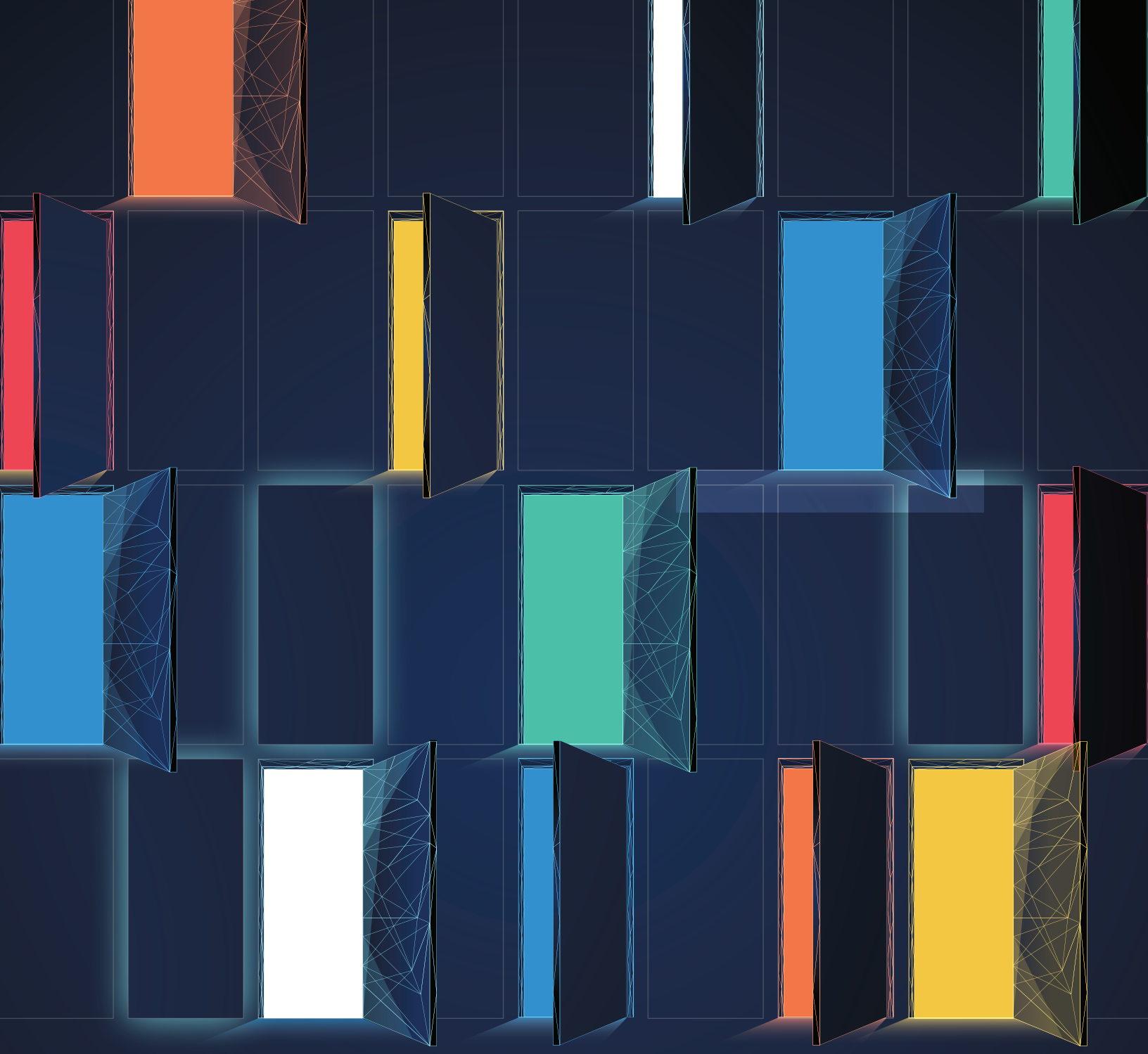

A Framework for **Implementing Open-by-Default** with Federal Government Science

JANUARY 2021

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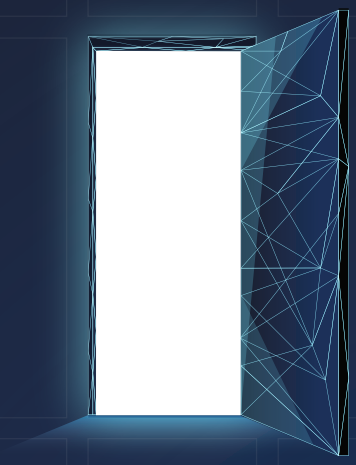

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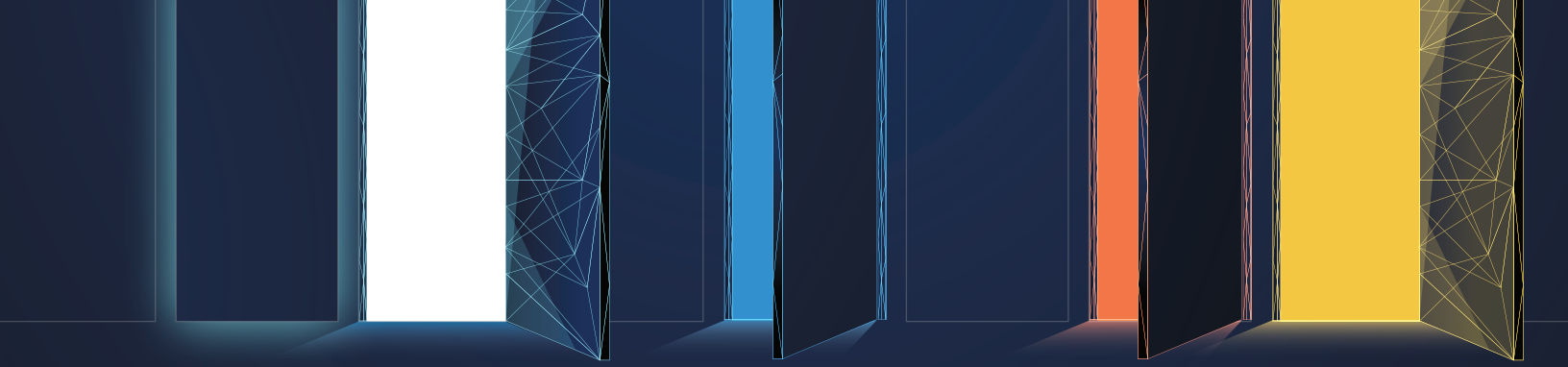


Preamble

Around the world, researchers and decision makers are becoming increasingly aware of the value and importance of open science. With the growing body of evidence that scientists engaged in global collaboration can achieve breakthroughs far more quickly than individual research teams, there is strong momentum behind fully open science.

We have seen the value of this approach most recently in the response to COVID-19. Canadian science funding organizations signed a joint statement in early 2020 to openly share COVID-19 research data and findings. In addition, I and my counterparts from 15 countries issued a joint call for open access to COVID-19 publications in March 2020. Both these initiatives were well received by the global publishing community, and the vast majority of coronavirus research is now open. Moreover, the Government of Canada's COVID-19 data is freely available online, providing citizens with reliable information and empowering them to make informed decisions about their lives. The COVID-19 crisis has shown how open-science practices can accelerate discovery and increase trust in both science and science-informed government policies.

Canada's commitment to open science predates the pandemic. In fact, when I was appointed Canada's Chief Science Advisor over 3 years ago, I was asked to provide guidelines to ensure that government science is available to the public. To achieve that goal, I worked with international and domestic colleagues to develop the Roadmap for Open Science, announced by the Honourable Navdeep Bains, Minister of Innovation, Science and Industry, in February 2020.

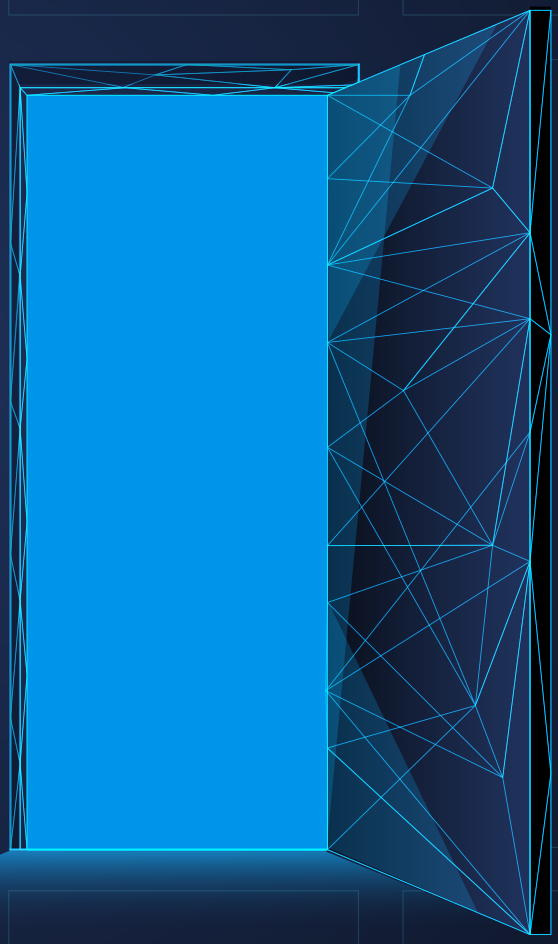
This guidance document is one of a series of actions stemming from the Roadmap to support scientists with the timely release of federal research outputs, either conducted or funded by the organization, while presenting criteria on how to manage privacy, security, ethical considerations and appropriate intellectual property protection. This document has incorporated open-by-design as part of its approach to implementing the Roadmap.

I want to acknowledge the work of all the Open-by-Default Framework committee members who brought diverse perspectives to the drafting of this guidance document, namely Corinne Charette, Jonathon Dewar, Sarah Gallagher, Brian Gray, Jean-François Morel, Isabelle Steers, Carolyn Watters and Rita Whittle. I particularly want to thank George Enei for his leadership in chairing the committee. The committee worked diligently under tight timelines and during the COVID-19 pandemic, and was further informed thanks to the thoughtful feedback received from federal departments, agencies, granting councils, and thought leaders throughout the public service and academia.

