geospatial Data Infrastructure (CGDI)
- The OSDP initiative aims to give to all Canadians a single point of access to data and science information relevant to project impacts, and regional cumulative effects assessment



Priority Data for Cumulative Effects & Regional Assessments

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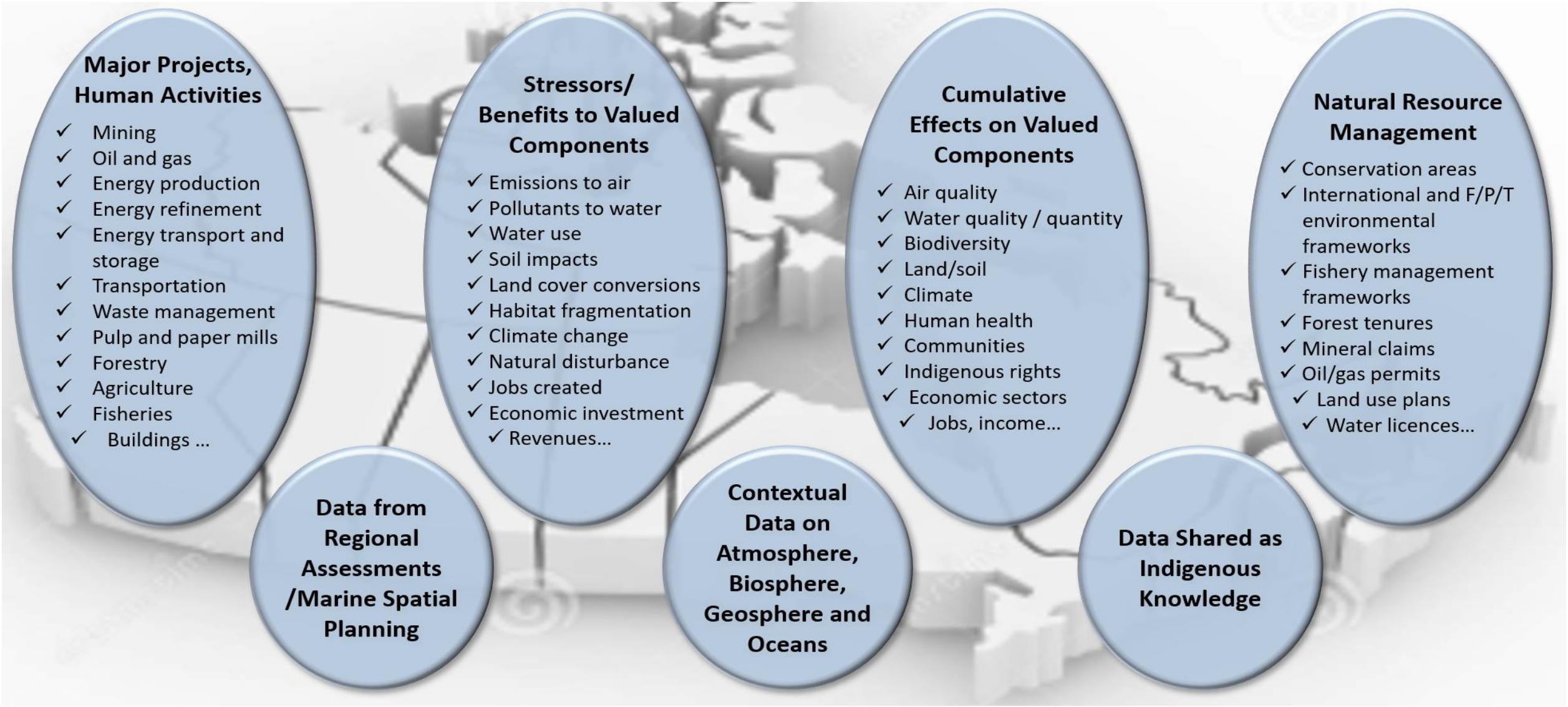
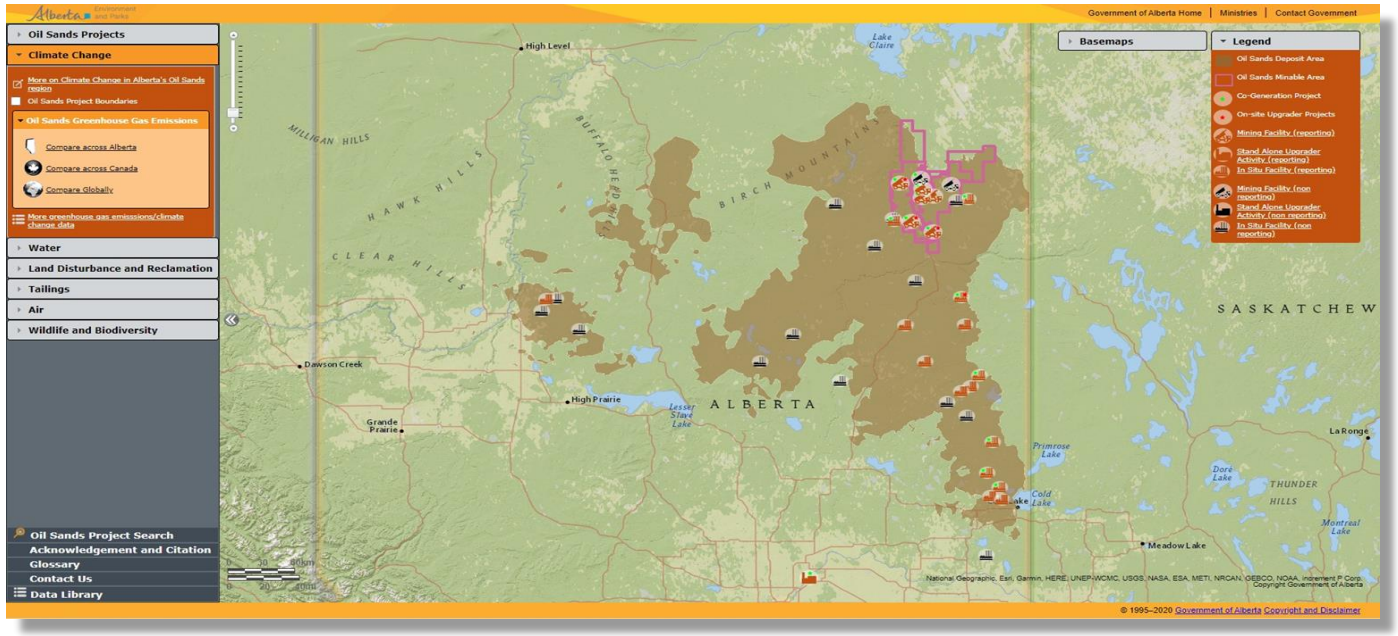


