Open Science Roadmap

Report by the Open Science Working Group, University of Ottawa

OCTOBER 2024

uOttawa

uOttawa Open Science Working Group

The Open Science Working Group was charged with examining the current state of open science at The University of Ottawa (uOttawa) and worked to define uOttawa's goals towards open research practices, considering disciplinary practices, our francophonie mission, and recognizing the need for a distinctions-based approach as it relates to projects engaging with First Nations, Métis and Inuit communities (University of Ottawa Library, 2023).

In March 2023, Talia Chung, the University Librarian and Dean of Libraries, and Dr. Stefanie Haustein, Associate Professor at the School of Information Studies, proposed to the Research Commission the formation of a working group with the objective of strengthening open science practices at uOttawa and bolstering existing expertise to ensure that uOttawa remains competitive in a shifting research landscape.

The Open Science Working Group was then struck, co-chaired by the Associate Vice-President of Research, Innovation and Development, Dr. Martine Lagacé and the University Librarian and Dean of Libraries, Talia Chung, and included representatives from nine faculties, the Library, uO Press, the Collège des chaires de recherche sur le monde francophone, and a PhD student from the Faculty of Social Sciences.

In June 2024, the working group presented its recommendations to the Research Commission, positioning uOttawa as an open science leader, to ensure it remains a competitive collaborator in national and international contexts, and well positioned to advance cutting edge and impactful research.

Mandate

To achieve its aim, the Open Science Working Group considered the following questions within the context of uOttawa's academic mission:

- In order to achieve the vision set out in Transformation 2030, how can the university leverage existing open science strengths and further promote open practices?
- What set of principles can the university develop to guide open practices and open access investments, to support uOttawa's research activities?
- How can uOttawa support and incentivize open research practices via the creation, dissemination, and accessibility of research in French, which is fundamental to uOttawa's mandate?
- What approaches and best practices are adopted by peer institutions, in Canada and internationally, to increase uptake of open science?

Working group members

The working group was co-chaired by the University Librarian Talia Chung and Associate Vice-President Research Martine Lagacé and advised by Stefanie Haustein, Associate Professor at the School of Information Studies (ÉSIS) and Leigh-Ann Butler, Scholarly Communications Librarian. Based on suggestions from the co-chairs, advisors and the Vice-Deans Research at least one faculty member per Faculty was invited to ensure representation across disciplines. In addition, Lara Mainville represented the University of Ottawa Press and Gishleine Oukouomi Djouonang represented PhD students.

Talia Chung, University Librarian and Dean of Libraries, Co-Chair

Martine Lagacé, Associate Vice-President, Research, Promotion, and Development, Co-Chair

Stefanie Haustein (Arts), Special Advisor to the chairs of the working group, Associate Professor, School of Information Studies (ÉSIS) and co-director of the ScholCommLab

Leigh-Ann Butler, Scholarly Communications Librarian (ex-officio)

Daniel Amyot (Faculty of Engineering)

Matthieu Boisgontier (Faculty of Health Sciences)

Kelly Cobey (Medicine and the University of Ottawa Heart Institute)

Éric Dionne (Faculty of Education)

Mistrale Goudreau (Faculty of Law – Civil Law Section)

Sylvie Grosjean (Faculty of Arts)

Lara Mainville (University of Ottawa Press - PUO-UOP)

Evelyn Micelotta (Telfer School of Management)

Gishleine Oukouomi Djouonang (PhD student, Faculty of Social Sciences)

Jonathan Paquette (Faculty of Social Sciences and Director of the Collège des chaires de recherche sur le monde francophone)

Mark Salter (Faculty of Social Sciences)

Teresa Scassa (Faculty of Law – Common Law)

The working group was supported by Madelaine Hare and Saskia van Walsum, who assisted the monthly meetings with literature reviews and environmental scans as well as writing summaries of monthly meetings. Madelaine Hare also helped to write this report. Chantal Ripp provided input on developing the uOttawa Open Science Strategy Framework and Josée-Anne Cyr provided support with organizing monthly meetings, translations and writing monthly summaries.

Madelaine Hare (PhD student, Digital Transformation and Innovation)

Saskia van Walsum (PhD student, Digital Transformation and Innovation)

Chantal Ripp (Research Librarian, uOttawa Library and PhD student, Digital Transformation and Innovation)

Josée-Anne Cyr (Senior Executive Assistant, uOttawa Library)

Executive summary

Context

Open science aims to promote the transparency and accessibility of research outputs to the benefit of all levels of science and society. The global open science landscape is increasingly complex and subject to the influence of policy. Recognizing this, an Open Science Working Group was formed at the University of Ottawa (uOttawa) in 2023. It is co-chaired by the Associate Vice-President, Research, Promotion, and Development (OVPRI), the University Librarian and Dean of Libraries, and comprises representatives across Faculties, the uOttawa Library, and uO Press.

uOttawa's formation of an Open Science Working Group aims to contextualize global and regional developments, understand their implications for uOttawa, and develop recommendations the university can implement to advance open science practices and promote a culture of open science. Its mandate was to develop **uOttawa's position as an open science leader** and enhance its ability to **produce cutting edge and impactful research**. This work is especially critical as we see Canada's open science practices and mandates falling behind many jurisdictions, including those of uOttawa's top collaborators, such as the US, UK, Australia, China, Germany and France.

While the benefits of an open research system are globally acknowledged, several barriers to open science have surfaced, such as predatory (or deceptive) publishing, substantial financial, technical, and cultural costs, and systemic inequities, making the adoption of open science challenging. Furthermore, many researchers express concerns about aspects like the quality of open access research, the appropriateness or risks of making some research open or opening up certain processes like peer review, and who should bear the burden of costs associated with making research open. Addressing the unique barriers and concerns around different open practices requires concerted attention, coordinated efforts, and ongoing dialogue among stakeholders.

Approach

The Open Science Working Group surveyed the current open science landscape in Canada and internationally to understand its implications for advancing research at uOttawa. An environmental scan and bibliometric data collection and analysis were conducted, supplementing a survey of the literature. This evidence base was used to inform discussions at monthly meetings, held during the 2023-2024 academic year (October-April).

Meetings were organized thematically to focus on distinct aspects of open science **relevant to the mandate and objectives** of the uOttawa Open Science Working Group:

1. open science at uOttawa (October)
2. barriers to OS and the policy landscape (November)
3. the open access publishing landscape (December)
4. article processing charges (APCs) and read and publish agreements (January)

5. open practices and research assessment (February)
6. disciplinary practices (March)
7. la Francophonie (April)

Detailed meeting summaries are available in uO Research http://hdl.handle.net/10393/46564. Discussions around the monthly meetings were used to contextualize and formulate eight recommendations that were presented to the Research Commission. Example actions for each recommendation are provided from the Canadian and global context, and specific actions proposed for uOttawa.

Recommendations

We developed four pillars to structure the eight recommendations. These pillars reflect general aims to a) foster a culture of open science, b) value open science practices, c) promote and invest in open infrastructure, and d) implement open science into uOttawa's strategic plan. The four pillars and eight recommendations are presented below:

A. Foster a culture of open science at uOttawa

A.1: Education. We recommend that uOttawa implement training programs, workshops, and events that train researchers in open science practices.

A.2: Capacity building. We recommend that uOttawa ensure dedicated roles and task forces to promote and advocate for open science practices, and to coordinate existing expertise.

B. Value open science practices

B.1: Hiring, tenure & promotion. We recommend that uOttawa integrate open science into the academic reward system and adopt evaluation frameworks to foster and value diversity in scholarly communication.

B.2: Institutional incentives. We recommend that uOttawa implement recognition and rewards that incentivize open science practices, including awards and prizes, teaching releases, competitions, or communication initiatives that highlight open research.

C. Promote and invest in open infrastructure

C.1: Tools and resources. We recommend that uOttawa create tools and resources, and promote existing ones, to build awareness, encourage best practices, and provide guidance to the community in navigating the complex landscape of open science.

C.2: Evidence base. We recommend that uOttawa evaluate progress towards making research outputs and practices open and transparent and recognize the importance of regular monitoring to support evidence-based decision making.

D. Implement open science in uOttawa's strategic plan

D.1: Policy. We recommend that uOttawa be a Canadian leader by implementing open science policies, and endorsing relevant declarations and initiatives aligned with its strategic objectives as well as Canadian and international developments.

D.2: Francophonie and bilingualism. We recommend that uOttawa place particular emphasis on promoting and supporting open research outputs by the French-language community, and support francophone researchers in publishing and communicating their work.

This report proposes sample actions for each recommendation, informed by activities at universities across Canada and in other countries. These actions draw on existing resources and infrastructure at the institution, while providing for and investing in new ones.

The recommendations were presented to the Research Commission in June 2024.

Next steps

Open science is not solely focused on research *outputs* being universally accessible; UNESCO stipulates that the *production of knowledge* itself must be inclusive, equitable, and sustainable (UNESCO, 2022). uOttawa recognizes that some academic research requires careful consideration and treatment around intellectual property, privacy, and security. It prioritizes pairing open science considerations with purposeful dialogue with Indigenous knowledge systems, acknowledging the complexity and evolution of efforts towards decolonization, and recognizing the current state of open science may not be suitable in some contexts.

Looking forward, the Open Science Working Group recognizes valuable foundational work conducted in this area but emphasizes that a continued focus from uOttawa will be required. Concrete suggestions with regard to **implementation, capacity gaps, and organizational responsibilities** are needed, which are beyond the mandate of the Open Science Working Group. Working group members hope that this report and the resources identified will not only advance open science practices at uOttawa but also support other Canadian institutions, both within their own organizations and in calibration and collaboration with others.

