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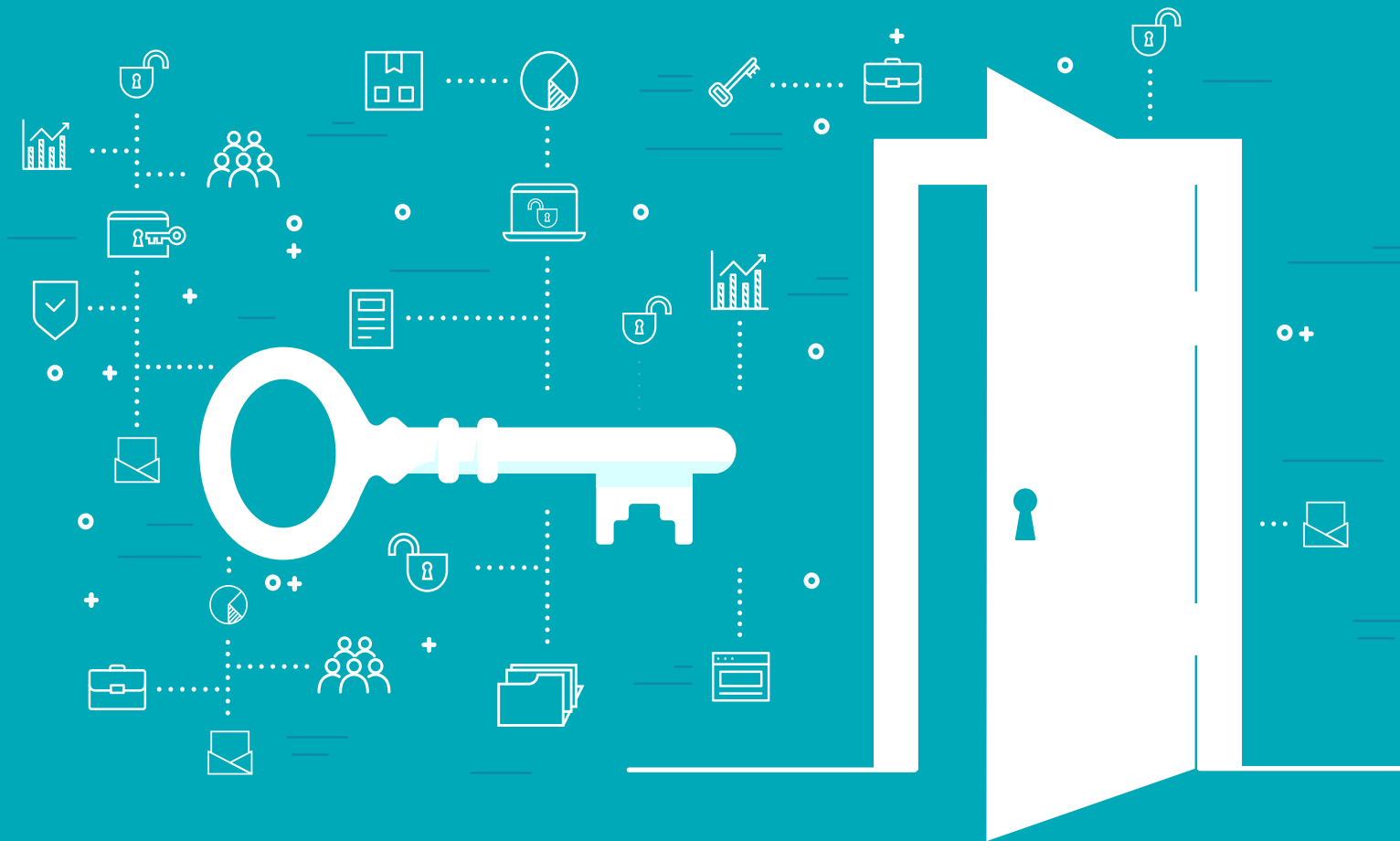
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Roadmap for Open Science (Canada)