Case Study: Canada-Alberta Oil Sands Environmental Monitoring

- The Governments of Canada and Alberta have committed to implementing scientifically rigorous, comprehensive, integrated and transparent **environmental monitoring** of the oil sands region to ensure this important national resource is developed in a responsible way.



- Working with **Indigenous** peoples and their communities, **stakeholders** and environmental **agencies**, the implementation of monitoring enhancements will ensure installation of necessary infrastructure and appropriate integration with existing monitoring activities in the region. These efforts contribute to an **improved understanding** of the long-term **cumulative effects of oil sands development**.

- URL: https://www.canada.ca/en/environment-climate-change/services/oil-sands-monitoring.html

CDS : Key Questions for a Modernized SDI

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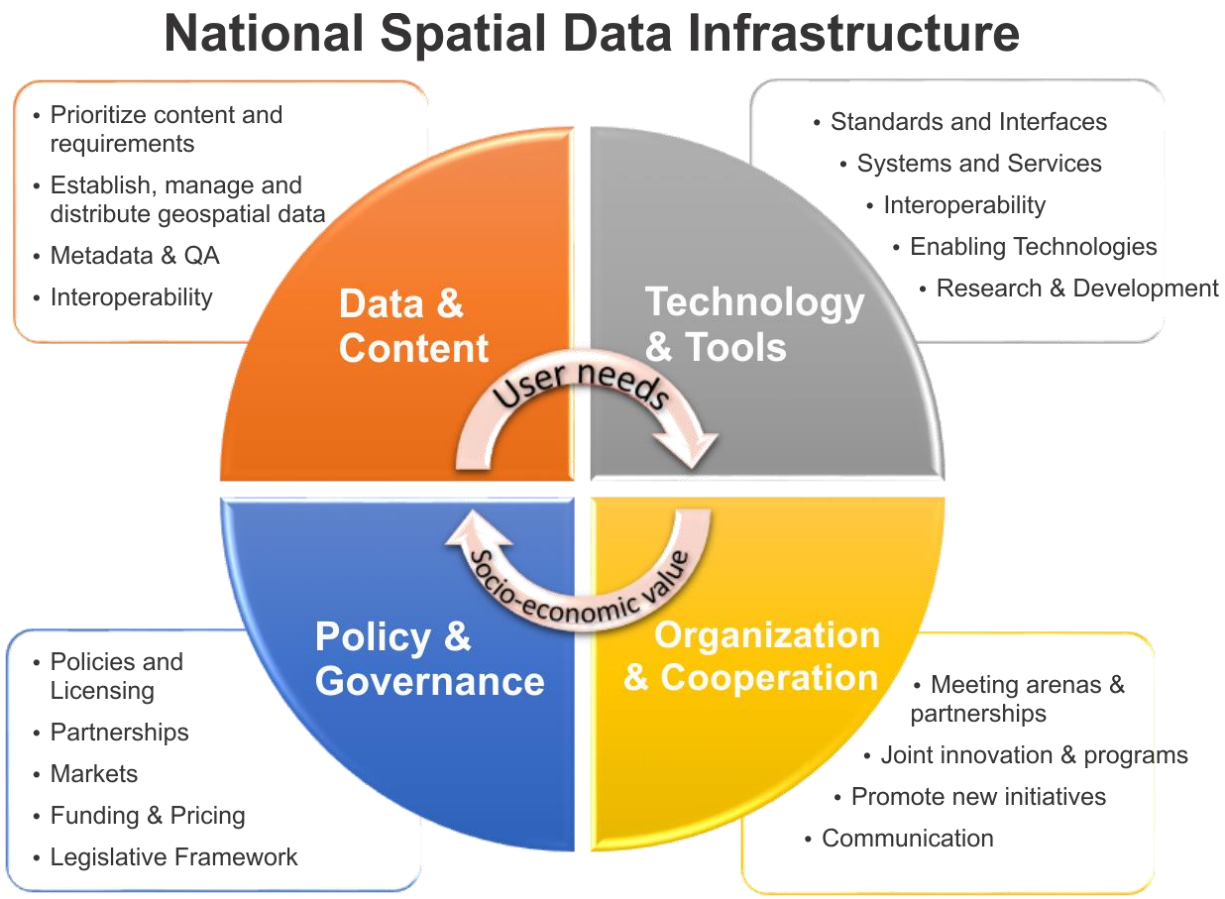
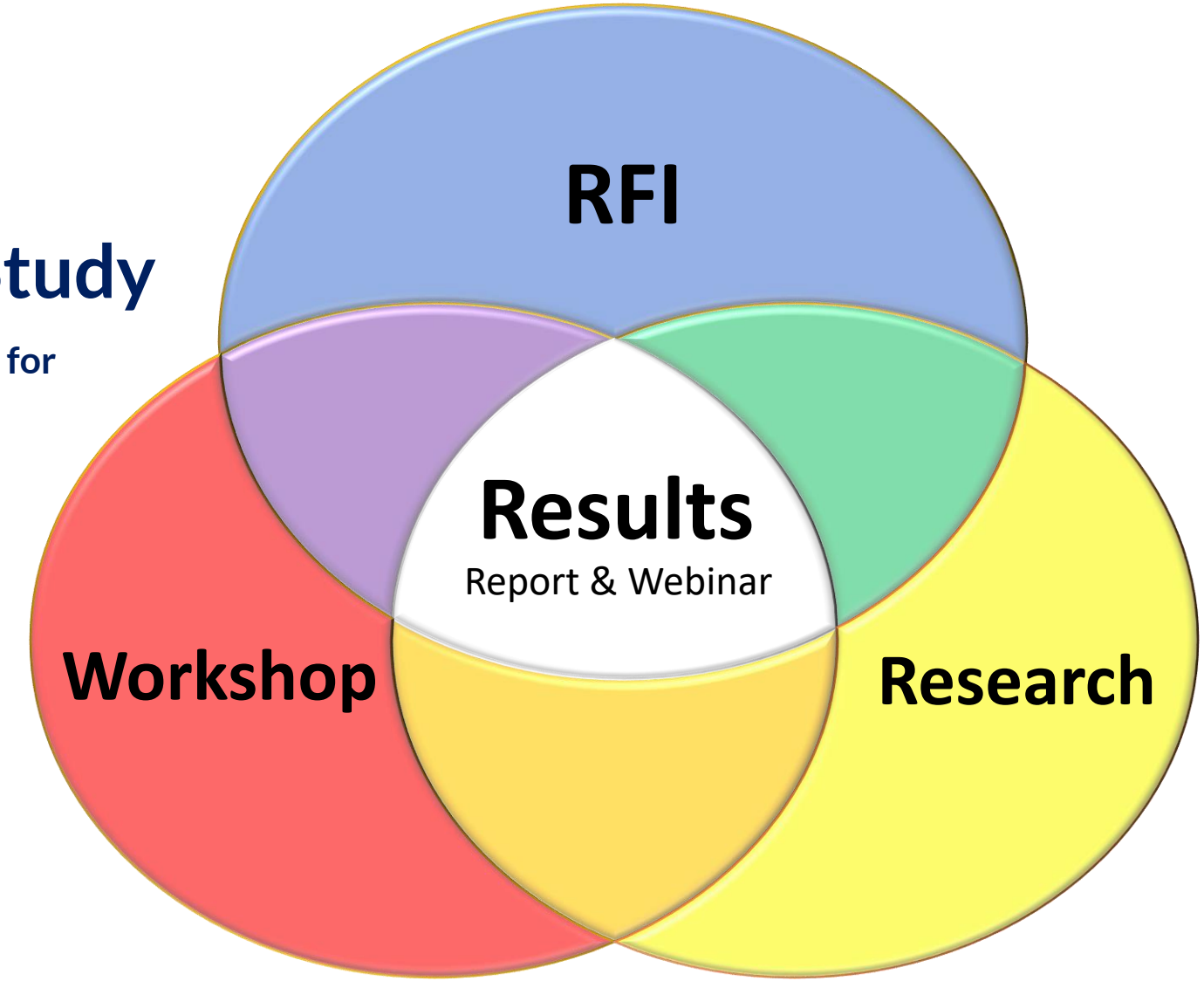


- Are SDIs living up to their expectations?
- Are SDIs delivering the access, *use*, *integration*, *collaboration*, and preservation of spatial data to stakeholders? Are they delivering data that is ***FAIR***?
- Are SDI benefits, to the various stakeholders, being realized?
  - Especially considering regional interests (across jurisdictional boundaries).
- What can be done to increase SDI benefits to the different categories of stakeholders?
- How do the OGC and other international standards fit in?