1. Preamble

The Open Science Working Group's (OSWG) mandate is especially timely as we observe numerous national developments, like the Tri-Agencies announcement in July 2023 for the review of the Open Access Policy on Publications (Adem et al., 2023) and international developments, such as the UNESCO Recommendations on Open Science (UNESCO, 2021), France's coherent national OS plan for 2021-2024 (Ministère de l'enseignement supérieur et de la recherche, 2021), the 2022 announcement by the US Office of Science and Technology (OSTP) Memo on immediate public access for federal agencies (Nelson, 2022), and the Year of Open Science (2023) declared by the US OSTP. These advances signal the continued prioritization of open science (OS) across many jurisdictions, including those of uOttawa's top collaborators, which include the US, UK, Australia, China, Germany and France (see Appendix A.1.3.). Researchers at uOttawa may be influenced by the practices and mandates of their collaborative network. Consequently, they might already be performing distinct OS practices in line with global developments, or they may require additional support to ensure they keep pace. With these considerations in mind, the OSWG examined the current state of OS at the university to identify ways OS can be further supported and advanced.

The UNESCO definition of OS was used to frame working group discussions. UNESCO provides the "first internationally agreed definition of OS which is defined as an inclusive construct that combines various movements and practices, aiming to:

- make multilingual scientific knowledge openly available, accessible and reusable for everyone,
- increase scientific collaborations and sharing of information for the benefits of science and society, and to
- open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community" (UNESCO, 2022, p. 1).

According to UNESCO, OS is not solely focused on making *research outputs* universally accessible but stipulates that the *production of that knowledge* itself must be inclusive, equitable, and sustainable (UNESCO, 2022). It is also recognized that some scientific research requires careful consideration and treatment around intellectual property, privacy, and security. As a result, many institutions operate within the framework "as open as possible, as closed as necessary" (Government of Canada, 2024; European Commission, n.d.; UNESCO, n.d.).

uOttawa is uniquely positioned in Canada to become a hub for OS. The university's existing expertise is diversely situated across the campus, with experts that perform meta research on OS, as well as OS champions - evidenced by the recipients of the Library's Open Scholarship Award (University of Ottawa Library, n.d.), members of this working group (University of Ottawa Library, 2023), and editors who support and manage OA journals, including those hosted by the Library (The University of Ottawa, n.d.B). This existing expertise

can drive forward OS work across campus, ensuring that uOttawa not only leads in OS, but responds effectively to evolving changes in the research landscape.

Myriad barriers to OS exist, such as predatory (or deceptive) publishing, substantial financial, technical, and cultural costs, and systemic inequities which make the adoption of OS challenging. Furthermore, many researchers express concerns around the quality of open access (OA) research, the appropriateness or risks of making some research open or opening some processes like peer review, and who should bear the burden of costs associated with making research open. Addressing the unique concerns and barriers to different open practices requires concerted attention, coordinated efforts, and ongoing dialogue among stakeholders (see Appendix A.1 for a more thorough discussion regarding the central themes, barriers and concerns discussed by the OSWG).

2. Recommendations

The OSWG proposes a set of eight recommendations to advance OS at uOttawa. These recommendations were informed by meeting discussions (see Appendix A.2), an environmental scan, and literature review of national and international OS initiatives and practices. These recommendations were presented to the uOttawa Research Commission in June 2024.

The eight recommendations are structured into four core pillars. An overview of the uOttawa Open Science Strategy Framework including the pillars and recommendations is provided in Figure 1, while each of the recommendations are described in further detail below (sections 2.1 to 2.4), where we also provide sample action items that could be used for implementation. Each recommendation is contextualized with examples of institutional implementation in Canada and internationally. Additional examples of OS practices proposed and adopted nationally and internationally can be found in this spreadsheet.

uOttawa Core Values	• Innovate boldly and sustainably • Build trust and connections • Collaborate with transparency			
Pillars	**A. Foster a culture of open science at uOttawa**	**B. Value open science practices**	**C. Promote and invest in open infrastructure**	**D. Implement open science into uOttawa's strategic plan**
Priorities	A.1: Education We recommend that uOttawa implement training programs, workshops, and events that train researchers in open science practices.	B.1. Hiring, tenure & promotion We recommend that uOttawa integrate open science into the academic reward system and adopt evaluation frameworks to foster and value diversity in scholarly communication.	C.1. Tools and resources We recommend that uOttawa create tools and resources, and promote existing ones, to build awareness, encourage best practices, and provide guidance to the community in navigating the complex landscape of open science.	D.1. Policy We recommend that uOttawa be a Canadian leader by implementing open science policies, and endorsing relevant declarations and initiatives aligned with its strategic objectives as well as Canadian and international developments.
	A.2: Capacity building We recommend that uOttawa ensure dedicated roles and task forces to promote and advocate for open science practices, and to coordinate existing expertise.	B.2. Institutional incentives We recommend that uOttawa implement recognition and rewards that incentivize open science practices, including awards and prizes, teaching releases, competitions or communication initiatives that highlight open research.	C.2. Evidence base We recommend that uOttawa evaluate the progress towards making research outputs and practices open and transparent and recognize the importance of regular monitoring to support evidence-based decision making.	D.2. Francophonie and bilingualism We recommend that uOttawa place particular emphasis on promoting and supporting open research outputs by the French-language community, and support francophone researchers in publishing and communicating their work.
Sample Actions	• Establish OS continuous learning programs • Create an OS student course • Promote OS outreach • Establish an advisory committee on OS • Appoint an OS Research Chair • Coordinate with other institutions advancing OS	• Add language to Tenure and Promotion and recruitment material valuing OS • Provide clear guidance to Tenure Committees • Create an OS Prize of Excellence • Provide a teaching release for OS-related work	• Create a repository of OS resources • Develop OS communications campaigns • Develop an OS monitoring framework • Integrate OA publication cost into existing financial systems	• Develop an institutional statement of OS principles • Work towards OS policy development • Identify and increase awareness of OS-related developments across campus • Ensure greater visibility of French research via OS practices • Continue to prioritize funding support of infrastructure and initiatives that support French research
Next steps / critically enable	Institutional adoption, raising awareness, action plan development	Institutional adoption, raising awareness, action plan development	Institutional adoption, raising awareness, action plan development	Institutional adoption, raising awareness, action plan development
	Data collection and evaluation	Data collection and evaluation	Data collection and evaluation	Data collection and evaluation

Figure 1. Proposed uOttawa Open Science Strategy framework. For a more detailed overview of recommendations, see below.

2.1 Pillar A: Foster a culture of open science at uOttawa

Fostering an environment that encourages and advances OS practices and processes requires a cultural transformation. Studies show that awareness and attitudes towards OS vary by demographic such as location, discipline, career stage, language, or economical capabilities such as access to funding (Ferguson et al., 2023; Abele-Brehm et al., 2019; Gownaris et al., 2022). Misinformation and the complexity of scholarly publishing contribute to challenges and create barriers to OS. Through educational efforts, such as open resources and learning programs, we can help address these issues.

2.1.1 Recommendation A.1: Education

We recommend that uOttawa implement training programs, workshops, and events that train researchers in open science practices.

Related action items can include:

- Establishing continuous learning programs and/or educational resources (e.g., videos, webinars) to support OS adoption.
- Creating a course in OS for students, covering a broad range of practices.
- Creating an OS Centre/Hub to coordinate expertise across the university.
- Promoting OS outreach by leveraging campus expertise (e.g., faculty OS champions, research advisors, the Library).

We propose to leverage and build upon existing educational activities at uOttawa or elsewhere. Elsewhere in Canada, educational efforts on OS include training, courses, and workshops, for example at Université Laval and Université de Montréal (Open Science uMontreal, n.d.; Université Laval, n.d.).

In Europe, we see that France's OS education initiatives are tied to their National Plan for Open Science, which includes developing OS training pathways for students and senior researchers alike (Ministère de l'enseignement supérieur et de la recherche, 2021). For example, Université de Lorraine provides customizable OS training for departments, labs, or projects (Université de Lorraine, 2024) and Sorbonne Université offers a Massive Open Online Course (MOOC) (Sorbonne Université, 2023a). In the Netherlands, research centres, like the CWTS Open Science Thematic Hub, coalesce knowledge and expertise across an institution, helping to raise capacity for OS (CWTS, 2024).

2.1.2 Recommendation A.2: Capacity building

We recommend that uOttawa ensure dedicated roles and task forces to promote and advocate for open science practices, and to coordinate existing expertise.

This recommendation aims to strengthen institutional capacity.

Actions can include:

- Establishing an advisory committee on OS.
- Appointing a Research Chair in OS.
- Establishing OS awards to encourage role-modelling and to champion best practices.
- Coordinating with other institutions advancing OS to effectively shift the culture of OS across Canada and streamline activities.

These actions are in line with similar capacity-building initiatives across Canada. The Université de Montréal, for example, is home to the UNESCO Chair on Open Science (UNESCO Chair in Open Science, n.d.) and Concordia University established an Open Science Working Group (Alessandroni et al., 2023). The University of Calgary has recently appointed a Consultant of Open Science Strategy to lead the development and implementation of an institutional strategy for OS.

Internationally, the League of European Research Universities appointed a senior manager to lead OS, and KU Leuven commissioned an OS ambassador to coordinate activities and participate globally in OS-related forums (KU Leuven, 2023). The Latin American Council of Social Sciences (CLACSO), a non-governmental initiative coordinating activities across over 800 research centres, effectively promotes open practices, tools, and platforms to its members (CLACSO, n.d.).

To achieve the benefits of OS across all levels of the institution, adequate coordination across dedicated roles and committees is necessary.

2.2 Pillar B: Value open science practices

Universities can strengthen their OS culture through policies on hiring, promotion, and tenure. Without clear guidance, committees often rely on narrow and flawed metrics such as the impact factor or h-index to evaluate a researchers' work, which fail to consider the diverse research practices and outputs, such as those written in French and languages other than English. Institutions can provide guidance and incorporate language into recruitment and promotion materials, and collective agreements that convey their OS values and offer incentives to promote OS practices that foster equity, diversity, and inclusion.

2.2.1 Recommendation B.1: Hiring, tenure & promotion

We recommend that uOttawa integrate open science into the academic reward system and adopt evaluation frameworks to foster and value diversity in scholarly communication.