This guidance will be the object of review and improvement in the years to come. I look forward to working together and making science accessible to all.

Mona Nemer, Chief Science Advisor of Canada

1 Introduction



This document was developed in response to the need for common guidance in the application of the Roadmap for Open Science, more specifically, Recommendation 6, which calls for "a framework identifying criteria for when restricting access to federal scientific research outputs is warranted."

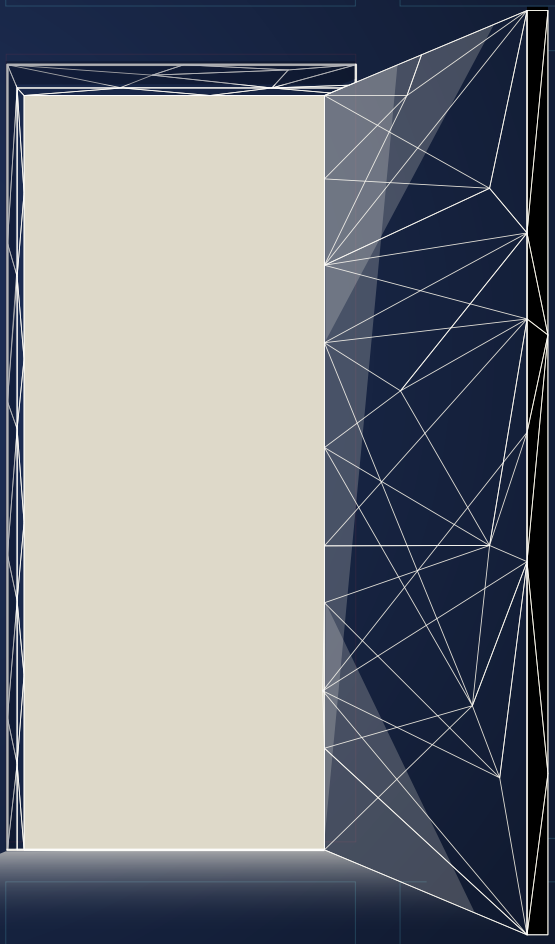
The Roadmap highlights open-by-default as a founding tenet of managing the availability of scientific research outputs. Similarly, the Directive on Open Government aims to "maximize the release of government information and data of business value to support transparency, accountability, citizen engagement, and socio-economic benefits through reuse, subject to applicable restrictions associated with privacy, confidentiality, and security." In line with the Roadmap and the Directive, the Model Policy on Scientific Integrity recognizes that the timely release of scientific and research information is integral to the culture of government scientific integrity and instrumental to public trust in science.

The information in this guidance document has been developed using a variety of sources, from legislation to best management practices. There is no new policy presented. The aim of this guidance document is to support federal scientists in departments and agencies, who partner with access to information and privacy (ATIP), intellectual property (IP) and information management (IM) officers and other subject-matter experts, to ensure the timely, secure and resource-effective release of the outputs of federal research, either conducted or funded by the organization. The guidance document supports implementation by outlining criteria on which decisions to withhold publication should be based. It should be used to guide all decisions going forward as of the document's effective date. Scientific research outputs should be accessible when there is no justification for them to remain closed.

The guidance document is a model that can be adopted or adapted by individual federal departments or agencies on the basis of their disciplinary norms and operating circumstances (for example, defence, national security and health).

All hyperlinks and references to legislation and policy instruments are current at the time of publication.

2 Definitions



The following definitions reflect or build upon those presented in the Roadmap for Open Science:

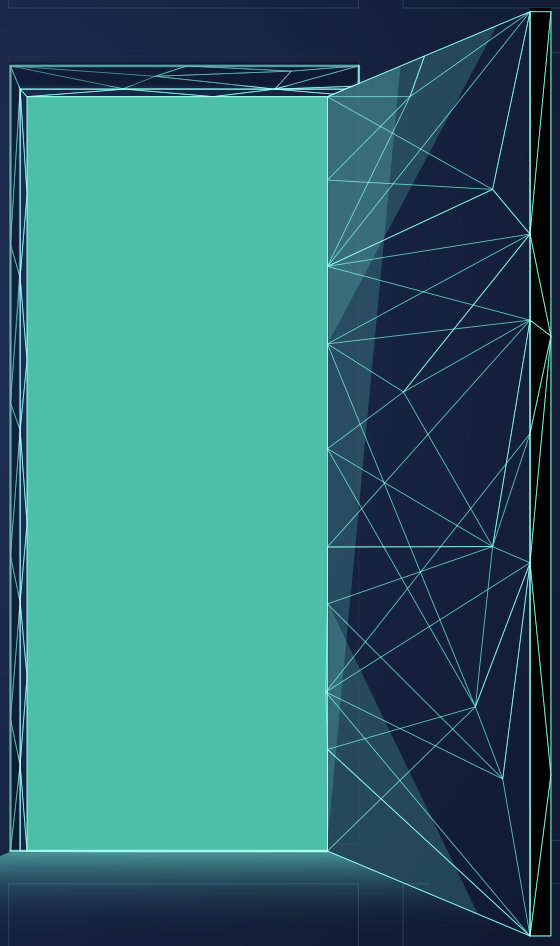
- **Open science:** The practice of making scientific inputs, outputs and processes freely available to all with minimal restrictions. Open science is enabled by people, technology and infrastructure. It is practised in full respect of privacy, security, ethical considerations and appropriate intellectual property protection.
- **Technology:** The branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society and the environment, drawing upon such subjects as industrial arts, engineering, applied science and pure science.
- **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.
- **Scientific research outputs:** These include, but are not limited to, peer-reviewed science articles and publications, scientific and research data, and contributions to public dialogue about science.

The Roadmap recommendations focus on the following outputs of federal scientific research, either conducted or funded by the organization:

- **Federal science articles:** Scholarly articles authored or co-authored by federal scientists or researchers 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.
- **Scientific and research data:** Data that include, but are not limited to, observational, monitoring, operational, modelling and simulation, risk assessment, survey and surveillance, diagnostics and targeted survey, research and development, and technology innovation data.

Each of the categories above (articles, publications and data) includes tools such as software and protocols used for the development of the scientific research output.

3 Objectives and expected results



3.1 Keeping pace with a changing environment

Scientific knowledge and associated technologies continue to evolve. Digital technologies have rapidly influenced the growth, storage and sharing of knowledge. Government must keep pace with this evolution through policy development and regulatory reform.

Open-by-default is a principle that assists federal science organizations in achieving government transparency and accountability. It also contributes to the potential for new discoveries and collaborations in areas not traditionally considered. COVID-19 has clearly demonstrated the possibilities of non-traditional partnerships based on purpose-driven discovery with new publicly available information.

This document is intended to support federal scientists in managing open-by-default decision making. The advice contained in this document is not intended to be read in isolation, but rather, in conjunction with existing government policies and procedures for information management. For complex cases, where additional guidance is needed, an advisory committee led by the Office of the Chief Science Advisor can provide additional feedback to aid organizational decision making. The decision to keep certain research outputs closed ultimately lies with the departments or agencies that produced the output.

3.2 Ensuring scientific discovery and collaboration are supported

Releasing scientific information contributes to the growth and advancement of knowledge, and is a critical component of the scientific process because it enables others to reproduce and validate scientific results. In addition, the sharing of data and results provides the opportunity for new scientific discoveries. It also facilitates scientific cooperation across organizations and jurisdictions, creates economic growth through better opportunities for innovation, increases resource efficiency, improves transparency and accountability in the disbursement of public funds, and increases transparency to ensure greater public trust in research. The open publication of scientific results is a pillar of digital science practices, which enable collaboration and problem solving on an unprecedented scale.

Enhanced access, however, also bears associated risks related to privacy, intellectual property, national security, constitutional and other commitments to Indigenous peoples, and the public interest. These risks need to be adequately communicated and responsibly managed. Legislation, regulations and directives on information management are available (see section 7 for a list of domestic and select international references and

COVID-19 has clearly demonstrated the possibilities of non-traditional partnerships based on purpose-driven discovery with new publicly available information.

resources), but there is no specific federal guidance document aimed at the federal scientist, working with ATIP officers, to guide assessment on whether it is appropriate to withhold scientific outputs from disclosure. Responsibly managing these risks also involves working with IP and IM officers to determine the approach and tools to be used to achieve the right degree of openness and security.

Federal science-based departments and agencies have to make decisions about managing access and the timing of access to scientific results as part of implementing the Model Policy on Scientific Integrity and the Directive on Open Government, as well as fulfill their commitment to the overarching principles of Canada's Roadmap for Open Science. Those documents work in parallel to manage open-by-default for the design, conduct, communication, management and review of research, science or related activities.

3.3 Applying existing government information and management policies to scientific research

Release of scientific research outputs should always conform to current legal, ethical and regulatory frameworks. Relevant acts and directives include the following:

- The *Access to Information Act* gives Canadian citizens, permanent residents, and any person or corporation present in Canada the right to access records of government institutions that are subject to the Act. The *Access to Information Act* provides that any necessary exemptions should be limited and specific.
- The *Privacy Act* gives Canadian citizens, permanent residents, and individuals present in Canada the right to access their personal information held by government institutions that are subject to the Act, and protects that information against unauthorized collection, use, retention and disclosure. The Act is complemented by other acts and procedures for access to personal information, such as the Interim Policy on Privacy Protection.
- Other acts, notably those related to the implementation of the Chemical Weapons Convention, the Biological and Toxin Weapons Convention, the Defence Production Act, or acts governing explosives, controlled goods or export and import permits, may also apply.
- The Directive on Open Government aims to maximize the release of government information and data of business value to support transparency, accountability, citizen engagement, and socio-economic benefits through reuse, subject to applicable restrictions associated with privacy, confidentiality and security. All data resources of business value held by Government of Canada departments should be open by default and released as open data unless subject to valid exceptions such as ownership, security, privacy and confidentiality, as determined by the department. The Treasury Board of Canada Secretariat (TBS) has supported departments and agencies in the development of their decision-making and approval processes for legal and policy issues by providing a release criteria checklist and other guidance tools.
- The objective of the Roadmap for Open Science is to provide overarching principles and recommendations to guide open science in Canada. The recommendations are intended for use by scientists and researchers in federal government departments and agencies.
- The Model Policy on Scientific Integrity supports and promotes scientific integrity in the design, conduct, management, review and communication of research, science, and related activities. Scientific organizations recognize that stakeholder trust in the research and scientific information provided by the federal government depends upon the integrity of the process by which such information is produced, managed and communicated. Furthermore, federal organizations recognize that scientists and researchers must uphold and conform to standards of excellence accepted by the wider research and scientific community. In the absence of clear and compelling reasons for limiting disclosure, research and scientific information produced by federal organizations should be made available to the public in a timely, secure and resource-effective manner and in keeping with the Government of Canada's Directive on Open Government.