Concept Development Study

Modernizing SDI: Enabling Data Interoperability for Cumulative Effects



Modernizing SDI CDS: Activities & Schedule

Activity	Date
RFI Issued https://portal.ogc.org/files/92706	March 31, 2020
RFI Responses Due	June 19, 2020
Preliminary Response Analysis and Perform Additional Research	Jul - Aug, 2020
Presentation of CDS Preliminary Results at OGC Member Meeting	Sep 14-18, 2020
Deep Dive Expert Panel and SME / Stakeholder Workshop	***Nov 10, 2020***
Analyze Workshop Input and Integrate Results	December, 2020
Draft CDS Report	by December 31, 2020
Two Public Webinars (English and French)	February 2021
Final CDS Report and Recommendations	by March 31, 2021

Secondary Research

- EUROGI *Beyond SDI* series: 17 Perspectives
  http://eurogi.org/category/beyond-sdi/

- *CGDI User Needs Assessment: NRCan*
  https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=314606.

- From Spatial Data Infrastructures to Data Spaces
  A Technological Perspective on the Evolution of European SDIs:
  European Commission, Joint Research Centre (JRC)
  https://www.mdpi.com/2220-9964/9/3/176

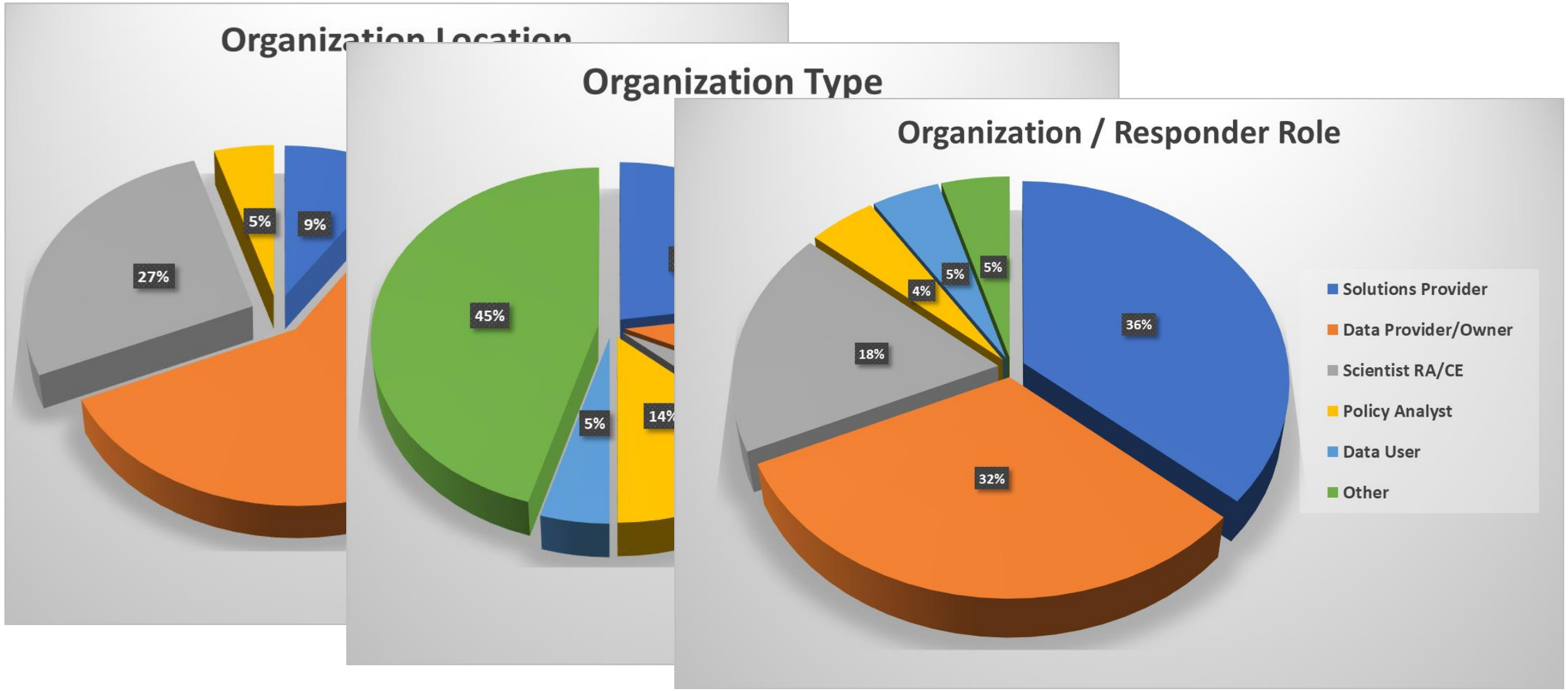
CDS RFI: 8 Categories of Questions

- Stakeholders
- SDIs and Data Architectures
- Data for Regional Assessments/Cumulative Effects Analysis
- Technology and Applications
- Requirements
- Usage Scenarios
- Operation and Organization
- Other Factors