Implementation of this recommendation should be paired with careful consideration of Indigenous knowledge systems, acknowledging the complexity and evolution of efforts towards decolonization, and recognizing that the current state of OS may be at tension with

some types of knowledge and data. uOttawa can also develop policies affirming institutional values that emphasize a positive link between equity, diversity and inclusion (EDI) and OS.

Actions can include:

- Adding language to guidance documents for tenure and promotion to value OS in the evaluation process.
- Adding language to recruitment material emphasizing uOttawa's institutional value of OS.
- Working towards policies that affirm institutional values and emphasize a positive link between EDI and OS.
- Applying comprehensive evaluation criteria including collaborative research, knowledge mobilization, training, and trainee supervision when assessing research excellence.
- Providing clear guidance to tenure committees to consider qualitative indicators (e.g., knowledge mobilization, media, involvement in expert committees, service) in addition to quantitative metrics and refrain from using metrics such as the h-index or impact factor for assessments of individuals.

In Canada, OS practices are increasingly recognized as quality indicators in evaluation processes. For example, the Canadian Institutes of Health Research's (CIHR) incorporated OS as a key component in their Research Excellence Framework (CIHR, 2024b), and the Natural Sciences and Engineering Research Council (NSERC) includes OS in their Guidelines on the assessment of contributions to research, training and mentoring (NSERC, 2023). We can also see University of Calgary, a signatory of the San Francisco Declaration on Research Assessment (DORA, 2013), integrating OS into faculty guidelines (e.g., 2024 Faculty of Education Guidelines and 2024 Schulich Faculty of Engineering Guidelines) (University of Calgary, 2023; University of Calgary, 2024).

Global initiatives like DORA (2013) and the Coalition for Advancing Research Assessment (CoARA, 2024) promote the inclusion of qualitative measures in research assessment, supported by responsible use of quantitative indicators. More recently, institutional signatories of the Barcelona Declaration on Open Research Information (Barcelona Declaration, 2024) commit to using open infrastructure, systems and services. Relying on open, less selective databases may also improve the representation and visibility of Francophone and other non-English research outputs in research assessment.

2.2.2 Recommendation B.2: Institutional incentives

We recommend that uOttawa implement recognition and rewards that incentivize open science practices, including awards and prizes, teaching releases, competitions or communication initiatives that highlight open research.

Implementing recommendation B.2 will help shift academic culture to value open practices and processes.

Actions can include:

- Creating a Prize of Excellence in OS, similar to the EDI Research Award (Research and Innovation, n.d.B).
- Leveraging uOttawa's position in the National Capital Region to work with national bodies to advance OS and encourage funding opportunities (e.g., the Tri-Agencies).
- Extending the Library's Open Scholarship Award, and in collaboration with the OVPRI, award a monetary prize.
- Providing institutional funding support for OS through awards and grants.
- Granting teaching releases for editors of diamond OA journals.

Much of the literature emphasizes the effectiveness of incentives as a mechanism for reforming research assessment. At uOttawa, the Equity, Diversity and Inclusion Action Plan for Research (Research and Innovation, n.d.A) recommends establishing EDI recognition awards to champion best practices; this similarly could apply to OS. Concordia University proposes offering a teaching release for professors who develop open textbooks (Alessandroni et al., 2023).

Examples of incentives for OS in Europe include the French Open Science Plan's research data prize for the sharing or reuse of data, or the open-source research software prize (Ministère de l'enseignement supérieur et de la recherche, 2021). The European University Alliance similarly recommends organizations create awards to recognize OS work being conducted by researchers across the institution (Circle U, 2023).

2.3 Pillar C: Promote and invest in open infrastructure

Open infrastructure is a key enabler to facilitating the exchange and visibility of open research outputs. Institutions can create tailored resources, support and build upon existing tools, and use open infrastructure and data to understand OS trends. Adopting open over proprietary systems supports the free exchange of ideas across institutions, innovating practices and leveraging resources and expertise.

2.3.1 Recommendation C.1: Tools and resources

We recommend that uOttawa create tools and resources, and promote existing ones, to build awareness, encourage best practices, and provide guidance to the community in navigating the complex landscape of open science.

Actions can include:

- Creating and disseminating a repository of OS resources.
- Developing communication campaigns to promote open outputs of uOttawa researchers, such as news items that promote OS practices across the institution (website, The Gazette, etc.), or an "Inspiring Stories" video competition.
- Contributing to improvements of the Open Journal Systems (OJS) platform, to reduce barriers to managing and launching OA journals.

Coalition Publica, a partnership between Érudit and the Public Knowledge Project with funding support from the Canada Foundation for Innovation (CFI) and the Social Sciences and Humanities Research Council (SSHRC), exemplifies non-commercial, open source infrastructure advancing research dissemination and scholarly publishing in Canada. Continued support and promotion of their work will ensure their sustainability and the ongoing advancement of scholarly publishing in Canada.

Elsewhere, Princeton has published a LibGuide for the Open Science Framework (OSF), where they publicize Princeton OSF repositories, ensuring the visibility of open practices across the institution (Princeton University Library, 2023). Harvard publicizes open access to their metadata through their APIs, promoting and ensuring access to their institutional records (Harvard Library, n.d.). The Netherlands invested heavily in new infrastructures and networks to support their national OS policy (NWO, 2023), and recently launched an ambitious programme to make further advancements (Open Science NL, 2024).

With increasing developments in open infrastructure, institutions should stay attuned to advancements that equitably enhance the visibility and discoverability of their research outputs. OpenAlex, a new open-source and open data platform for research outputs may soon become a viable alternative to proprietary citation indexes, such as Web of Science and Scopus for research discovery, bibliometric analysis, and research evaluation (Alperin et al., 2024).

2.3.2 Recommendation C.2: Evidence base

We recommend that uOttawa evaluate the progress towards making research outputs and practices open and transparent and recognize the importance of regular monitoring to support evidence based decision making.

Creating an evidence base on the extent to which uOttawa's research outputs are open will be helpful to monitor progress and target further support. Such monitoring exercises will not assess any one actor or entity, but rather provide useful benchmarks of institutional progress towards OS and support evidence-based decisions on ways forward. This is in line with efforts in France where Université de Lorraine built an OA monitor not to "evaluate research, but to become a tool to help an institution establish an effective action plan to advance Open Science at institutional level" (Bracco, 2022, p. 15).

Actions can include:

- Developing a monitoring framework and investing in a program of regular tracking of uOttawa's OS outputs, to evaluate progress. To perform this work, uOttawa will leverage open infrastructure, where possible, and allow for the diversity of research practices across faculties and disciplines.
- Integrating OA publication cost reporting into existing financial systems.

In Canada, much work can be done to improve the monitoring of open outputs. At the national level, the Tri-Agencies have not yet committed to monitoring the effectiveness of

their OA policy. It will be important to remain engaged in conversations with various stakeholders to ensure efforts are not duplicated, and to share best practices.

Internationally, France monitors OS outputs for French-affiliated authors and publicizes results on their dashboard, the French Open Science Monitor (Ministère de l'enseignement supérieur et de la recherche, 2021), while the Curtin Open Knowledge Initiative (COKI) in Australia runs a dashboard that displays global OA outputs (COKI, n.d.). UNESCO's Monitoring Framework for Open Science recommends that monitoring include a range of dimensions beyond observable outputs (i.e., OS processes, such as collaborative practices like public engagement) (Rafols et al., 2024). Responsible monitoring practices should consider open infrastructure, as outlined in the Barcelona Declaration on Open Research Information (Barcelona Declaration, 2024), as transparent and inclusive data can better support responsible decision-making in areas like policy-making, research assessment, and bibliometric analysis.

2.4 Pillar D: Implement open science into uOttawa's strategic plan

Many funding agencies, academic institutions, and research organizations have adopted OS mandates to promote open research. Institutions can advance and encourage the adoption of OS practices through incentives and strategic visions aligned with community needs and best practices. uOttawa can be a leader by setting a clear vision to advance OS at the institutional level.

2.4.1 Recommendation D.1: Policy

We recommend that uOttawa be a Canadian leader by implementing open science policies, and endorsing relevant declarations and initiatives aligned with its strategic objectives as well as Canadian and international developments.

In 2009, uOttawa was among the first Canadian institution to develop a comprehensive OA program (uOttawa News, 2009). As a longstanding advocate of OA, uOttawa can leverage its expertise to achieve priorities, such as its commitments in Transformation 2030, to promote OA publishing and develop Open Education Resources in French, and extend the current emphasis on OA to foster and encourage OS processes and practices.

Actions can include:

- Developing an Institutional Statement of OS Principles.
- Implementing OS into uOttawa's strategic plan.
- Working towards developing an OS policy or Senate resolution that provides clear guidance on institutional priorities as it relates to OS.
- Identifying and increasing awareness of national and international guidelines, commitments, declarations, and initiatives (e.g., DORA, Barcelona Declaration, Peer Community In).

In Canada, open access (OA)-related strategies, such as institutional policies, statements, or commitments, are more advanced than OS. Several Canadian institutions have created OA policies, including Université de Montréal (Université de Montréal, 2019), Université de Laval (Université Laval, n.d.), and Simon Fraser University (Simon Fraser University, 2017). Other institutions, like Concordia (Concordia University, 2010), have passed resolutions or declarations. The Canadian Association of Research Libraries (CARL) developed the Institutional Open Access Policy Template and Toolkit (CARL, 2020) that offers language for institutional OA policy development and encourages institutions to adopt policies that are broad and ambitious in scope and reflect the goals of their community (e.g., opt-out policies achieve the highest level of open publications as opposed to those that merely encourage OA). These OA-related strategies can be used as a blueprint for drafting OS policies, and endorsing relevant declarations.