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ROADMAP FOR OPEN SCIENCE

FEBRUARY 2020

Office of the Chief
Science Advisor of Canada

Bureau du conseiller
scientifique en chef du Canada

Canada

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This Roadmap outlines next steps that should be taken to make federal science open to all, while respecting privacy, security, ethical considerations and appropriate intellectual property protection. It has been informed by the work of the Open Science Roadmap Advisory Committee, chaired by Leslie Weir. The Committee worked diligently under tight timelines and delivered unanimous principles that guided my recommendations. The Roadmap was further refined thanks to the thoughtful feedback received from the federal departments, agencies and granting councils.

I want to acknowledge the work of all committee members that brought diverse perspectives to the discussion, including Tammy Clifford, Martha Crago, Chad Gaffield, Luc Gagnon, Sarah Gallagher, Danika Goosney, Nancy Hamzawi, André Loranger, Donna Kirkwood, Gilles Patry, Bo Wandschneider and Dan Wayner. I particularly want to thank Leslie Weir for her leadership in chairing the committee. I look forward to working together and making science accessible to all.

Mona Nemer
Chief Science Advisor of Canada

OBJECTIVE

The objective of the Roadmap for Open Science is to provide overarching principles and recommendations to guide Open Science* activities in Canada. The recommendations are intended for science and research funded by federal government departments and agencies.

VISION

To make Canadian science* open to all, maximizing benefits for the well-being, health and economy of our country.

WHY OPEN SCIENCE

Open Science makes scientific information available to all. The benefits include:

Ensuring Accountability: Open Access to scientific research outputs provides greater accountability to taxpayers and research funders.

Increasing Reproducibility: Open Science enables the scientific community to evaluate the reproducibility of scientific results.

Creating Open Engagement: Open and accessible science fosters public dialogue about, understanding of, and public confidence in, science.

Reducing Duplication: Open Science minimizes duplication of efforts and enables more efficient and effective use of research investments.

Creating Opportunities for Impact: Open Science accelerates the discovery process by allowing others to build on previously validated discoveries and research contributions and to create opportunities for innovation and prosperity.

Leveraging Diversity and Inclusion: Open Science creates opportunities to benefit from the diversity of knowledge systems and perspectives.

Accelerating Knowledge Transfer: Open Science reduces delays in the sharing and re-use of scientific information.

Building Synergies with International and Domestic Open Science Movements: Governments around the world are embracing Open Science. Canada has an opportunity to be a part of this movement to shape the global vision of Open Science.

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* Asterisk denotes words defined in the Appendix.

CONTEXT

The Roadmap for Open Science was developed in the context of the Directive on Open Government, the Model Policy on Scientific Integrity and the Data Strategy Roadmap for the Federal Public Service. It builds on the Tri-Agency Open Access Policy on Publications and the Statement of Principles on Digital Data Management.

A federal approach to supporting Indigenous data strategies is outlined in the Data Strategy Roadmap for the Federal Public Service, Recommendation 8. For this reason, Indigenous knowledge and rights to self-determination are not explicitly covered in this roadmap and its recommendations.

PRINCIPLES

1. **PEOPLE:** Open Science is a shared commitment between all stakeholders. The scientific community is integral to Open Science and needs to be meaningfully engaged at every stage of the process, including the design, implementation and evaluation of its effectiveness and impact.

2. **TRANSPARENCY:** Scientific research outputs are "Open by Design and by Default"; they are "FAIR", i.e. Findable, Accessible, Interoperable and Reusable. Withholding scientific research outputs requires a valid reason consistent with a framework (to be developed) on which scientific information will be kept private or confidential.

3. **INCLUSIVENESS:** In achieving Open Science, diverse and inclusive approaches are used, reflecting the breadth of perspectives across scientific communities and knowledge systems.

4. **COLLABORATION:** Open Science enables collaborations between and among intramural and extramural science communities, within Canada and globally.

5. **SUSTAINABILITY:** The practice of Open Science requires a sustainable approach with concrete steps forward and the commitment necessary to achieve the long-term vision.