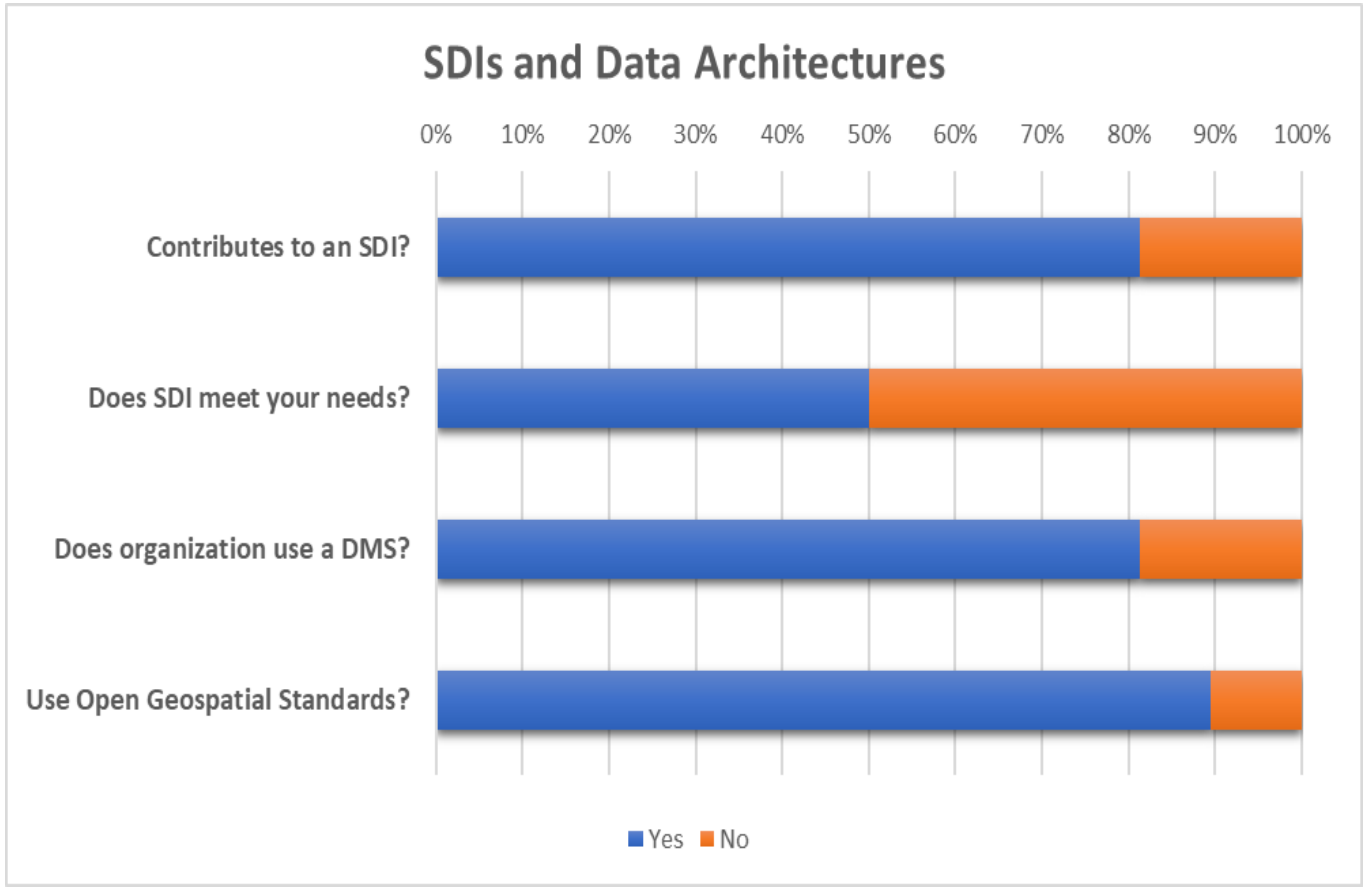
RFI Responders (22)