The objective of the Roadmap for Open Science is to provide overarching principles and recommendations to guide open science in Canada. The recommendations are intended for use by scientists and researchers in federal government departments and agencies.

- The Values and Ethics Code for the Public Sector (Public Sector Code) outlines the values and expected behaviours that guide public servants in all activities related to their professional duties. By committing to these values and adhering to the expected behaviours, public servants strengthen the ethical culture of the public sector and contribute to public confidence in all public institutions. Adherence to the Public Sector Code is one of the terms and conditions of employment. The Public Sector Code lists 5 values: respect for democracy, respect for people, integrity, stewardship and excellence.
- The Policy on Government Security sets out expectations, responsibilities and consequences for all employees of the Government of Canada, including safeguarding information and assets under their control, whether working on site or off site; participating in security awareness and training activities to maintain awareness of security concerns, issues and responsibilities; and maintaining vigilance and reporting changes in circumstances, potential security deficiencies, security incidents, and other security issues through appropriate departmental channels. In addition, a valid security status or security clearance is a condition of employment, contract, appointment or assignment and it may also be established as a condition for other individuals external to government with whom government may need to share or provide access to sensitive or classified information or assets, or access to facilities. Access to sensitive information, assets or facilities is a privilege, not a right. When individuals are granted a security status or clearance, they accept the responsibility for using, handling and protecting sensitive information, assets or facilities that accompany this privilege.

3.4 Sharing and employing best practices

Scientists have a responsibility to communicate their work to their peers and to the public. This has always been part of the scientific method, but the tools for communication have differed throughout the years and differ by field of inquiry.

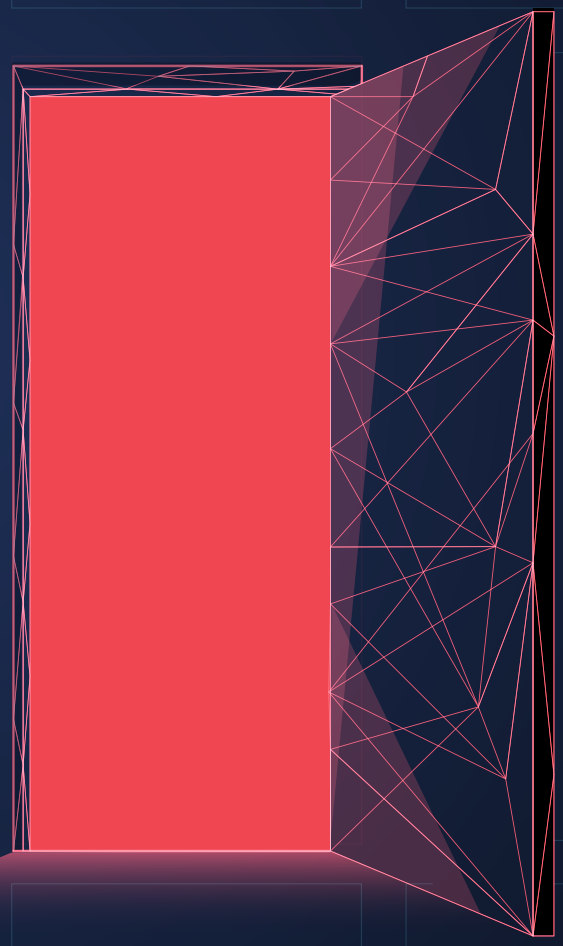
The work of government scientists supports a range of program and policy objectives. At the heart of any scientific research output is the generation of knowledge, and the validity and impact of the outputs relies on their veracity and reproducibility. Open-by-default is a means to that end and its incorporation at the start of a project and its inclusion in ongoing management decisions supports an open-by-design culture.

The unique aspects of practising science create conditions that may make it difficult to practise open-by-default. Owing to an incentive system based largely on publication in specialized journals that are usually associated with commercial publishers, not all outputs are open access. Canada and other nations, through international commitments and domestic prioritization, are moving towards publishing scientific research outputs and making them available in a transparent manner through public fora so that they can be accessible, verifiable and reproducible. The ideas that follow are suggestions, when possible and appropriate, for best practices to achieve these goals:

- Adopt an open-by-design approach by incorporating best practices at the start of the planning phase of scientific projects.
- Provide incentives to federal scientists (for example, by giving greater weight to practising open-by-default in research promotion boards).
- Create systems and provide infrastructure that facilitate disclosure (for example, inventory of pre-approved information sources for automated release; software and tools for better management of information).
- Use technology and processes (such as data in machine-readable formats) to help achieve organizational goals for open-by-default and create an organizational culture that will ensure success.
- Maintain inventories of information holdings, document rationales for not releasing information, employ adaptive management to review the rationales, and have metrics on the use of information / disclosed information, which are all hallmarks of good open-by-default science practices.
- Encourage continuous learning for employees, students, contractors and partners to build awareness and a breadth and depth of understanding that will support data integrity (for example, engaging in discussions about open and reproducible science, especially when it comes to training new scientists and at the design stage of project planning).
- When conducting peer review as an editor, reviewer or dissertation evaluator, consider the evaluated researcher's commitment to and practise of open-by-default based on the availability of their data, publications, etc.

Additional guidance for best practices at different stages of life-cycle management of projects and programs is provided in section 9.

4 Application criteria for managing open-by-default



Open-by-default is the operating premise for managing the availability of scientific research outputs; it applies to all science in the federal government, either conducted or funded by an organization. The guidance below discusses three common factors, as well as specific criteria for defining appropriate access to research outputs, that support scientists, who partner with ATIP, IP and IM officers, when considering the release of scientific research outputs.

The following tabular depiction is designed to help the reader with decision making, with references to the appropriate sections provided. As a complement, a decision tree for releasing scientific research outputs is provided in section 8.

Open-by-default is the operating premise when reviewing information. Any rationale for withholding information, in part or in whole, would need to consider the following common issues:

- ☐ Do the exemption or exclusion provisions set out in the *Access to Information Act* or *Privacy Act* apply to the information? Should an exemption or exclusion be requested under one of those acts? Does all of the information need to be withheld, or can a portion of it be released? (section 4.1.1)
- ☐ Does the scientific information in question, on its own or in combination with other information or data sets, reveal information that was not intended to be shared? If so, this information may need to be anonymized, reformatted, licensed or explicitly assigned to a single party before it is released. (section 4.1.2)
- ☐ Does the preparation of the information for release create an operational burden on the organization that is not commensurate with the value of the information? (section 4.1.3)

Theme-specific considerations:

- ☐ Does the open-by-default release involve Canadian individuals or businesses? Have you considered:
  - personal information, including health information (section 4.2.1.1)
  - external (third party) information (section 4.2.1.2)
  - information obtained in confidence (section 4.2.1.3)
- ☐ Does the open-by-default release involve Indigenous rights or community or regional impacts? Have you considered:
  - Indigenous knowledge and data (section 4.2.2.1)
  - federal–provincial–territorial affairs (section 4.2.2.2)
- ☐ Does the open-by-default release involve economic considerations? Have you considered:
  - economic or strategic interests of Canada (section 4.2.3.1)
  - patents, trademarks and intellectual property (section 4.2.3.2)
- ☐ Does the open-by-default release involve security concerns? Have you considered:
  - hazardous materials; toxic industrial chemicals; and chemical, biological, radiological, nuclear or explosive (CBRNE) research (section 4.2.4.1)
  - dual-use research of concern (section 4.2.4.2)
  - the safety of individuals (section 4.2.4.3)
  - international affairs and defence (section 4.2.4.4)
  - law enforcement and investigations (section 4.2.4.5)
  - government operations (section 4.2.4.6)

4.1 Common issues to be assessed for any open-by-default exceptions

4.1.1 *Access to Information Act* and *Privacy Act* exemptions to scientific research outputs

In general, the *Access to Information Act* affords any Canadian citizen or permanent resident and any individual or any corporation present in Canada the right to access records under the control of the federal government, unless there is a specific provision in the Act that permits or requires the head of the government institution to refuse to disclose the information.

Restrictions on the release of information generally apply to federal–provincial affairs; international affairs and defence; law enforcement and investigations; national security; safety of individuals; and economic interests of Canada.

The discretion to disclose or withhold information in the above categories can only be exercised by the head of a government institution or by an individual that the head has designated in writing for this purpose. The operational underpinning is to release information unless there is a rationale to limit its release.

The *Privacy Act* sets out privacy rights in citizen interactions with the federal government. It applies to how the government collects, uses and discloses your personal information. The *Privacy Act* protects your personal information that government institutions hold. The Act also gives you the right to access your personal information held by the federal government.

Personal information under the control of a government institution cannot be disclosed without your consent except in specific circumstances, such as:

- For the original purpose for which the information was collected or a use consistent with that purpose
- Where the disclosure is authorized in federal legislation
- To comply with subpoenas, warrants or orders of a court or another body with authority to compel information
- Where disclosure would clearly benefit the individual
- Where the public interest in disclosure outweighs any invasion of privacy

If any of the above are relevant to the federal science outputs, then they would be governed by the legislation in place to deal with information releases. In such cases, the organization's ATIP officers should be consulted.