RECOMMENDATIONS

1. **Canada should adopt an Open Science approach to federally funded scientific and research outputs.**

   This recommendation sets the tone for the document and for the recommendations that follow. Given the complexities associated with adopting an Open Science approach, implementation should take a phased approach.

2. **Federal departments and agencies should conduct intradepartmental consultations with the science community before June 2020 to seek feedback on, and address in the action plan, the challenges and opportunities of Open Science. These should be led by the Department's Open Science Champion(s), e.g., Departmental Science Advisor, Chief Science Officer, Assistant Deputy Minister and Vice President Science.**

   This recommendation aims to engage federal researchers and scientists in identifying challenges and concerns, as well as benefits and tools that would enable employee participation in Open Science activities. Feedback received should inform the Open Science action plans (Recommendation 3). This recommendation is consistent with the Model Policy on Scientific Integrity section 7.7, *Role of employees in science advice and evidence-informed decision-making,* in particular clauses 7.7.1 – 7.7.3.

3. **To achieve the overall objective of Open Science, and taking into consideration feedback from intradepartmental consultation (Recommendation 2), departments and agencies should develop action plans for Open Science by October 2020. This should include plans for a common, phased approach towards making federal science open (taking into account Recommendations 4, 5 and 7) and readily and easily available to Canadians.**

   Newly generated scientific research outputs produced by federal scientists and researchers, as well as scientific research outputs that were contracted by federal departments and agencies need to be made "Open by Design and by Default." For legacy data, a responsive action plan should be developed to share data requested with time-bound commitment for delivery.

   Federal departments and agencies should collaborate on central approaches to common elements of their plans to achieve this recommendation, particularly, in terms of IT solutions, guiding principles with regards to official languages, web-accessibility and timelines. The Chief Science Advisor will facilitate, as necessary.

   The action plans should include a performance measurement element. Metrics for Open Science have been developed by the Open Science Metrics Working Group convened by Environment and Climate Change Canada, these should lay a foundation for the performance measurement element of the action plans.

4. **Federal departments and agencies should make federal science articles* openly accessible by January 2022 and federal science publications* openly accessible by January 2023, while respecting privacy, security, ethical considerations and appropriate intellectual property protection.**

This recommendation aims to achieve Open Access by default without an embargo period. It applies to new science articles published in academic scholarly journals as of January 2022, as well as new federal science publications released as of January 2023. This recommendation also applies to new science articles and publications that were contracted by a federal government department or agency and published as of January 2023. For legacy publications, a responsive action plan should be developed to share publications requested with time-bound commitment for delivery. When a research project and resulting publication have received support from multiple funders, the federal government should uphold the most open of the Open Access policies.

This recommendation is consistent with the Model Policy on Scientific Integrity, section 6.3, *In the absence of clear and compelling reasons for limiting disclosure, ensure that research and scientific information produced by a department or agency is made available to the public in a timely manner and in keeping with the Government of Canada's Directive on Open Government.*

The federal science community should use a common approach to achieving this recommendation. It may explore the opportunity to develop shared tools and infrastructure to meet this target. The Chief Science Advisor will facilitate, as necessary.

5. **Federal departments and agencies should develop strategies and tools to implement FAIR data principles to ensure interoperability of scientific and research data* and metadata standards by January 2023, with a phased plan for full implementation by January 2025.**

This recommendation aims to ensure that the scientific information that is open is also "Findable, Accessible, Interoperable and Reusable" (or "FAIR") in order to maximize the benefit. It is aligned with the Data Strategy Roadmap for the Federal Public Service.

A pre-requisite for the implementation of FAIR data principles is strong data management practices, including annotation and curation to the most updated standards (e.g. current data and metadata standards). When commonly agreed data and metadata standards are not available, meaningful engagement and coordination with the extramural and international scientific communities and disciplinary societies may be required to achieve interoperability of scientific and research data and metadata.