- Arctic SDI (Arctic)
- CRIM, Computer Research Institute of Montreal (Canada)
- CubeWerx (Canada)
- Cyient Limited (India)
- DFO – Flood Observatory, at the University of Colorado (USA)
- Ecere (Canada)
- Esri Canada (Canada)
- Fisheries and Oceans Canada (Canada)
- GeoCat (Netherlands)
- Government of Alberta (Canada)
- Government of Saskatchewan: Saskatchewan Ministry of Environment, Cumulative Impacts and Science
- Geomatys (France)
- Health Solutions Research (HSR) (USA)
- JRC (European Commission)
- KU Leuven Be: Public Governance Institute (Belgium)
- Natural Resources Canada (GeoConnections)
- Netherlands' Kadaster Land Registry and Mapping Agency (Netherlands)
- Nunatsiavut Government (Canada)
- PatternedScience (Canada)
- SensorUp (Canada)
- Skymantics Europe, SL (Spain)
- United Kingdom Hydrographic Office

Preliminary Results: Who Responded to the RFI

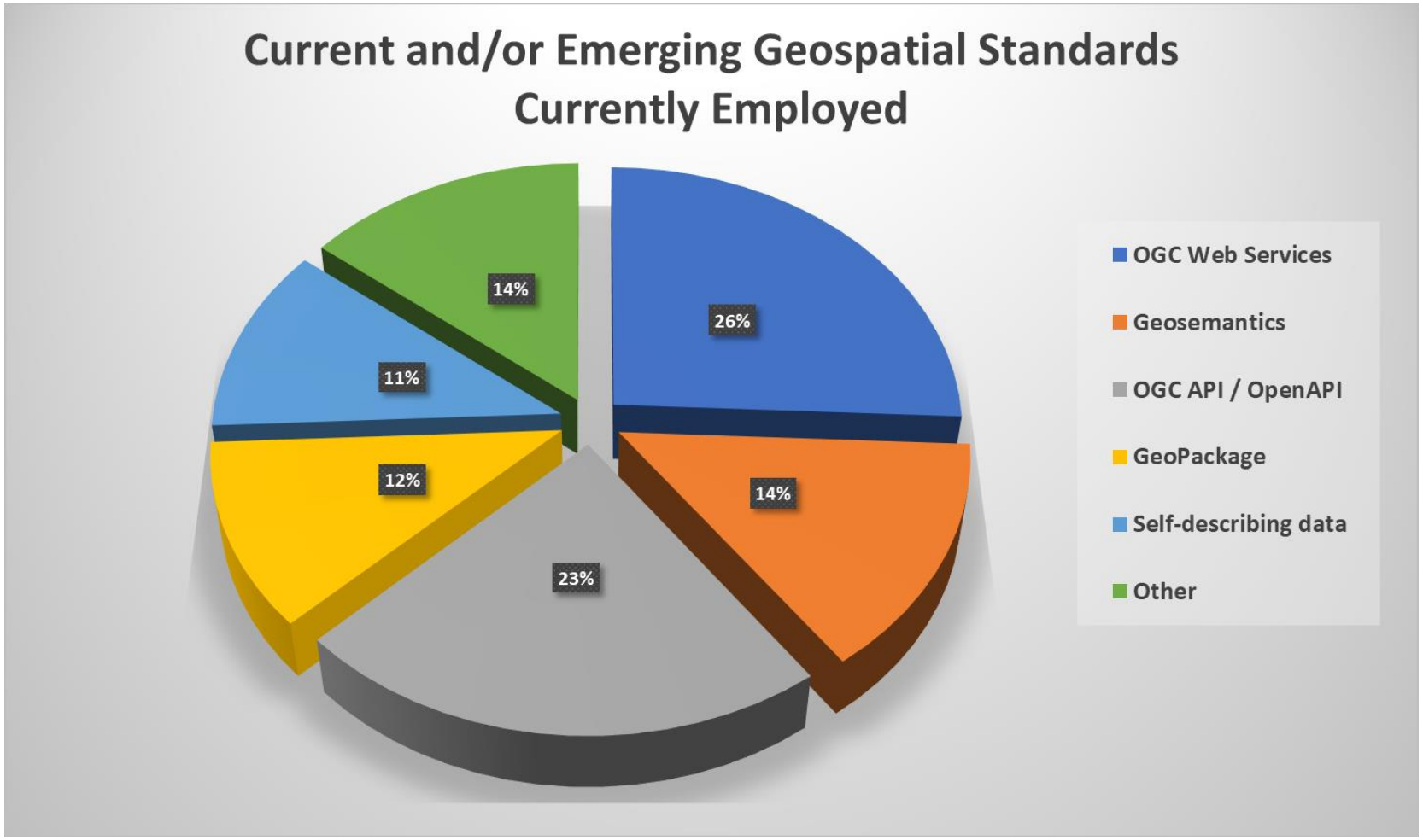


Preliminary Results: SDI and Architectures



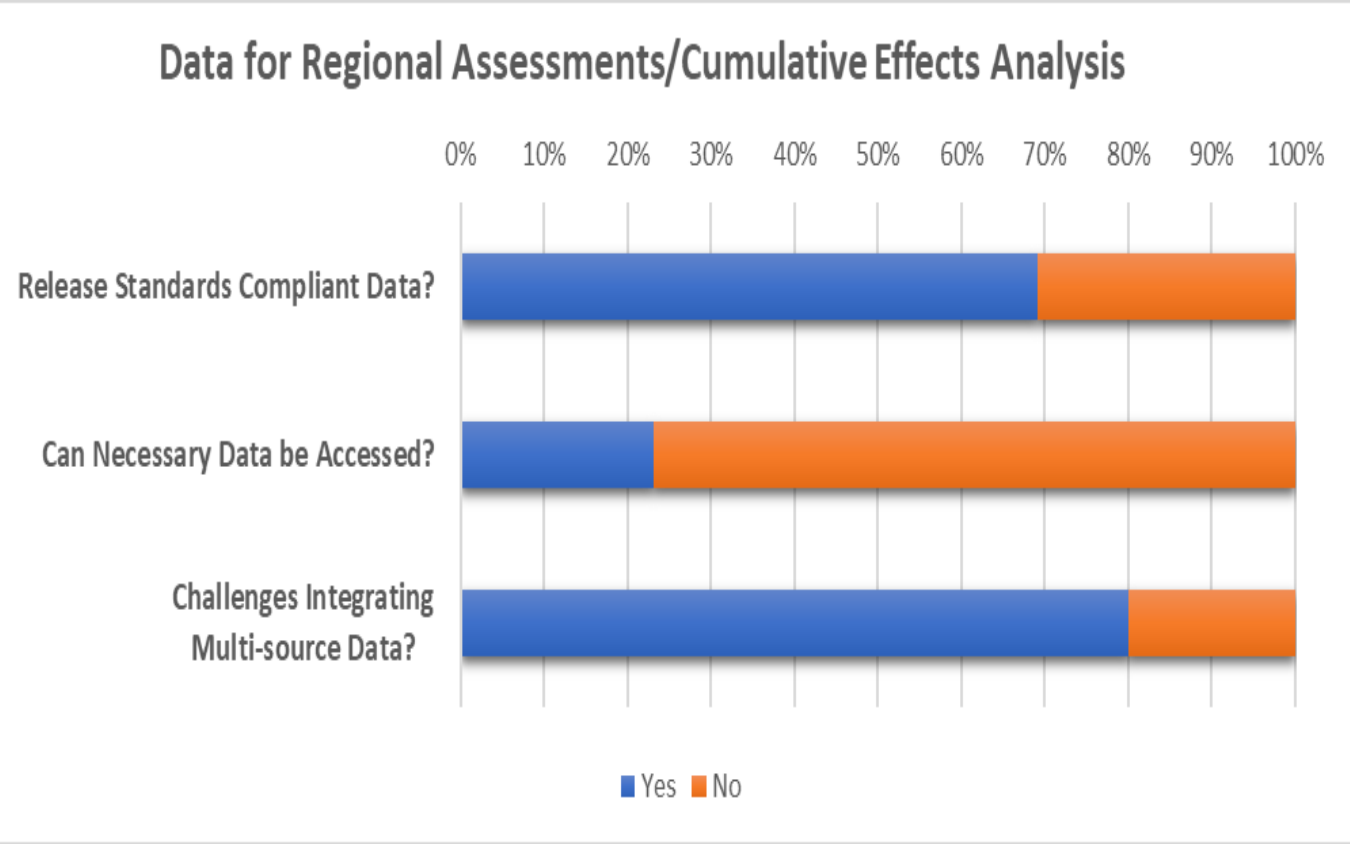
- **Over 80%** of respondents **contributed to SDIs** indicating a broad use of SDIs for this group.
- Nearly **90%** of RFI respondents noted the **use of open geospatial standards** in their organization.
- However, **over 50%** of respondents indicated that SDIs are not necessarily meeting users needs.