4.1.2 The right degree of openness and balancing benefits and risks

A large majority of federal science outputs should fall outside the limited and specific scope of *Access to Information Act* exemptions and exclusions. An effort should be made to make that information available to citizens and other scientists. Managing the open-by-default principle becomes a question of finding the right degree of openness and the right timing if there are limitations on what can be released and how it can be released.

In assessing the release of scientific research outputs, a reviewer must characterize the value and impact of the information and determine whether degrees of openness could be considered in the case of sensitive information. The Organisation for Economic Co-operation and Development (OECD) identifies degrees of openness to enhance access to information:[1]

- Open access with open licence
- Public access with a specific licence that limits use
- Group-based access through authentication
- Named access explicitly assigned by contract

There may also be opportunities to make metadata openly available without sharing the science product itself up front.

1 OECD (2020), Enhanced Access to Publicly Funded Data for Science, Technology and Innovation.

A scientist, partnering with ATIP, IP and IM officers, must weigh all the options, noting the rationale for limiting release and the benefits that can be achieved through openness:

- Balance the potential risks with the benefits of making information available/partially available. The impacts of not making it available should also be made explicit.
- Develop and apply an injury test for the risk involved. More specifically, determine what the plausible negative impacts could be from the release of information.
- Consider all possible research outputs and whether they have in part or in whole been made publicly available by another organization.
- Factor in timelines for release (for example, what may not be okay for release today may be fine tomorrow, or vice-versa).

It should also be noted that in cases where private or foreign funding is involved (such as Global Affairs Canada's Canadian International Innovation Program), the project partners will have negotiated the rights to the background and foreground intellectual property. It is also possible that the private or foreign research partners could be subject to laws and policies dealing with the openness, or not, of research outputs, as a consequence of the funding. Accordingly, when private or foreign partners are involved, the rights of these partners to the scientific research outputs and the possible applicability of laws and policies to these outputs (inasmuch as they were co-funded by Canadian and foreign sources) should be considered.

4.1.3 Burden and cost

Decisions concerning open-by-default should be made at the design stage of a science experiment or project, thereby creating an open-by-design foundation. This includes, for example, support and costs for consultations when the data or information involves Indigenous communities, personnel and systems for information management and release, as well as consultation with subject-matters experts such as ATIP or IP officers.

Injury test: Under the *Access to Information Act*, an injury test considers whether disclosure of the information could reasonably be expected to prove harmful or damaging to the specific public or private interest covered by the disclosure. The fact that the disclosure could result in administrative change in a government institution is not sufficient to satisfy an injury test. Under the law, it must be possible to identify an actual detrimental effect on the interest specified in the exemption.

An ATIP officer can be consulted for further information.

The science community is concerned that information management costs are steadily rising. This could reflect the steady increase in the volume of information, greater emphasis on information management, and growing demand for information witnessed in science.

Combining open-by-default with publication in machine-readable format will improve access to the volume and variety of government information. From a pragmatic perspective, limited resources and infrastructure may force some form of prioritization in terms of what is made open and through what mechanism. The Roadmap for Open Science's recommendation on release of federal science articles and publications (Recommendation 4) applies only to new publications, with legacy publications to be shared upon request in the context of a "responsive action plan [that] should be developed to share publications requested with time-bound commitment for delivery."

With respect to official languages, when federal organizations provide information to the public, it must make that information equally accessible in either official language. Note that if a federal scientific research output is made available in a peer-reviewed journal, a conference proceeding, or an article published in a non-government publication, it can be provided in the language in which it was written, although a number of departments, as a good practice, provide abstracts in both official languages.

The objective of the TBS Policy on Financial Management is that the financial resources of the Government of Canada are well managed in the delivery of programs to Canadians and safeguarded through balanced controls that enable flexibility and manage risk. Parliament expects that government programs be delivered in keeping with the needs of citizens served by those programs and broader public expectations. The taxpayer expects that all programs be delivered prudently and with due regard for the funds entrusted. The government's policy on cost recovery directs that users should pay a fair share for services received. These priorities must be balanced and, while they at times appear to be at cross-purposes, opportunities exist to complement access with the degree of openness.

In cases where the decision was not made at the design phase, a scientist should consider how much work is needed to make scientific research outputs accessible (no metadata, no obvious place to publish it, etc.) and whether a partial or targeted release that is operationally possible would meet the spirit and intent of open-by-default. For example, there could be an opportunity to lower the cost of making federal science open using pre-prints as an alternative to the open-access gold standard of paying article processing charges.

Producing an inventory of holdings, information and related sensitivity statements, by department or agency, and building processes and infrastructure for automated or procedural release of information commensurate with risk, could be used to help scientists manage workflow in departments and agencies, create equitable access, and minimize errors in judgment with the release of higher-risk information. For example:

- Automated provisions to address the issue of large data sets (such as data streams from monitoring stations) or information that is cyclical in nature (such as background analyses for public annual reports)
- Measures to aggregate requests for information where multiple requests are made by one person

In exceptional cases, consideration could be given to the introduction of a cost threshold over which a department or agency would not be expected to release information without support. This recognizes the need to ensure the continuity of other public programs and the need to manage financial resources prudently given the resource implications a release can have on other operations.

4.2 Specific issues to be assessed for any open-by-default exceptions

4.2.1 Information about Canadian individuals or businesses

4.2.1.1 Personal information, including health information

If the scientific research output contains information about an identifiable individual that is recorded in any form, there is most likely a rationale for limiting access. This includes a situation in which there is a serious possibility that an individual could be identified from the information alone or in combination with other available information. It should be noted that specific policies are in place for personal health records and other such information for scientific research.

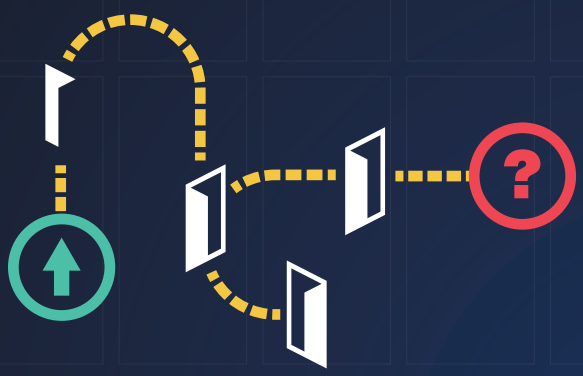
Examples of personal or health information include:

- DNA or related information (for example, test results) that can be linked to an identifiable individual
- Information about income, revenue, or enrolment in certain government programs (for example, gender-based programs, religious information)

Respect for personal privacy is a core principle of research ethics, and it is managed by making records confidential, anonymizing data, or collecting anonymous data. Further steps, such as data aggregation or noise injection, enable sharing while protecting privacy.

Having access to disaggregated "individual level" information is important for research such as Gender Based Analysis+ (GBA+). GBA+ is a process for examining how various intersecting identity factors affect the effectiveness of government initiatives. It involves examining disaggregated data and research, and considering social, economic and cultural conditions and norms. The benefit of such research is to more effectively respond to the challenges of an increasingly diversified Canadian population. Controlled access (for example, Statistics Canada microdata access portal) can be a way to enable access for legitimate research purposes.

If the scientific research output contains information about an identifiable individual that is recorded in any form, there is most likely a rationale for limiting access.



There is no one universally accepted definition of Indigenous knowledge, as Indigenous knowledge systems vary between Indigenous groups.

4.2.1.2 External (third party) information

If the scientific research output includes or is based on information produced or owned by someone other than the federal government, and this information is not already public and is treated consistently in a confidential manner by the owner, there may be a rationale for limiting access. For example, this could occur if the scientific research outputs are based on or reference:

- Trade secrets
- Confidential science and technology information
- Certain emergency management plans

Protecting sensitive external information is important in order to build trust and facilitate the exchange of information between Government of Canada scientists and others.

Enhancing access to such information may require convincing the information owner of the benefit of sharing, or considering from the outset the option of instituting research environments that create a protected and secure IT viewing environment based on sharing arrangements, such as research networks or patent pooling.

4.2.1.3 Information obtained in confidence

There would be limitations on the release of information if the scientific research outputs included information received in confidence from the following parties:

- The government of a foreign state or an institution thereof
- An international organization of states or an institution thereof, such as the United Nations or the OECD
- The government of a province or an institution thereof
- A municipal or regional government
- An Indigenous community or organization

The term “in confidence” is usually applied to information obtained with the explicit understanding that it must remain confidential. If the scientific research output involves information obtained in confidence, the organization’s ATIP officers and chief security officer should be consulted.

4.2.2 Impacts on Indigenous rights and provincial–territorial impacts

4.2.2.1 Indigenous knowledge and data

The Canadian Constitution recognizes three groups of Aboriginal[2] peoples: Indians (more commonly referred to as First Nations), Inuit and Métis. These are three distinct peoples with unique histories, languages, cultural practices, spiritual beliefs, and inherent, treaty and/or constitutional rights.

There is no one universally accepted definition of Indigenous knowledge, as Indigenous knowledge systems vary between Indigenous groups. For the purposes of this document, Indigenous knowledge and data are defined as information about Indigenous peoples (population, health, employment, etc.), information from Indigenous peoples (music, dance, arts, language, etc.), and information about Indigenous peoples' lands, waters and environment. Indigenous knowledge is cumulative and dynamic. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change.

Partnering with Indigenous communities and co-developing scientific studies from the planning phase onward is the best way to help enhance access to science research outputs in a way that is respectful and beneficial for all. There is a rationale for restricting access if the research output contains or is informed by Indigenous knowledge and data, or could likely harm Indigenous communities and peoples if released.

Federal departments and institutions are legally obliged to respect Indigenous peoples' inherent, treaty and constitutional rights to self-determination and self-government. The Crown has made commitments to adhere to free, prior and informed consent; respect Nation-to-Nation (for First Nations), Crown–Inuit and government-to-government (for the Métis Nation) relationships; and recognize the distinct customs of Nations in any interaction involving the public release of Indigenous data and information.