Internationally, organizations like the League of European Research Universities recommend the adoption of institutional policies to advance OS (LERU, 2018). Horizon Europe, the EU's key funding program for research and innovation, applies a mandatory OA policy as well as OS principles throughout the program (Horizon Europe, n.d.). Owing to the Second French Plan for Open Science, many institutions in France have created and implemented OS-related policies, or the integration of OS into strategic documents (Université de Lille, 2021; Université de Lille, 2022; Sorbonne Université, 2023b; Université de Strasbourg, 2023; Université Paris-Saclay; 2023). In the US, uOttawa's biggest collaborator (see section A.1.3), the OSTP designated 2023 as the *Year of Open Science,* to promote and advance OS activities. Notable outcomes include the strengthening of OS policies, such as NIH's Data Management and Sharing Policy, which influenced institutional efforts, like training by the University of California San Francisco.

2.4.2 Recommendation D.2: Francophonie and bilingualism

We recommend that uOttawa place particular emphasis on promoting and supporting open research outputs by the French language community, and support francophone researchers in publishing and communicating their work.

uOttawa is uniquely positioned as the world's largest English-French bilingual university, making it a leader in many spaces relating to the advancement of multilingual research practices. OS can be more effectively promoted across the institution by considering disciplinary and linguistic contexts.

Suggested action items include:

- Continuing to prioritize Library funding for support of French publishing initiatives like French-language OA books through uO Press, Érudit, Coalition Publica, and the support of French and French-English bilingual journals through its Library publishing program.
- Advancing and prioritizing Transformation 2030's objective to ensure greater visibility for research undertaken in French. This can include supporting faculty in their

editorial work for French OA journals through funding and course releases, and/or encouraging OA as a means to raise the visibility of research published in French.
- Creating communication campaigns that promote OA and francophone publications.
- Identifying and promoting tools that disseminate francophone research, such as preprint servers, repositories and publishing platforms.

Several Canadian studies and reports highlight the decline of francophone publications and research, emphasizing the need to value and promote knowledge creation and research dissemination in French (St-Onge et al., 2021; FRQ, 2023); see also the Government of Canada's Standing Committee on Science & Research (Longfield, 2023). These reports also recommend encouraging the development of OA resources to better support OA practices in French, and injecting more funding for French-language research, and creating strategies to ensure the visibility of francophone research.

The importance of multilingualism in science is internationally acknowledged; the Helsinki Initiative on Multilingualism in Scholarly Communication (Federation of Finnish Learned Societies et al., 2019) includes a range of institutional and individual signatories supporting a commitment to ensuring equal access to the results of research provided in a variety of languages. Canadian signatories of the Helsinki initiative include ACFAS, Érudit, Gouvernement du Québec and the Public Knowledge Project. The UNESCO Recommendations on Open Science include multilingualism as a key element to advancing research globally, and CoARA has recently established a working group in Multilingualism and language biases in research assessment and will be running various workshops and events that a uOttawa representative could attend (CoARA, 2024; UNESCO, 2021).

3. Implementation

Implementation of the recommendations and associated action items requires the involvement and potential financial commitments from various stakeholders across campus. As the OSWG concludes its work with the submission of this report, the identification of stakeholders and responsibilities is beyond its scope. Recognizing the need for coordination across units and stakeholders, the working group therefore suggests, as part of *Recommendation A.2: Capacity building*, to establish a **uOttawa advisory committee on OS** as a first step towards implementing open research practices. This committee would oversee efforts and identify the appropriate accountabilities and units. For example, some recommendations could be implemented centrally by the OVPRI or the Library, while others require leadership from individual faculties. The advisory committee could also conduct a gap analysis to identify existing efforts and initiatives and prioritize actions.

Considering disciplinary differences, the OSWG also suggests that, with support from the respective Vice-Deans Research, the working group co-chairs tour the faculties during the Fall 2024 and Winter 2025 semesters to present the recommendations and discuss potential implementation in the context of each faculty.

The working group acknowledges that the various action items require different financial and human resources. The matrix in Figure 2 aims to position items according to an initial estimated amount of resources (less resources versus more resources) and time (short term versus long term) necessary for successful implementation. The proposed advisory committee, with support from the Research Commission and senior academic leadership, would be well-positioned to revise for greater accuracy.

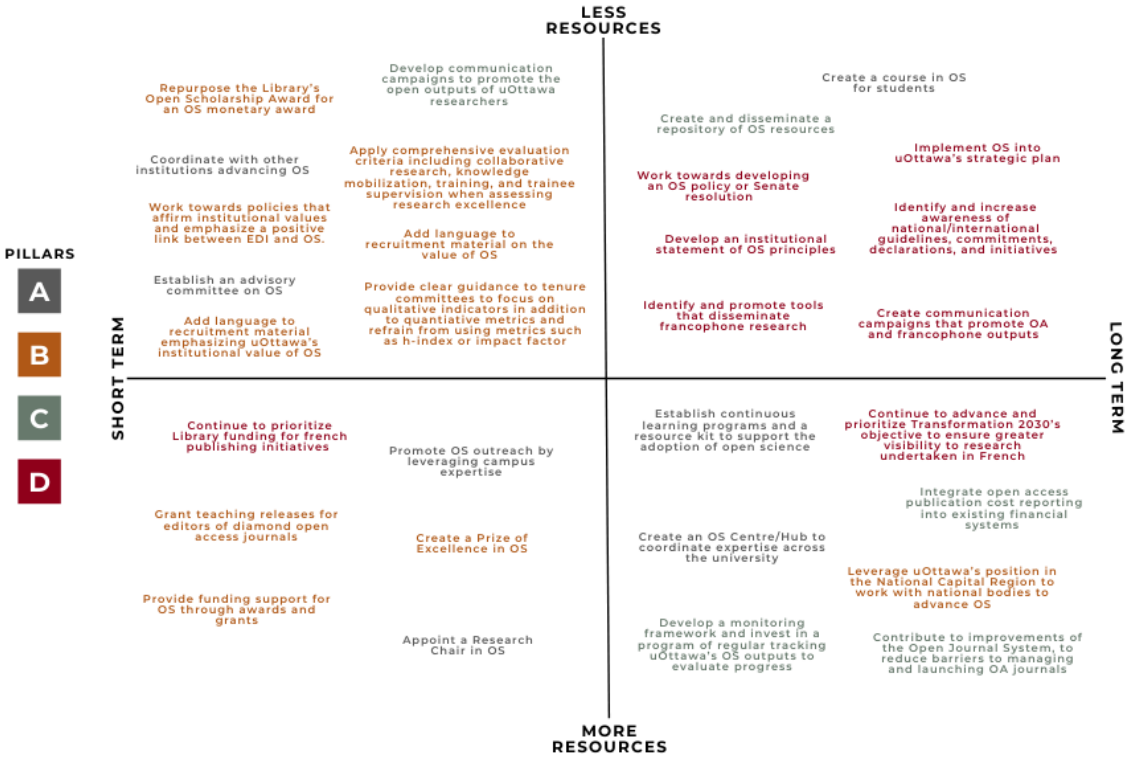

Figure 2. Matrix of action items for implementation, grouped according to estimated requirements in terms of resources (less resources vs more resources) and time (short term vs long term).

Following the OSWG's May meeting, an anonymous survey was conducted among members, asking them to rank the eight proposed recommendations in terms of perceived priority or importance. Although there were limited responses, some general trends emerged that showed that Pillar A and B, which focus on creating a culture of and valuing OS practices, seemed to be most important. For example, *Capacity building* (A.2) was frequently ranked as the highest priority, followed by *Education* (A.1), *Institutional incentives* (B.2), and *Hiring, tenure & promotion* (B.1). However, there was notable variation among the eight respondents and no clear consensus emerged on prioritizing the eight recommendations.

The varying priorities among participating OSWG members highlight the need for a tailored approach to implementation rather than a one-size-fits-all solution. It is essential to involve all relevant stakeholders and ensure equity, diversity, and inclusion with a particular focus on Francophone and Indigenous communities, in determining priorities, and that each

recommendation and associated action item should be considered within the context of feasibility with respect to available resources and practical timelines.

4. Conclusion and outlook

In 2009, uOttawa became one of the first institutions in Canada to establish a comprehensive OA program (uOttawa News, 2009). This initiative laid the groundwork for building expertise in open research practices at uOttawa. Since then, uOttawa has continued to adapt its efforts to promote OS practices alongside global advancements. The formation of the OSWG is one such initiative focused on taking actionable steps towards a more open future. The recommendations outlined in this report underscore uOttawa's commitment to advancing its mission through the lens of OS. They propose ways for uOttawa to leverage its core mission by promoting bilingual research practices, as well as furthering its research agenda through educational initiatives in OS, research assessment reform that incentivizes and values OS, support for community-driven efforts, and policy development.

uOttawa already benefits from a strong cohort of OS experts, with a range of skills across faculty, researchers, and students. This strong foundation positions the institution to play a pivotal role in advancing OS. Our current achievements in areas such as OA publishing, including advancements by uO Press, research data management, experts in OS meta research (Centre of Journalology, ScholCommLab, uOttawa Heart Institute) as well as researchers across faculties and disciplines who already publish OA, share their data and code, pre-register their studies, practice open peer review and conduct their research in an open and transparent manner. While these researchers would make ideal champions to establish OS on campus, a cohesive vision and continued investments by uOttawa are essential to enhancing this capacity and ensuring alignment with national and global initiatives.

uOttawa's objectives within Transformation 2030 - to promote OA publishing and develop Open Education Resources in French - provide a starting point and position the institution well for implementing the report's recommendations. However, achieving success relies on effective implementation of these recommendations. To facilitate this, we recommend establishing an advisory committee to oversee implementation and ensure alignment with ongoing national and global developments.

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A. Appendices

A.1 Central themes

This section provides an overview of certain open science (OS) themes and related topics discussed by the working group. The goal of this section is to provide background information and summarize the evidence base that informed discussions and were foundational for the development of the uOttawa Open Science Strategy framework and recommendations. Although this section provides background information to contextualize the central themes discussed by the working group, it is not intended as a comprehensive literature review. For a more detailed summary of working group discussions, please consult the meeting summaries available in uO Research: http://hdl.handle.net/10393/46534.