Preliminary Results: Standards Employed



Almost 50% of respondents currently employ OGC Web Services and APIs

Preliminary Results: Data for CE / RA

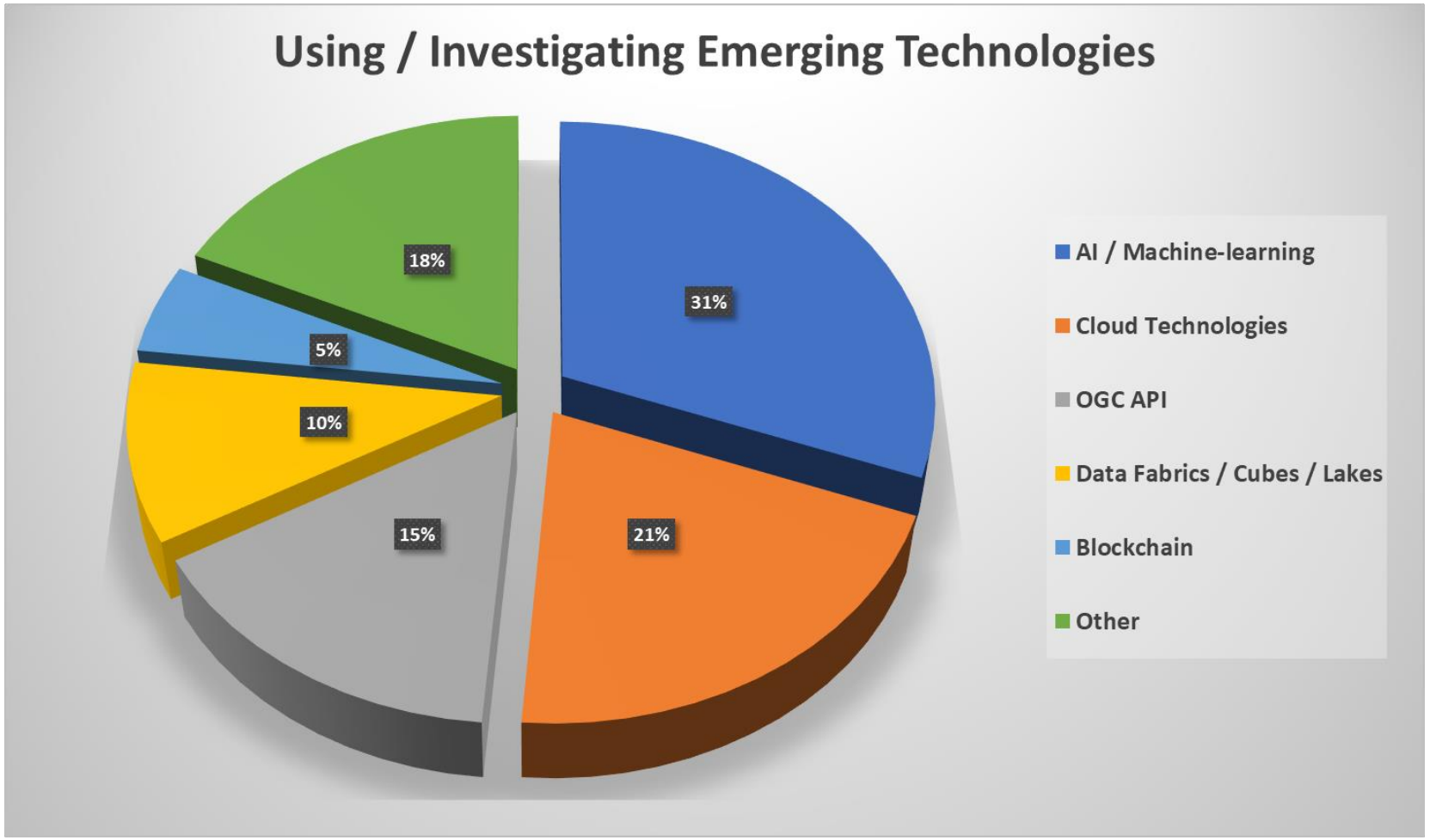


- Most respondents, almost **80%**, **encounter challenges** when trying to integrate disparate data (different sources, times, etc.).
- Less than **25%** of RFI respondents can access the data required for their work indicating **over 75% cannot access the data they need**.

Preliminary Results: Challenges

- Integration of mass quantities and diverse types of information from multiple provincial/state/ municipal/territorial stakeholders to create national-level products.
- Data Discovery and Access - existing geospatial services can be difficult to *easily* discover and access.
- Significant limitations and restrictions on sharing / integrating health data.
- Traditional Knowledge and Scientific Data - western stakeholders understanding of Indigenous geospatial concepts may be limited.
- Standards usage generally remains limited to experts with strong technical knowledge.
- Accessing training datasets to support machine learning applications.
- Geometry / Attribute / Projection Incompatibility.
- Data Preprocessing Required before use.
- Language and licensing issues.
- Making data available for a SDI can be expensive, time-consuming, and is a lower priority for many organisations.

Emerging Technology Solutions



Over 50% of respondents are using or investigating ML and Cloud Technologies to help meet some of the challenges

What we heard: Technologies for Increased Interoperability

- Machine Learning and Cloud Services leveraged against data mined from web services, Open APIs, and other sources, may provide valuable solutions in resolving interoperability challenges.

- With SDI modernization, there maybe an opportunity for a more prominent role of data intermediaries that will help bridge the *gap* between the providers, and users, of data.

- Improved Geospatial / Health integration maybe possible using improved analytics to bring together digital health records and health trends with geospatial data (e.g. clusters, hot spots, etc.).

- Discovery of existing geospatial data and services can be improved by using more advanced analysis (semantics, NLP) of data and services to improve metadata information.

Modernizing SDI:

- Several key questions that the following panels will help address.
  - Articulating the Challenges to Data Interoperability.
    - What is the current state of SDIs?
    - How is their use of current or emerging standards and advanced technology enabling data interoperability?
  - SDI Vision
    - How SDI Modernization will improve the availability and interoperability of geospatial data across various regions or jurisdictions?
    - How SDI Modernization will help achieve intelligent, inferential, machine-driven solutions that support and enable improved, efficient geospatial data interoperability?

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Thank You!

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Web: **ogc.org/mod-sdi**