First Nations expect federal departments and institutions to respect the First Nations Principles of OCAP®. OCAP® stands for First Nations ownership, control, access and possession of First Nations knowledge and data. Priority area 4 of the National Inuit Strategy on Research (2018) describes expectations for partnership in research premised on self-determination, respect and transparency in terms of Inuit access, ownership and control over data and information on Inuit peoples. Métis Nation organizations have Métis-specific, culturally competent, ethical health research principles that are a starting point for engaging Métis communities in ethical research (Principles of Ethical Métis Research). Regardless, federal scientists should consult with Indigenous Nations and/or governing bodies as necessary when considering the release of Indigenous data and information or scientific outputs that rely on such data and information.

4.2.2.2 Federal–provincial–territorial affairs

Many federal departments and agencies have relationships with provinces and territories that reflect a shared responsibility on key files. A well-functioning relationship between the federal government and the provinces/territories is vital for the successful delivery of programs and services to Canadians.

If the research output includes or references information created by the federal government or obtained from other sources (such as an agent or a consulting firm) that has a reasonable likelihood of injuring the role of the federal government in its conduct of federal–provincial affairs, there may be a rationale for limiting access to these science products. Injury to federal–provincial–territorial affairs is most likely to occur when the federal government is about to commence or is in the midst of conducting specific negotiations, deliberations or consultations. Examples include documents and information used in federal–provincial–territorial deliberations or those used in the development of strategies or tactics relating to the conduct of federal–provincial–territorial affairs.

2 A note on terminology: The term "Indigenous" has, in practice, largely replaced the term "Aboriginal" as the collective noun that refers to First Nations, Inuit and Métis, but the above terms remain within the Constitution.

Some of the benefits of sharing such information can include increasing the number of perspectives for discussions (the public is more diverse than the people at the table for federal–provincial–territorial discussions) and creating opportunities to find new solutions. For example, transparently sharing information on the COVID-19 situation in each province is essential to the public perception that every region of the country is being treated according to its needs.

Enhanced access can be achieved through the promotion of open government and other transparency initiatives.

4.2.3 Economic considerations

4.2.3.1 Commercial interests

Scientific research outputs may contain information that is known to have, or is anticipated to have, commercial value. It may be in the interest of the information holder to retain custody of the information so that it can exploit, or investigate the potential to exploit, that value. Notably, this exploitation of value may occur with or without intellectual property protection (see 4.2.3.2 below).

For example, the government may produce scientific research outputs that may have significant long-term socio-economic impacts, even stimulating new technology sectors. A historical example is the long-term contribution of scientific research on low-earth orbit and geo-stationary satellites to telecommunications industries. A contemporary example is the commercialization of adaptive optics technologies developed through astronomy research programs.

Scientific research outputs or technical information belonging to the Government of Canada that has arisen through a program or partnership between the government and other parties may also be subject to limited release. Again, the information must reasonably have a substantial value now or in the future. An example could be information obtained as part of National Research Council industrial support programs that involve post-secondary research institutions and private or voluntary sector partners.

Regulatory approval processes can involve the acquisition and retention of scientific information created by the private sector. In cases where public disclosure would harm commercial interests, the information would not be released. Examples include *Canadian Environmental Protection Act* scientific reviews of substances prior to entry into the Canadian marketplace. As part of the global movement towards greater transparency, regulators have found ways to provide high-level information about pre-market submissions and summaries about its final decisions that provide the public with useful, relevant information while meeting legal obligations to protect third-party information.

4.2.3.2 Intellectual property rights

Intellectual property rights are legal means of excluding or limiting the access to or use of knowledge. Using intellectual property rights to restrict access is generally meant to temporarily reward creators for having taken on risk in their work, thereby providing an incentive for further creativity, discovery and invention. The Canadian Intellectual Property Office recognizes copyright, trademark, patents and industrial designs as intellectual property.

Scientific research outputs are often protected with copyright and patents. Copyright is the sole right to first publish, reproduce or publicly perform or communicate a work or a substantial part thereof. Protected works include every original literary, artistic, dramatic or musical work, as well as computer programs and the selection and arrangement of data. Scientific papers, for instance, would be protected literary works. Copyright also provides protection for performers' performances, sound recordings and communication signals. Patents can be granted for any new inventions (process, machine, product, composition of matter) or any new and useful improvement to an existing invention. Canadian patent protection applies within Canada for 20 years from the date the patent application is filed. The Canadian patent application is open to the public 18 months after filing. Patent protection for the invention can also be obtained in other countries.

CASE STUDY: An example of where preventing premature disclosure of project results based on economic considerations was advisable

In North America alone, the cost of mastitis to the dairy industry amounts to billions of dollars as a result of discarded milk and drug and veterinary treatments. Current treatments, such as the use of antibiotics on healthy animals, are controversial because it can lead to antibiotic resistance.

In 2016, an Agriculture and Agri-Food Canada (AAFC) researcher developed an invention entitled “A management tool to prevent intra-mammary infections of dairy cows at drying-off” that addresses this universal issue without the need of antibiotics. Given the commercial potential of this invention, the information had been kept secret until a patent was filed.

Soon after filing, AAFC invited the industrial sector to express its interest in collaborating with AAFC to further develop the technology. To preserve the technical edge, confidentiality agreements were signed with companies who responded to the call. The selection was based on commercialization plans submitted, with AAFC ensuring that the technology would be available to the Canadian industry and would contribute to economic and social benefits for Canada.

Reassured that sole rights for commercialization would be granted and that AAFC would not prematurely disclose the intellectual property being developed, the company selected by AAFC invested in the collaborative research and agreed to pay for patent costs in selected countries. AAFC’s careful release of information, timed with the patent application, was key in securing those rights and the company’s interest. This was critical to ensure that this alternative solution to antibiotics would be fabricated, distributed and available to Canadian producers.

Commercial confidential information described in 4.2.3.1 may be regarded as a trade secret if it gives a business an advantage over a competitor. Trade secrets are a form of intellectual property, but do not have formal protection in Canada under statute, as patents do for example. Other jurisdictions do protect trade secrets by statute or registration processes. Scientific research that results in a new invention that is kept secret can also be patented later.

Sometimes scientific research leads to an invention for which patent protection is sought. Alternatively, the outputs may have relied on something that was a trade secret. In any of the above situations, there may be limits on the release of information. Your ATIP office and other subject-matter experts (for example, IP officer) would be able to assist you in making the determination.

4.2.4 Security concerns

4.2.4.1 Hazardous materials, toxic industrial chemicals, and CBRNE research

Research on hazardous materials; toxic industrial chemicals; and chemical, biological, radiological, nuclear or explosive (CBRNE) materials can be governed by several acts and international conventions, such as the *Criminal Code of Canada*, the *Human Pathogens and Toxins Act*, or those implementing Canada's accession to the Chemical Weapons Convention and the Biological and Toxin Weapons Convention. Materials should be safeguarded, and research in these areas should therefore be released with necessary due diligence and recognition for the potential unintended diversion or exploitation of the materials or information by others.[3] Research in these areas is more likely to be shared with individuals who have the right authorization/clearance level or on a need-to-know basis.

4.2.4.2 Dual-use research

Dual-use research produces scientific results, technologies or data that can be used in more than one context. In the context of international regimes for controlled goods, dual use typically refers to technologies that have civilian and military uses (such as geographic information system and laser). Planned dual-use research anticipates science, technology and data that is intended to be useful in multiple contexts (protective clothing for unmounted soldiers and civilian first responders, for example). Restrictions on access to dual-use research may be applied if it is reasonable to anticipate that the outcomes of that research might be used for nefarious purposes or has strategic military value (such as weaponizing microbiology research). Not all dual uses can be easily anticipated, however, and the ingenuity of others can lead to a novel inventive step that leads to a new application, benign or otherwise. Researchers should be aware that dual-use restrictions differ depending on the nature of the research and the extent to which alternative uses can be generated, or the potential and seriousness of any harm that may arise.

3 In accordance with the *Human Pathogens and Toxins Regulations*, licence holders who intend to carry out scientific research must have an approved plan that sets out administrative measures for managing and controlling biosafety and biosecurity risks during the period in which the licence is in effect. Known as the Plan for Administrative Oversight, it specifies how a facility will assess and mitigate against the risks posed by research activities—not just the pathogens themselves, but also the release of research data/information associated with pathogen research.

4.2.4.3 Safety of individuals

If there are reasonable grounds to expect that the disclosure of outputs from scientific research could threaten the safety of individuals, the release of the information may be refused.

The phrase "threaten the safety of individuals" has the following general meaning:

Threaten: to expose to risk or harm; to be a menace or source of danger

Safety: freedom from danger or hazard; exempt from hurt, injury or loss

Individual: a human being

The types of individual safety interests that could be threatened are relatively broad, covering an individual's life and bodily integrity as well as psychological injury.

The types of scientific research outputs normally considered relevant to personal safety involve the release of information that either directly or indirectly reveals the identity, home address or other identifier of individuals that could threaten their safety if publicly released.

Care should be taken to assess publicly available information that can be matched with other data to reveal information that could threaten the security of an individual.

4.2.4.4 International affairs and defence

If the scientific research outputs include any of the following, release of information should be reviewed to assess whether it could reasonably be expected to be injurious:

- **The conduct of international affairs:** This includes not only state-to-state affairs, but also commercial, cultural or scientific links established by citizens with counterparts in other countries.
- **The defence of Canada or any state allied or associated with Canada:** An "allied state" is one with which Canada has concluded formal alliances or treaties. An "associated state" is a state with which Canada may be linked for trade or other purposes outside the scope of a formal alliance.
- **The detection, prevention or suppression of subversive or hostile activities:** This protects specific types of information pertaining to the security of Canada.

These three general areas of public interest can be considered independently even though they are closely and intimately interrelated and frequently overlap.

The types of scientific research outputs normally considered relevant to international affairs include exchanges of diplomatic correspondence with foreign states or international organizations of states, or official correspondence exchanged with Canadian diplomatic missions or consular posts abroad.