A.1.1 Open science policies

In Canada, national OS policy is shaped by government bodies, such as funding agencies. While the focus has been on OA, recent efforts have expanded to include other open practices. For instance, the Tri-Agencies adopted their OA Policy on Publications in 2015 (Government of Canada, 2016), FRQ's OA policy (FRQ, 2022) was revised in 2022, and the Office of the Chief Science Advisor released a Roadmap for Open Science in 2020 (Office of the Chief Science Advisor, 2020). More recently, we see national bodies broaden the scope toward other open practices, with CIHR's requirements, as of 2021, for clinical trial registration (CIHR, 2024a), although predated by the 2018 and now 2022 Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (Government of Canada, 2022), and the Tri-Agency requirements for data sharing and management, with their RDM policy (Government of Canada, 2021).

Studies on OA policy compliance in Canada found varying but relatively low OA rates of journal articles that acknowledge Tri-Agency funding (Larivière and Sugimoto, 2018; Paquet et al., 2022; Scaffidi et al., 2021). CIHR, an early adopter of OA policy, reported a 10% decrease in compliance from 2014 to 2017 following the harmonization of Tri-Agency policies (Larivière & Sugimoto, 2018). Factors contributing to these low rates include the absence of a national OA infrastructure, lack of enforcement, and disciplinary norms affecting funding distribution (Larivière and Sugimoto, 2018; Paquet et al., 2022; Scaffidi et al., 2021).

Institutional policies vary in Canada, leaning toward recommendations rather than requirements, and often originate from or apply specifically to the library (Betz et al., 2019). Several U15 institutions have statements or roadmaps, but only two have an institutional-wide OA policy: the Université de Montréal and the Université Laval (see Figure 3). A 2023 study (Riddle et al., 2023) found that the Université de Montréal is the only institution to mandate authors to deposit their work in an institutional repository.

Gold OA

Green OA

Hybrid OA

Hybrid (Transformative only)

Creative Commons License

Commitment to monitor

Policy applies to journal articles

Policy applies to data

Policy applies to books and chapters

Policy applies to other outputs (theses, patents, creative output...)

University	Approach	Policy				Embargo	Enforcement	Format			
Institution-wide											
The University of British Columbia	Declaration	✓				-	-	✓	✓	✓	✓
Université Laval	Policy	✓				0	-	✓			
McGill University	Declaration	✓	✓	✓		-	-	✓	✓	✓	✓
Université de Montréal	Policy	✓				0	✓	✓		✓	
SFU Simon Fraser University	Policy	✓				0	-	✓			
Library											
uOttawa	Policy	✓	✓	✓	✓	12	-	✓	✓	✓	✓
University of Saskatchewan	Commitment	✓	✓	✓		-	-	✓	✓	✓	✓
Western University	Declaration	✓	✓	✓		-	-	✓	✓	✓	✓
University of Alberta	Statement	✓	✓	✓	✓	12	-	✓	✓	✓	✓

to faculties on various pathways to OA publishing, highlighting their unique features and benefits (de Boer et al., 2024).

Other impactful OS initiatives include the Confederation of Open Access Repositories (2009), DORA (2013), the Research Data Alliance (2013), the Leiden manifesto (2013), Developing Institutional Open Access Publishing Models to Advance Scholarly Communication (DIAMAS), and CoARA (2024).

A.1.2 La Francophonie

The UNESCO recommendations on OS emphasize multilingualism as a key element in advancing research at the global level. Currently, English is the *lingua franca* across the scientific enterprise. However, a crucial factor in fostering inclusivity and equitable participation is ensuring knowledge is accessible to an audience with different linguistic backgrounds. Global initiatives, such as the Helsinki Initiative on Multilingualism in Scholarly Communication (Federation of Finnish Learned Societies et al., 2019), OPERAS (Delfim et al., 2018), or CoARA (CoARA, 2024), advocate for disseminating research results in locally relevant languages. They emphasize practical actions like creating infrastructure and tools as well as rewarding and incentivizing multilingual research, to enable impactful research that benefits local and regional communities.

Transformation 2030 aims to enhance the visibility of francophone research through strategic objectives to reinforce and promote scholarly dissemination in French, including OA publishing. uOttawa's active engagement in ongoing global efforts, and those in Canada, is crucial for enhancing the visibility and impact of francophone research.

A comparison of OA articles published in French by uOttawa authors in WoS and Érudit highlights the significance of the Érudit platform for increasing the visibility of francophone research. Notably, the number of OA publications by uOttawa authors continues to grow on Érudit (see Figure A1).

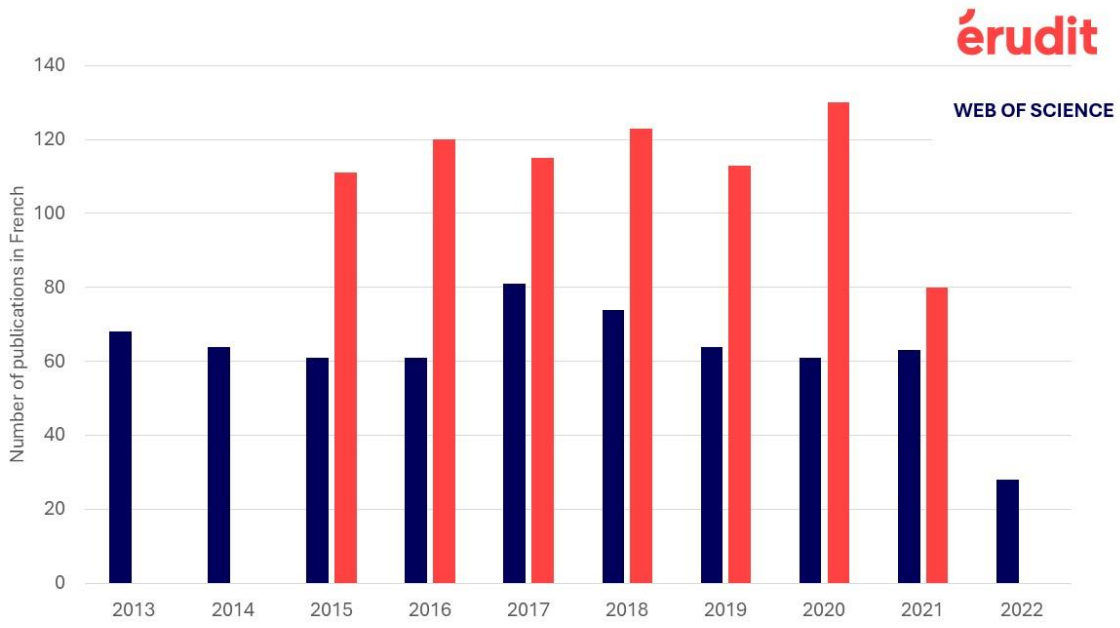


Figure A1. A comparison of articles published in French by uOttawa authors indexed in Érudit and Web of Science in 2022. Note that data for 2022 was not available for Érudit at the time of analysis.

Reports from ACFAS (St-Onge et al., 2021), FRQ (Fonds de recherche du Québec, 2023), and the Government of Canada's Standing Committee on Science & Research (Longfield, 2023), highlight the decline of francophone publications and research, emphasizing the need to value and promote knowledge creation and research dissemination in French. These reports point to studies that show the increasing dominance of English in scholarly databases (see Figures A2-4), which perpetuate language bias in research. The over reliance of such databases has a direct impact on academic recognition, since francophone research is less visible in these platforms.

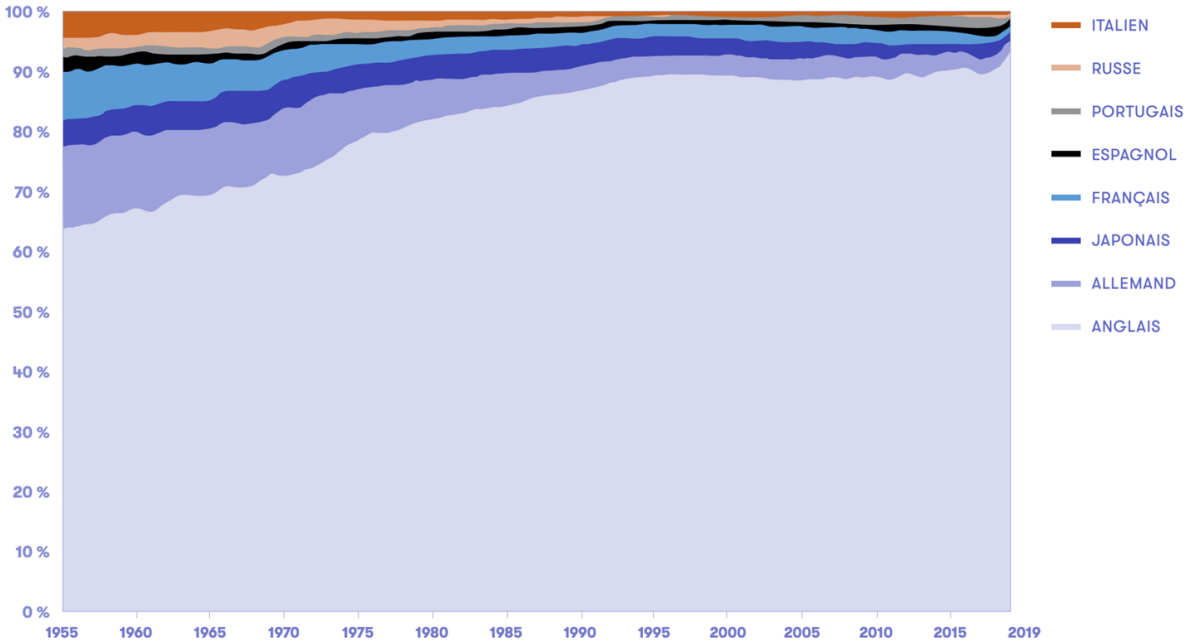
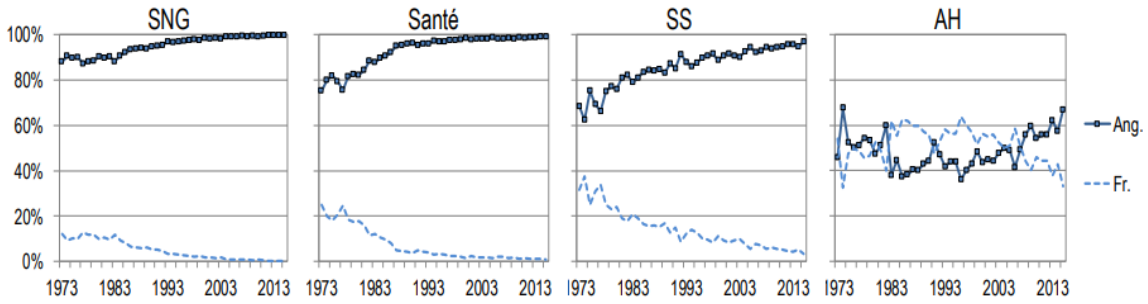
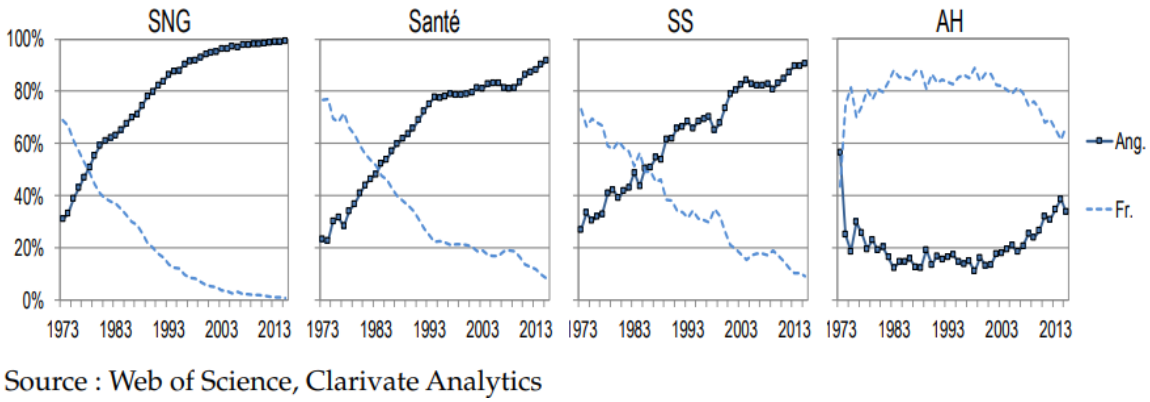