The federal science community should use a common approach to achieve this recommendation. This should be co-led by the Treasury Board Secretariat (Chief Information Officer) and the Office of Chief Science Advisor.

6. **In order to enable the "Open by Design and by Default" model for scientific research outputs, the Chief Science Advisor will work with the federal science community and other government departments and agencies to develop by December 2020 a framework identifying criteria for when restricting access to federal scientific research outputs is warranted.**

   This recommendation aims to provide a whole-of-government approach to identifying what scientific research outputs should be kept private or confidential.

7. **The Data Strategy Roadmap and the Open Science Action Plan should be aligned. For this to happen, consideration should be given to scientific and research data when developing and implementing data strategies in response to the 2018 Data Strategy Roadmap for the Federal Public Service. To facilitate that, deputy heads should designate a Chief Scientific Data Officer by June 2020. As relevant, this can be a stand-alone position or responsibility can be integrated into the scope of an existing position, e.g. Departmental Science Advisor, Assistant Deputy Minister and Vice President Science.**

   This recommendation aims to promote coordination between the Open Data, Open Science and Science Data Management work happening within the Government of Canada. Furthermore, coordination between Chief Scientific Data Officers, Chief Information Officers, Chief Data Officers, Open Science Champions and Open Government Champions will be critical for effective implementation of Open Science action plans.

8. **Successful and harmonized implementation of the Open Science Action Plans should be supported by a new high-level Open Science Steering Committee co-chaired by the Chief Science Advisor and either or both the Chief Information Officer of Canada and the President of Shared Services Canada.**

   This recommendation articulates a governance structure that would oversee the design and implementation of Open Science Action Plans. Through establishing a governance structure, it aims to ensure harmonized implementation of the Open Science Action Plans. The terms of reference and relationship structure with departments and agencies should be developed by June 2020.

9. **An Open Science strategy for federally funded research conducted outside of federal government agencies and departments should also be developed. The Chief Science Advisor could conduct such an exercise in partnership with the federal granting agencies (e.g. through the Canada Research Coordinating Committee), learned societies and provincial and territorial funders. These consultations should target scientific communities and their administrative leadership. The consultation should be completed by December 2021.**

   This recommendation articulates the need for a coherent Open Science strategy for Canadian science more broadly, while respecting privacy, security, ethical consider-ations and appropriate intellectual property protection. A consultation with the extramural scientific community and relevant partners should guide this strategy.

10. **The Chief Science Advisor should monitor the dynamic international context and make recommendations to ensure that the Open Science strategy for federally supported intramural and extramural science continues to keep pace with international developments.**

This recommendation highlights the dynamic and evolving nature of Open Science. As digital technology and Open Science practices evolve over time, the Roadmap will also evolve. The list of principles is not exhaustive and will continue to develop over time. Further considerations might also emerge in conversations with scientists, researchers and open science users.

APPENDIX: DEFINITIONS

Open Science: The practice of making scientific inputs, outputs and processes freely available to all with minimal restrictions. Scientific research outputs include (i) peer-reviewed science articles and publications, (ii) scientific and research data and (iii) public contribution to and dialogue about science. Open Science is enabled by people, technology and infrastructure. It is practiced in full respect of privacy, security, ethical considerations and appropriate intellectual property protection.

Science: The pursuit and application of knowledge and understanding of the natural world through application of one or more elements of the scientific method. In the context of this roadmap, it is understood to include both fundamental and applied natural, physical, biomedical and social science, as well as engineering and mathematics.

Federal science articles: Scholarly articles authored or co-authored by federal scientist(s) or researcher(s) in peer-reviewed academic journals.

Federal science publications: Scientific communications that scientists and researchers use to share their work. These include research or scientific reports, monographs, edited books, book chapters, conference proceedings, conference papers, conference contributions, posters, plain language summaries and technical scientific products. These publications have been validated by a peer-review process.

Scientific and research data: Data that include, but are not limited to, observational, monitoring, operational, modelling and simulation, risk-assessment, survey and surveillance, research and development and technology innovation data.

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