The types of information normally considered relevant to defence-related scientific research outputs could include, but are not limited to, military operations or capabilities, and time-sensitive information that could identify the location of certain military operations or personnel. The information may include both the raw data collected and the refined product or analysis.

4.2.4.5 Law enforcement and investigations

Examples of the types of scientific research outputs normally considered relevant to law enforcement and investigations include surveillance data from environmental monitoring of pollution; or samples, genetic materials and analyses emanating from food safety and security investigations.

If the scientific research outputs include any of the above, there are a series of reviews required under legislation to limit the release, in part or in whole, of information, with the aim to protect:

- Effective law enforcement, including criminal law enforcement
- The integrity and effectiveness of other types of investigative activities, such as ordinary administrative investigations under an act of Parliament, investigations in regulatory areas, and air accident investigations.

Before the limitations to release can be applied, the following 3 conditions must be met:

1. **The information was obtained or prepared by an investigative body.**
2. **The information was obtained or prepared in the course of a lawful investigation.**
3. **The investigation pertains to crime, enforcement of a law or a threat to the security of Canada.**

It is essential for any scientist to consult with the law enforcement organization before the release of any scientific research outputs if they were part of or provided input to any investigative process.

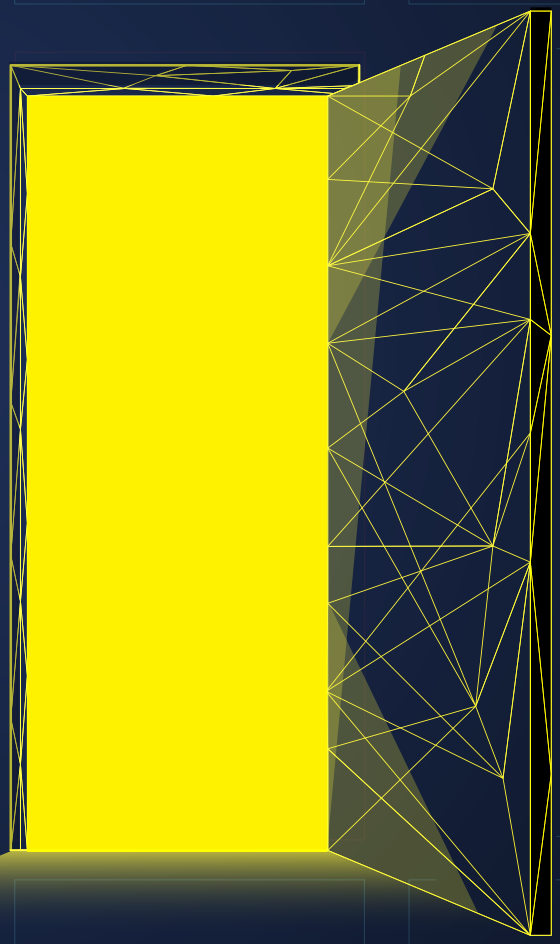
4.2.4.6 Government operations

If the scientific research outputs include information about the internal decision-making processes of government, the release of that information may interfere with the operations of government institutions. The rationale behind this limitation in open-by-default is that release can, at times, have a chilling effect on the candidness of the advice, recommendations, consultations and deliberations given or received by the federal public service and can lead to a reluctance to deal frankly with difficult questions. The determination of the limitation to open-by-default should be done in consultation with an organization's ATIP officer.

Examples of scientific research outputs could include coding for computer programming of sensitive automated services, scientific advice and analysis for policy development, or the purchase of sensitive scientific equipment.

In making a determination that open-by-default should be limited, consideration should be given to the expectation of disclosure from the process employed, the impact of release (from the risk and benefit perspectives equally), and the sensitivity of the information.

5 Requirements and roles of organizations



The Roadmap for Open Science and Directive on Open Government set out explicit requirements and recommendations that can be observed and followed by any government department. To ensure that open-by-default is widely embraced and promoted, it is important that departments adopt coordination plans and ensure that open-by-default is an organizing principle and motivating factor for research.

5.1 Responsibilities of organizations

Departments and agencies conducting science have a responsibility to determine the best way to make their scientific research outputs open whenever possible.

Departments and agencies also have a responsibility to arrive at such decisions in a transparent manner—establishing clear accountability and ensuring the coordination of relevant officials within the organization—and to create processes and systems that align with open-by-default principles.

5.2 Advisory mechanism for organizations

Complex cases may arise. For instance, it may be challenging to determine the consequences of not making some information open. One probable consequence may be that further scientific inquiry would be limited, thus affecting the impact of government science and the health of the synergies between intramural and extramural scientists and the public.

The Chief Science Advisor (CSA) may be contacted to provide third-party advice to the department in complex cases. The CSA will then determine, in consultation with the department, the best way to formulate advice in the circumstances. Informal mechanisms used to address issues arising from the implementation of scientific integrity policy, as well as values and ethics within and outside government (Tri-Council directions for instance), will serve as inspiration.

5.3 Officials and coordination within organizations

Multiple officals contribute to the decisions on and the implementation of the appropriate level of openness for government information (including data). Consideration should be given to the interest and potential role of:

- Departmental ATIP officers (Access to Information and Privacy)
- Chief data officer, chief scientific data officer
- Chief information officer
- Chief security officer
- Departmental chief scientist or equivalent (ADM of science and technology, for example)
- Departmental science advisor
- Departmental scientific integrity officer
- Technical advisor for Shared Services Canada
- Communications officers
- Legal services advisors, including IP officers

A first level of coordination between these officials will help achieve a shared vision and awareness of each other's roles and responsibilities. Stronger linkages should be made between the above groups to better support the deputy head of the organization.

A second level of coordination can be achieved by establishing transparent decision-making processes and clear accountabilities. More precisely:

- These processes will ensure that any decisions or reviews on the sensitivity of information are made in consultation with each department's ATIP office.
- In the event of a legal issue, departments should consult with their respective legal services to ensure the appropriate laws and regulations are respected.
- To explore options for achieving the appropriate degree of openness when there are commercial implications, intellectual property services should be consulted to inform decision making.
- In cases where the release of information would benefit from a deeper understanding of the issue and context, communications personnel could be called upon to facilitate engagement with the media and the relevant stakeholder community.
- The chief security officer should be notified of any persistent or unusual contact and of any attempt by another individual to solicit or obtain access to sensitive information, assets or facilities without proper authorization.

5.4 Motivating factors at various levels of the organizations

Two complementary approaches are needed to foster the culture change required to move to a successful open-by-default scientific environment. Defining and establishing appropriate processes and responsibilities is the first. The second involves fostering a change in mindset and behaviours.

Opportunities for creating the right mindset and for motivating desired behaviours are present at multiple levels of the organization. At the departmental level, motivations can be found through the Management Accountability Framework (MAF) or TBS instruments (for example, update to the Directive on Open Government). At the individual level, actions can be motivated through professional standards, performance management and career progression programs. Organizational culture integrates all these motivations. Scientists as a community also come with their own culture, which is echoed in such things as departmental scientific integrity policies.

5.4.1 Deputy heads

Deputy heads are accountable for the application of government management policies within their department. Where relevant, they have to apply these policies to scientific research activities in a way that creates a thriving environment for the science performed or funded by the department to support its mandate.

The MAF includes indicators that reflect expectations for information management performance at the departmental level. These are based on TBS information management policies, which include the Directive on Open Government. There are opportunities to motivate actions at that level by:

- Reflecting the current framework for managing open-by-default in science in an addendum/ appendix to the TBS Directive on Open Government
- Developing departmental tools and tracking mechanisms in order to support coordination and decision making and to make results visible

5.4.2 Scientists, government laboratories and research institutes

Scientists individually, and collectively through laboratories and institutes, ensure scientific discovery and collaboration are supported and encouraged. They play a critical role in defining the optimal degree of openness for the type of science conducted by balancing benefits and risks.

Behaviour is largely determined by institutional context. For government scientists, the institutional context is defined by their domain of expertise, their collaboration with industry and academia, the different types of projects they conduct, and the sector of application. Each institutional context calls for different "ideal" degrees of openness, dissemination practices and tools.

How the laboratory or institute values and promotes certain behaviours greatly influence what researchers see as important and where they invest their efforts. There are opportunities to motivate actions at that level by:

- Building on a baseline of good behaviours (for example, values and ethics code and scientific integrity policy)
- Leveraging work objectives and government researchers' career progression frameworks
- Supporting government research/science "institutes" in their efforts to become leaders within their respective domain

5.4.3 Program management, from line managers to senior management (directors general and assistant deputy ministers)

Government managers and senior managers are accountable for decisions and organizational results. They address questions of burden and cost.

They would be most interested by the good management practices outlined earlier in this guidance document (see section 3.4). These include adopting the "open-by-design" logic of determining goals up front and having ways to track results and promote their improvement. Program managers should consider developing data management plans as well as plans to manage all science outputs. Having plans means moving decision making to the start of the process instead of addressing the content after the fact. In the context of research collaboration, this becomes even more important.

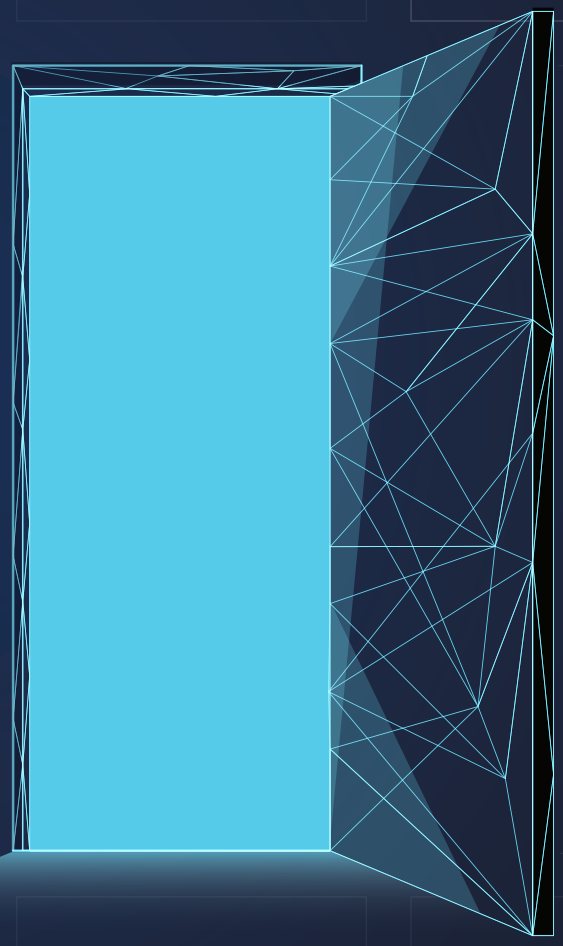
There are opportunities to motivate actions at this level by:

- Incorporating training for federal scientists and scientific program managers
- Seeking ways to reduce burden and cost with new practices or tools
- Aligning human resources processes, from recruitment to performance management, with these institutional goals

5.5 Enquiries

Questions regarding the content of these guidelines should be directed to your institution's Chief Scientific Data Officer, or you may contact the Office of the Chief Science Advisor at science@canada.ca.