Figure A2. La prédominance de l'anglais dans les bases de données (St-Onge et al., 2021)



Source : Web of Science, Clarivate Analytics

Figure A3. Percentage of articles in Social Sciences and Humanities, written in English and French by Québécois authors, 1973-2015 (Larivière, 2018).



Source : Web of Science, Clarivate Analytics

Figure A4. Percentage of articles in Social Sciences and Humanities, written in English and French by French authors, 1973-2015 (Larivière, 2018).

Canada is well-positioned to contribute to efforts to strengthen multilingualism in research with infrastructure like Érudit and Coalition Publica. Even more, uOttawa can take leadership by leveraging its core bilingual mission, and ensure the ongoing support, creation, and dissemination of francophone research.

A.1.3 Open access at uOttawa

uOttawa's research outputs are influenced by its bilingual (French and English) mission, research-capacity, including its numerous affiliated centres and institutes, collaborative network, and national and international policies (The University of Ottawa, n.d.A). An analysis of journal articles published between 2013 and 2022 by at least one author affiliated with uOttawa and indexed in the Web of Science (WoS) experienced a steady increase in OA availability, rising from 41% to 57% (Figure A5). Green OA (self-archiving) was the most common route (40%), followed by articles in gold OA journals (23%). Gold OA showed significant annual growth, doubling the number of articles from 15% in 2013 to 32% in 2022. Hybrid OA, while less common (7%), experienced significant growth from 4% to 11% in 2022. It should be noted that green OA is free of charge to authors, while many (although not all) gold OA and all hybrid OA articles are subject to an author fee called article processing charge (APC). These are analyzed in A.1.4 below.

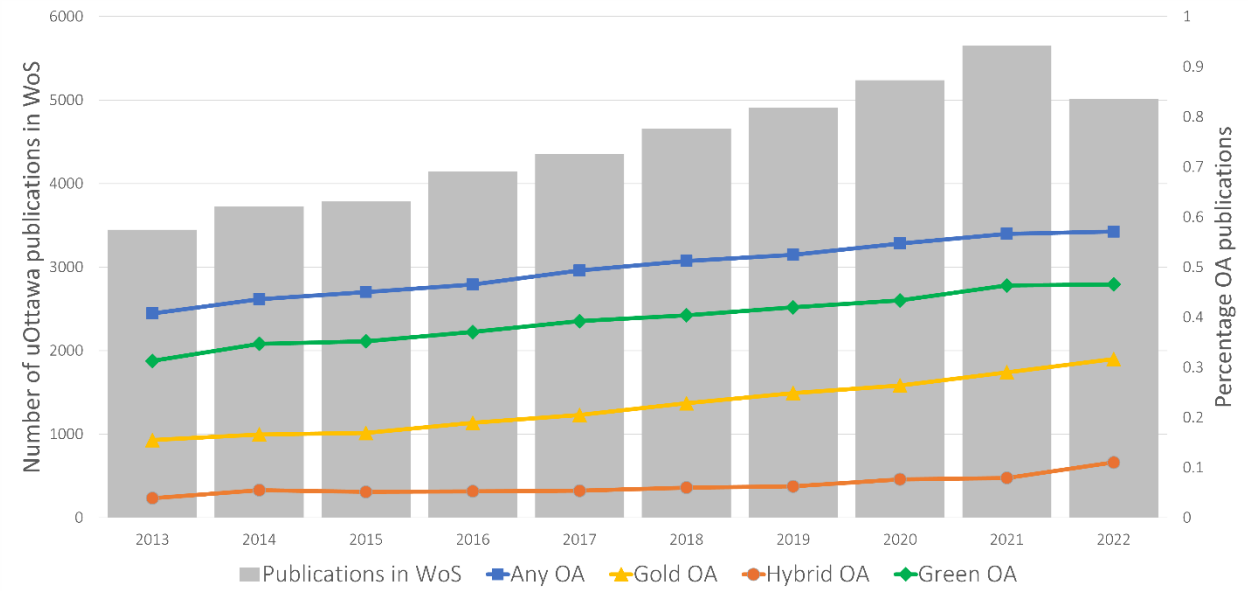


Figure A5. Rates of open access at the University of Ottawa 2013-2022. Based on data collected from the Web of Science in January 2023; includes articles and reviews published between 2013 and 2022 with at least one author affiliated to uOttawa or affiliated hospitals (n=44,952). Categories are not mutually exclusive, since green OA articles may also be published as gold or hybrid.

In terms of collaborations, we see that between 2013 and 2022 22% uOttawa publications in the WoS are co-authored with at least one author from the United States (Table A2). When collaborating with the top six countries, uOttawa authors publish more OA, particularly with the UK (80% OA), Germany (75%), Australia (73%) and France (69%), compared to their overall OA rate of 51%. Collaborations with the UK or Germany also led to an increase in hybrid publishing (17% vs 7%), likely influenced by specific funding programs (e.g., transformative agreements such as Project DEAL, UKRI block grants). Overall, these collaborations contributed to higher green OA rates.

Table A2. uOttawa-affiliated publications co-authored with top six collaborating countries 2013-2022, based on articles and reviews indexed in Web of Science with at least one author affiliated to uOttawa or affiliated hospitals (n=44,952). Collaborations represent the number of uOttawa publications including at least one co-author from the respective country.

with co-author from...	Publications 2013-2022		Any OA	Green OA	Gold OA	Hybrid OA	Closed
uOttawa	44,952		51%	43%	19%	13%	49%
US	10,076	22%	66%	56%	21%	11%	34%
UK	4,035	9%	80%	74%	26%	17%	20%
Australia	2,885	6%	73%	65%	25%	14%	27%
China	2,830	6%	54%	45%	26%	8%	46%
Germany	2,517	6%	75%	69%	23%	17%	25%
France	2,395	5%	69%	61%	19%	13%	31%

A.1.4 Open access fees

The author-pays model, where authors pay an APC for hybrid or gold OA journals, generates reliable revenue for commercial publishers (Butler et al., 2024). Using uOttawa-affiliated publications in the WoS in 2022, it is estimated that authors paid $7.3 million CAD for 2,142 gold (1,588) and hybrid (554) (Figure A6)[1]. Comparing publishers, the largest amounts went to Springer Nature and Elsevier, who offer both gold and hybrid OA options, and MDPI and Frontiers, who publish gold OA journals only.

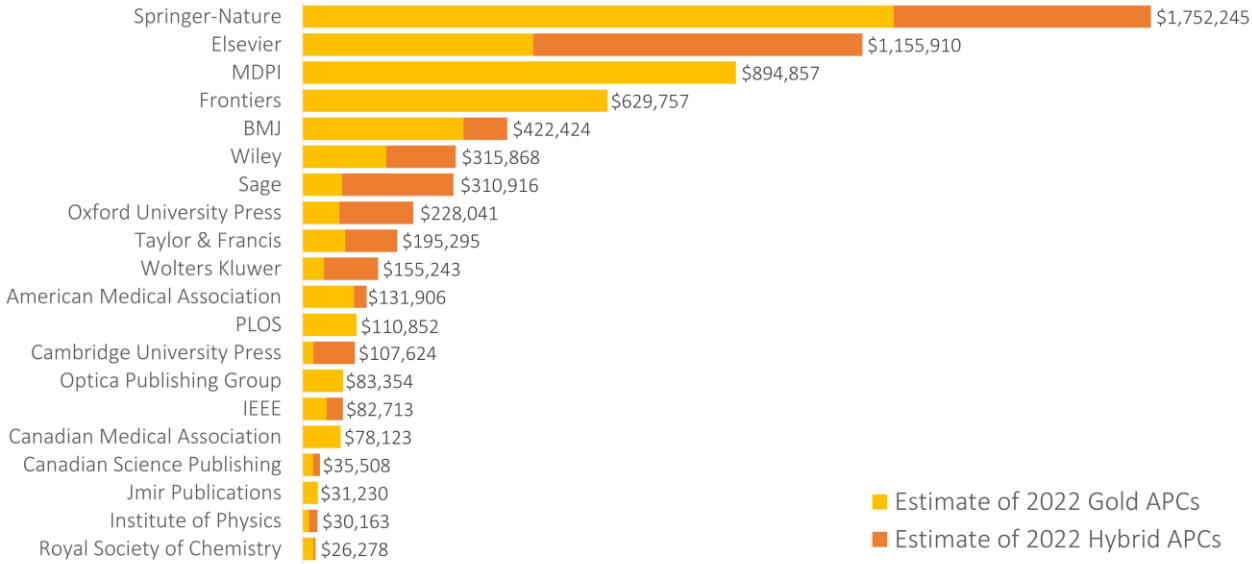


Figure A6. Estimate of APCs paid (in CAD) by uOttawa authors for journal articles published in 2022 for the top 20 publishers. Estimates are based on gold and hybrid OA papers published in 2022 as indexed in Web of Science with at least one author affiliated to uOttawa or affiliated institutes and centres (n=2,142). The number of papers per journal was multiplied with 2022 APCs for each journal. We collected APCs for 584 journals (=1,687 articles) and, since APCs are not readily available, used the median gold ($3,123) and hybrid APCs ($4,418) for the remaining 364 journals (=455 articles).

The $7.3 million estimate is based on any publication involving a uOttawa author. However, APCs are per article, so usually only one, often the corresponding author, pays the fee, either from their research grant or other funds. Therefore, estimates were also calculated for uOttawa corresponding authors only, which amounted to $2.9 million CAD for 878 gold and 186 hybrid OA publications (Table A3).

Recently, Read-and-Publish agreements (sometimes known as transformative agreements) have gained popularity, which bundle publishing costs with traditional subscriptions and are subsidized by libraries (ESAC, 2024). Libraries also provide discounts beyond these agreements. These negotiated discounts and agreements typically apply to the corresponding author. When considering these agreements and discounts, it is estimated that uOttawa authors paid approximately $744k less in 2022 (Table A3). While this seems

[1] Refer to Meeting summary #4 (http://hdl.handle.net/10393/46534) for a description of the methodology for this study, and a more detailed analysis of results.

beneficial as it comes across as savings, the fees are now just paid by the library up front instead of the authors per individual article. These read-and-publish agreements continue to tie universities to a model in which opaque cost increases by major publishers (similarly to current bundled subscriptions known as “big deals”), draw significant amounts from the academic enterprise.

Table A3. Estimates of uOttawa APCs spend and read-and-publish agreements in 2022.

Estimate of uOttawa APCs 2022

2022 publications in Web of Science	Gold OA publications	Estimated gold fees paid by authors (CAD)	Number of hybrid OA publications	Estimated hybrid fees paid by authors (CAD)	Total amount of estimated APCs
WoS 2022 articles with uOttawa author	1,588	$ 4,893,462	554	$ 2,446,929	$ 7,340,390
with uOttawa corresponding author	692	$ 2,087,657	186	$ 806,730	$ 2,894,387
with uOttawa Library agreements		$ 1,577,133		$ 573,442	$ 2,150,575*

uOttawa sources of financing APCs:

→ Library Shared Support Fund for gold OA: $ 133,324

→ *Discounts negotiated by library and tied to bundled subscription agreements

→ Other sources: Faculty research grants, OVPRI grants, Tri-Agency funding

Estimated gold fees paid by authors ($ CA)

Breaking down the $2.2 million of estimated fees paid by uOttawa corresponding author, we see that about half of the fees are affiliated with authors from the Faculty of Medicine, followed by Science, Engineering, Health Sciences and Social Sciences, while only a fraction is spent by authors at Arts, Telfer, Education and Law (Figure A7). This very much reflects disciplinary practices of publishing in APC journals, as well as available research budgets.

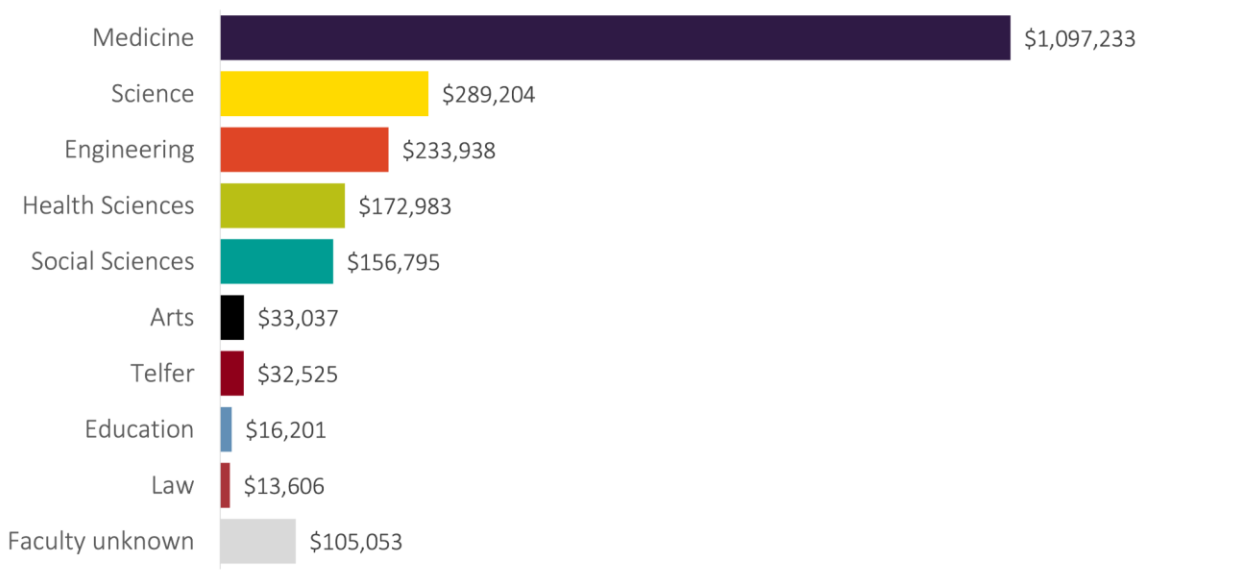


Figure A7. Estimate of uOttawa APCs 2022 per faculty for uOttawa corresponding authors (n=2,137). Faculty could not be determined for 5% (n=108) of publications.

A.1.5 Barriers to open science

Encouraging and supporting OS awareness requires ongoing financial and educational investments. At the institution level, this support helps the community navigate the complexities of OS practices and OA publishing. For example, OS is rooted in the same foundations as the traditional scientific research system, inheriting existing barriers which can impede its adoption (UNESCO, 2021; Bahlai et al., 2019). Power inequities related to career stage, employment stability, financial circumstances, geographic location, or cultural contexts (e.g., race, gender identity, ethnicity) contribute unique challenges for OS (Kent et al., 2022; Bahlai et al., 2019). Additionally, the financial, technical, and cultural costs associated with OS, such as limited funding initiatives, infrastructure and tools, data management, intellectual property concerns, and the labour required to build awareness and enable capacity, pose barriers (Gagliardi et al., 2015; Gownaris et al., 2022). The transparency and monitoring requirements of OS practices, such as the preregistration of clinical trials, demands skill, time and capacity - constraints often mentioned by researchers (Gagliardi et al., 2015; Gownaris et al, 2022; Alayche et al., 2023). Adequate allocation of time and resources is essential to ensure researchers gain knowledge of OS processes, and that institutions maintain necessary OS tools, like data repositories (Gagliardi et al., 2015).

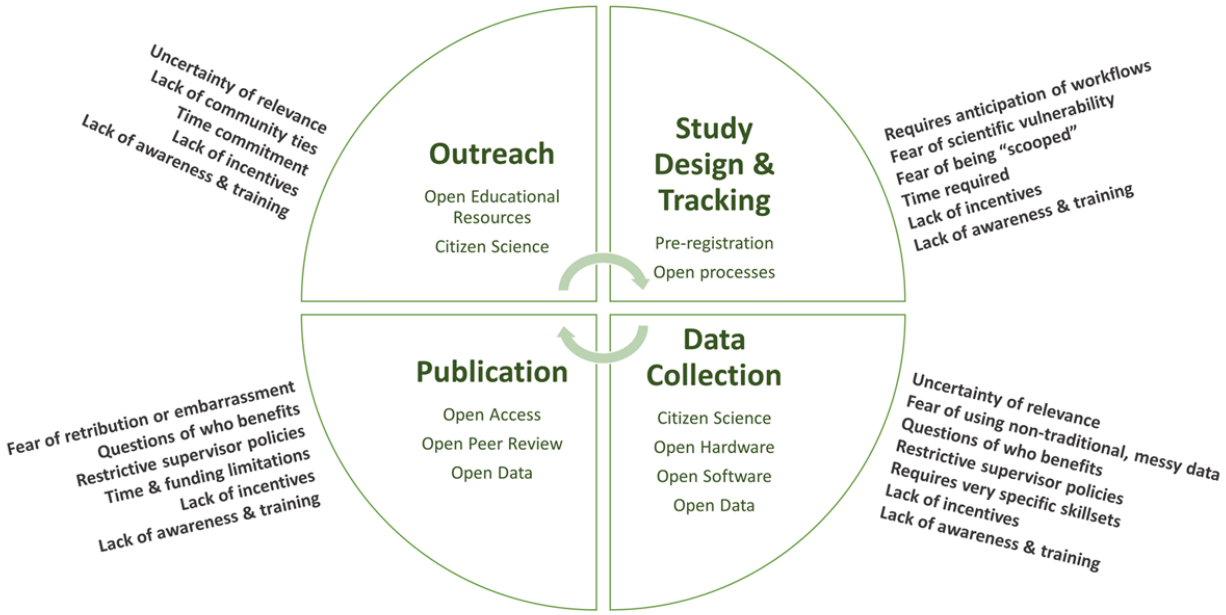


Figure A8. Barriers to the use of OS practices to four stages of the scientific life cycle mapped from published literature, an informal survey of 32 early career researchers from 14 countries, and discussions among members of the Global Working Group on Open Science (Gownaris et al., 2022).