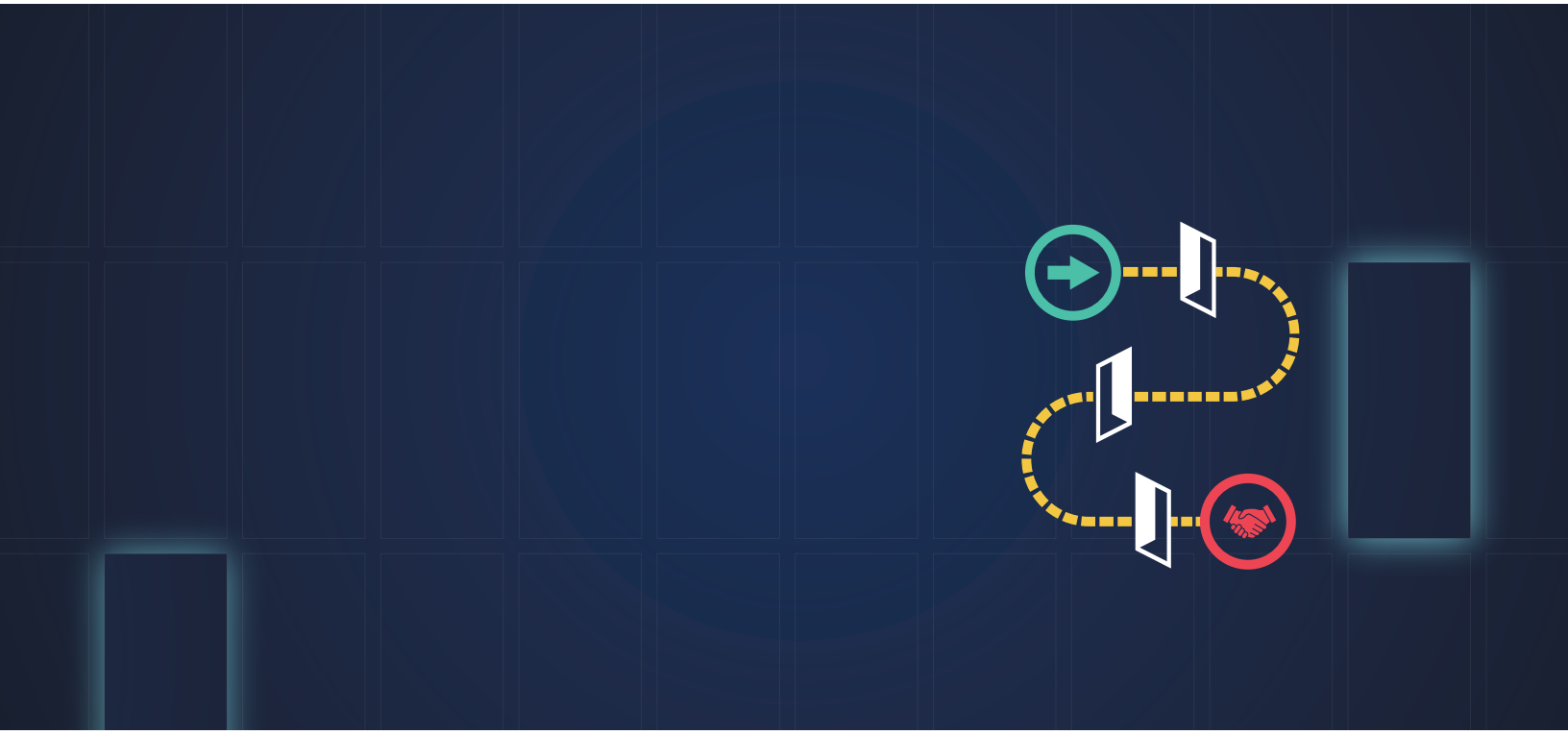
6 Effective Date and Duration



This guidance document takes effect on January 1, 2021. It supports both the Roadmap for Open Science and the Directive on Open Government.

A committee, led by the Chief Science Advisor, will reconvene in a year to take stock of successes and challenges revealed by implementation and to look at the opportunity to move some of the guidance into more formal TBS open-government policy instruments.

In addition, yearly reports will be developed on implementation and included in the Chief Science Advisor's annual report.



7 References and resource list

7.1 Legislation, policies and directives governing information releases to the public

Access to Information Act
https://laws-lois.justice.gc.ca/eng/acts/a-1/page-3.html#docCont

Access to information policies and guidance
https://www.canada.ca/en/treasury-board-secretariat/services/access-information-privacy/access-information/access-informatio-policies-guidance.html

Access to Information Manual
https://www.canada.ca/en/treasury-board-secretariat/services/access-information-privacy/access-information/access-information-manual.html

Access to Information and Privacy Process and Compliance Manual for the Office of the Privacy Commissioner of Canada
https://www.priv.gc.ca/en/about-the-opc/opc-access-to-information-and-privacy/manual/

Directive on Open Government
https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=28108

Model Policy on Scientific Integrity
https://www.ic.gc.ca/eic/site/063.nsf/eng/h_97643.html

Official Languages Act
https://laws-lois.justice.gc.ca/eng/acts/O-3.01

Official Languages policies and guidance
https://www.clo-ocol.gc.ca/en/language-rights/interpretation-bulletins

Policy on Government Security
https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=16578

Policy on Service and Digital
https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32603

Privacy Act
https://laws-lois.justice.gc.ca/eng/acts/P-21/FullText.html

Privacy policies and guidance
https://www.canada.ca/en/treasury-board-secretariat/services/access-information-privacy/privacy/privacy-policies-guidance.html

Interim Policy on Privacy Protection
https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=12510

Public Servants Inventions Act
https://laws-lois.justice.gc.ca/eng/acts/P-32/page-1.html

Roadmap for Open Science
https://www.ic.gc.ca/eic/site/063.nsf/eng/h_97992.html

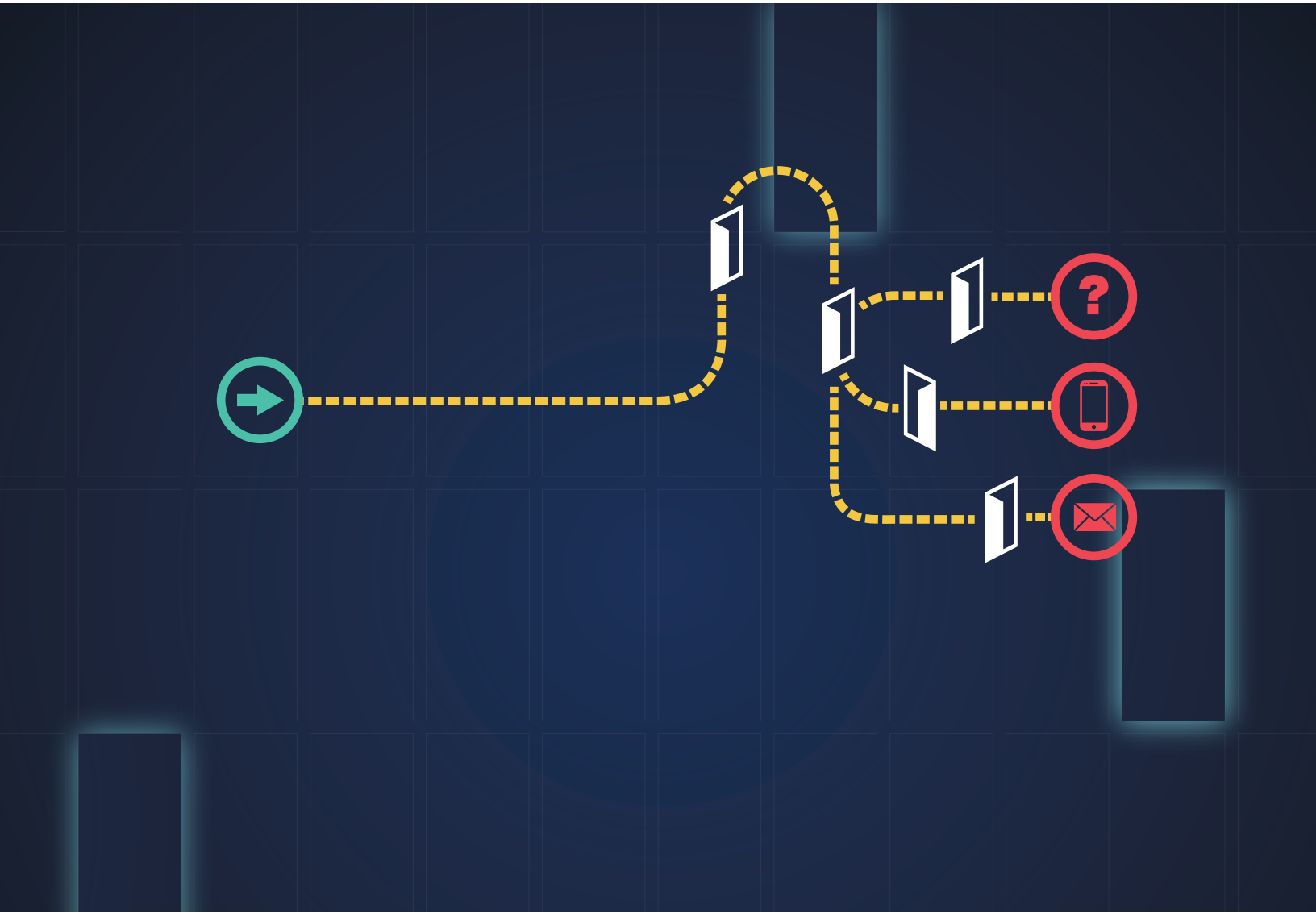
Safeguarding Your Research
https://www.ic.gc.ca/eic/site/063.nsf/eng/h_97955.html

Values and Ethics Code for the Public Sector
https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=25049

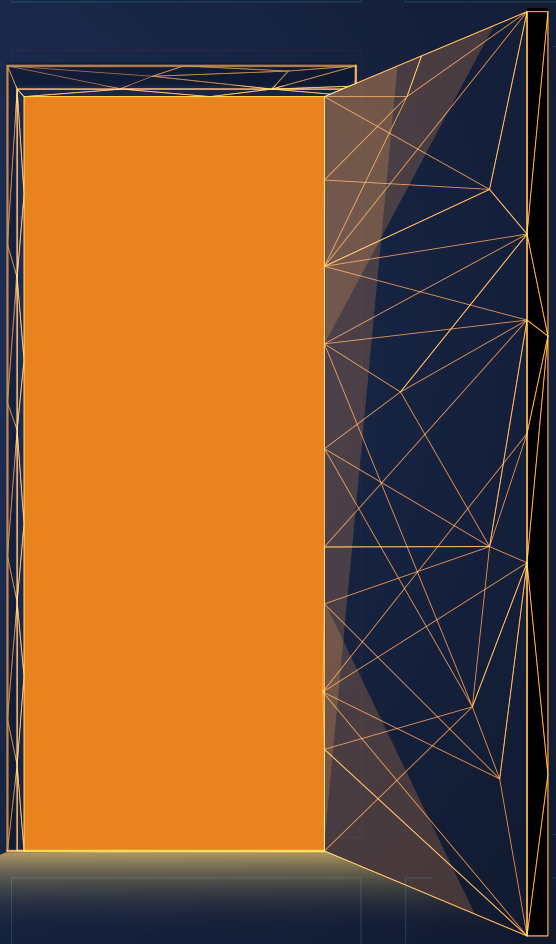
7.2 International guidance on open science

OECD report – Enhanced Access to Publicly Funded Data for Science, Technology and Innovation (2020)
http://www.oecd.org/sti/enhanced-access-to-publicly-funded-data-for-science-technology-and-innovation-947717bc-en.htm

United Kingdom, Office for National Statistics – Accessing secure research data as an accredited researcher
https://www.ons.gov.uk/aboutus/whatwedo/statistics/requestingstatistics/approvedresearcherscheme



8 Decision tree for releasing scientific information



START

Government fully owns rights on scientific research output?

NO

YES

Co-owns?

NO

YES

It should not be shared or published by government.

Publishing approach should be agreed to with co-owner, ideally upfront.

Scientific research output is or should be classified as secret?

NO

YES

It should not be shared or published by government.

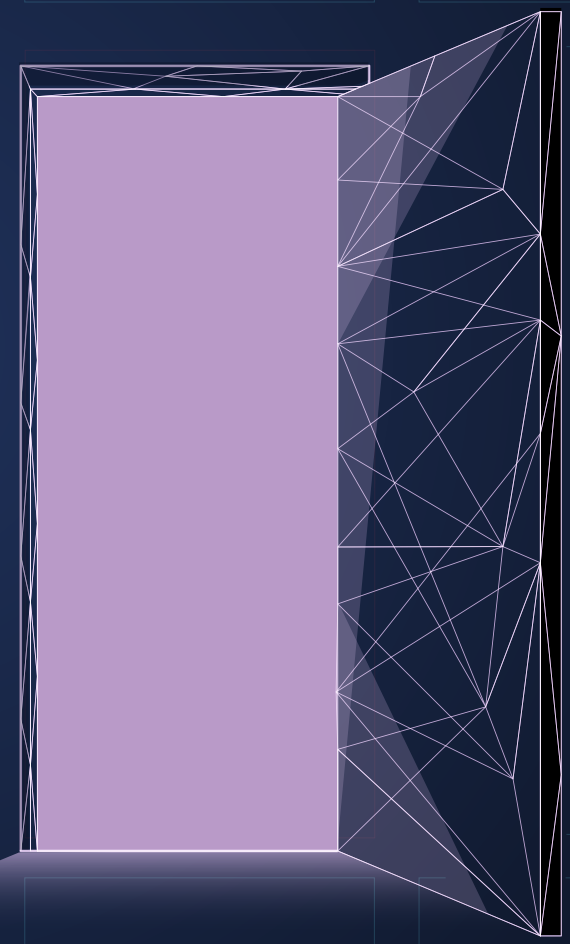
The appropriate way to share or publish should be identified reducing risks and maximizing potential benefits.

	Risks of publishing or Benefits of not publishing	**Risks of not publishing or Benefits of publishing**	
Individuals or Businesses	Privacy, ethical conduct of research, trust	Personalized health or policies, understanding risk factors	Individuals or Businesses
Indigenous or Provincial-Territorial	Reconciliation, Fed-prov collaboration	Transparency, open government, democracy	Indigenous or Provincial-Territorial
Economic	Competitive advantage, Intellectual property protection	Digital sciences, and service economy	Economic
Security	Public safety, national security, dual use	Collaboration to address global challanges, science doplomacy	Security

Controlled limited access

Fully open

9 Life-cycle management of projects and programs



An outline of some of the best management practices for open-by-default are provided below. They can be viewed as a complement to the Model Policy on Scientific Integrity, specifically section 7.

Initial project/ program design

- Include open-by-default in the design of the initiative (open-by-design mantra). Ensuring the systematic release of information and analysis, collecting and managing information in machine-readable formats, and establishing the infrastructure necessary for information management systems are just several considerations that should be included in any project/ program design.
- Document protocols before collecting data, with the aim of ensuring greater transparency. This makes it possible to facilitate downstream release of information consistent with open-by-default management. In addition, document the initial rationale for releasing information, as this will facilitate future affirmation of decision making and any adjustments to decisions based on new considerations. Protocols may be made publicly available or embargoed until the data is published.
- If there is an existing body of information and knowledge that is built upon by the new project or program, employ open-by-default on a go-forward basis and create a plan with milestones for managing the existing inventory. This practice makes it possible to manage expectations and employ adaptive management as you learn from the new project or program.
- Establish a data management plan that defines where the data will be stored during and after the project. The plan should include a strategy for safeguarding the data in order to ensure a back-up and long-term accessibility.
- If Indigenous nations, peoples or communities are involved, ensure that they are engaged in any decision making on the use, storage, access, possession, publication and ownership of the data and information.
- Similarly, if there issues relating to classified information, controlled goods or intellectual property, there may be limits on the release of information. Identify limitations at an early stage and introduce steps to ensure that they are managed. Consult the appropriate responsibility centre within the organization (such as the ATIP office and legal services).
- As scientists, be diligent in applying the appropriate security markings on documents and data, especially with the move, as a government, towards an open-by-default paradigm. Failure to do so (proper security marking) will result in the leak of sensitive information.

Implementing projects or programs

- Employ adaptive management and if the conditions for releasing information change (for example, new unintended consequences not originally foreseen, level of detail allows for identification of individuals, or impacts of an economic or security consequence), a review of the initial open-by-default decision will be required.
- As a corollary to adaptive management, adopt a system for recording any changes to protocols and results to support revised decisions.
- Ensure training on legislative requirements (*Access to Information Act*, *Privacy Act* or other acts) and Indigenous rights is provided to existing and new

employees or when employee roles change. Training for organization-specific needs (information management systems, department-specific protocols, etc.) should also be encouraged. Allow for cross-training of *Access to Information Act* personnel in science programs.

- Establish protocols for quality control and check common procedural errors to periodically evaluate the process for managing the release of information. If such procedures lead to the exclusion of projects or programs or parts thereof, establish criteria so that this takes place before results are obtained and explicitly mention them in the description of protocols.

Analysis of results

- Keep databases organized and document the analyses carried out, ready for implementation or available, through a pre-determined release schedule.
- When it comes to data that cannot be shared in full, consider whether this data can at least be made available in part (such as by removing information to guarantee anonymity) or after an embargo (such as after the intellectual property is established) or with approval of Indigenous nations and/or governing bodies as necessary.

Publication of results

- Use open-access platforms for publication if possible. This may include using open-access journals or placing versions of articles in public repositories. In the latter case, most publishers have policies that are compatible with the depositing of pre- and post-print versions.
- Check the policies of a particular publisher or journal. Upon publishing or depositing an article, use sharing options that guarantee that the article can be used and redistributed.
- If using open-access journals that cover the publication fees (bearing in mind that this is not the only way to guarantee open access), ensure that the journals have a legitimate peer review system and that they do not fall under the category of "predatory journals."
- Deposit articles as pre-prints before or upon submitting in repositories. Using pre-prints accelerates the scientific process and is compatible with submitting articles to most journals. After the peer review, update the pre-print so that it is as close to the final publication as possible.
- Cite pre-prints in scientific articles and comment on pre-prints (post-publishing peer review). Furthermore, pre-prints must be considered to be valid scientific production for evaluating projects and researchers (see section 3.4).
- Use government websites for open data (Open Data Inventory) to maximize access to information.
- Fully share the data from research upon submitting an article. The data can be included as supplementary material or be deposited in repositories, either those of your organization, general repositories, or platforms that specialize in a specific type of data.

Impact

- Keep abreast of uses being made of the scientific results shared. If relevant, try to understand users' needs, consider user feedback, and include up-front/ongoing user engagement as part of your science program.