As OS has evolved, additional complex challenges have surfaced. For example, the high cost to publish OA through the author-pays model is often expressed as a barrier. Commercial publishers have benefited from the growth of the OA model, particularly the author-pays model which relies on APCs. In a recent study, Haustein et al. (2024) estimate that authors paid approximately $8.349 billion ($8.968 billion in 2023 US dollars) globally between 2019 and 2023 to six publishers (Elsevier, Frontiers, MDPI, PLOS, Springer Nature, and Wiley)(see Figure A8). These findings highlight how APCs are leveraged as reliable revenue sources contributing to publisher strategies such as special issues or paper mills to generate high volumes of articles at the expense of ethical publishing practices (Brainard, 2023; Hanson et al., 2024; Brundy & Thornton, 2024). The exploitation of the author-pays model alongside systemic influences like "publish-or-perish" have similarly contributed to the proliferation of predatory publishers (OHRI, 2022. Predatory, sometimes referred to as deceptive publishers, deviate from best practices and publishing ethics, failing to deliver promised services like peer review, archiving, and preservation (Grundniewicz et al., 2019; Think. Check. Submit., n.d.). However, institutional efforts can foster conversations on ethical practices that consider diverse pathways to publishing, thereby circumventing the proliferation of questionable practices. Mentorship, guidance, and training are essential components to developing skills to counter such barriers.

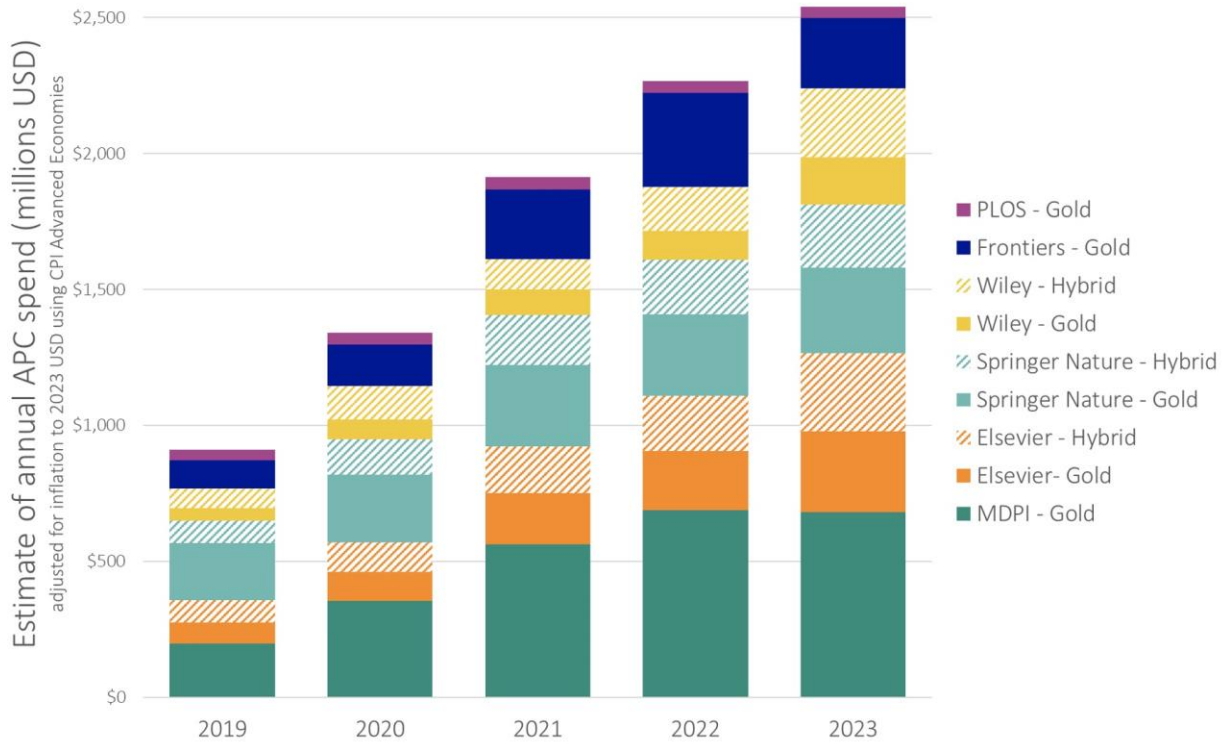


Figure A9. Estimate of annual APC spend (in millions USD) by publisher and OA type adjusted for inflation to 2023 USD using CPI Advanced Economies. Estimates are based on APCs (gold and hybrid) paid to six publishers (Elsevier, Frontiers, MDPI, PLOS, Springer Nature, and Wiley) between 2019 and 2023 (Haustein et al., 2024), using an open dataset of annual APC list prices (Butler et al., 2024) in combination with the number of open access articles from these publishers indexed by OpenAlex.

Low-levels of OS adoption are also often tied to insufficient incentives and rewards, which can be addressed through efforts to reform research assessment (DORA, 2013; CoARA, 2024). Institutions must consider the precarity of early career researchers as they work to secure tenured positions, to ensure incentives and rewards adequately recognize OS efforts (Gagliardi et al., 2015; Kent et al., 2022). As OS evolves, new challenges emerge, including the necessity for robust infrastructure to support open practices. Addressing and mitigating these barriers requires concerted attention, coordinated efforts, and ongoing dialogue among stakeholders, like funding agencies, institutions, and the research community.

A.2 Monthly meeting topics

Each monthly meeting was dedicated to a particular OS topic as listed in Table 5 below. The cross-cutting themes of academic careers and research assessment, field-specific differences and disciplinary practices as well as la francophonie were discussed throughout.

Table 5. Topics of monthly OSWG meetings and cross-cutting themes.

MONTH	TOPIC
October	Introduction – Open science at the University of Ottawa
November	Barriers to open science; Open Science policies (institutional, national, and international)
December	The open access publishing landscape (copyright, publication models, deceptive/predatory publishing)
January	Article processing charges and publishing agreements
February	Open practices (open data, open peer review), and research assessment (DORA)
March	A look at disciplinary open science practices (e.g., clinical trial registration, code, and software)
April	Open access and the francophonie
Cross cutting themes:	La francophonie; disciplinary practices; academic careers and research assessment

Glossary

This glossary presents a vocabulary of terms, included based on their relevance to the content of this report and presented in alphabetical order.

Academic reward system

The academic reward system is made up of a variety of structures, technologies, and discourses, which produce and reinforce academic achievement and success. Within the academic reward system, power operates through norms and standards that shapes and regulates academic identity and behavior. These norms and standards can include various forms of evaluation including citation counts, publication numbers, the amount of grant funding, or subsequent forms of evaluation such as tenure and promotion. However, just as with research assessment and academic publishing, the academic reward system is subject to a variety of influences including from universities, funding agencies, and broader political or social factors (Bowman, https://doi.org/10.3389/frma.2023.1179376).

Article Processing Charge (author-pays)

Article Processing Charges (APCs) are fees charged by publishers to make articles in scholarly journals open access, specifically to cover the costs of publication and journal administration. However, many scholarly journals, particularly those supported by universities, publish open access with no costs at all to researchers (IFLA Open Access Working Party, https://repository.ifla.org/handle/20.500.14598/3272).

Big Deals

The majority of academic journals in the sciences and the humanities are licenced to academic libraries in bundles, known colloquially among librarians as big deals. These bundles typically include an extensive catalogue of journal titles licensed to academic libraries for a fixed annual fee (Ivanov et al., https://doi.org/10.29173/cais1162).

Bronze OA

Articles made free-to-read on the publisher website, without an explicit open license (Piwowar et al., https://doi.org/10.7717/peerj.4375).

Bibliodiversity

A complex self-sustaining system of storytelling, writing, publishing and other kinds of production of oral and written literature. The writers and producers are comparable to the inhabitants of an ecosystem. Bibliodiversity contributes to a thriving life of culture and a healthy eco-social system (IFLA Open Access Working Party, https://repository.ifla.org/handle/20.500.14598/3272).

Bibliometrics

Bibliometrics uses scholarly publications to measure various aspects of research activity and scholarly impact. While its main application is in the context of research evaluation as a tool to provide quantitative assessments of research performance [10], bibliometric methods can also be used to understand researchers' publication and collaboration practices, levels of interdisciplinarity and shifts in research topics (Sauvé et al., https://doi.org/10.1371/journal.pone.0276840).

Copyright

Copyright subsists in every original literary, dramatic, musical and artistic work provided that certain conditions are met. An 'original work' is the product of a creator's exercise of skill and judgment, and may not be a copy of another work. Copyright also subsists in performers' performances, sound recordings and broadcast signals. Very few original works do not attract copyright. As well, simply because something is publicly available on the Internet does not mean it is not protected by copyright. Copyright comprises a bundle of exclusive rights owned by the copyright holder. Its purpose is to protect content creators and owners, providing them with control over their work and the potential of a financial reward. Conversely, copyright is meant to promote creativity – by establishing a system for making use of others' work – as well as the orderly exchange of ideas. Underlying data in copyright-protected works is not itself protected (University of Ottawa Library, https://www.uottawa.ca/library/copyright/what-is-copyright/overview).

Creative Commons

A set of free and easy-to-use copyright licenses that define the rights of the authors and users of open data and materials in a standardized way. CC licenses enable authors or creators to share copyright-law-protected work with the public and come in different varieties with more or less clauses. OR Creative Commons is an international nonprofit organization that provides Creative Commons licences, with the goal to minimize legal obstacles to the sharing of knowledge and creativity (Framework for Open and Reproducible Research Training (FORRT), https://forrt.org/glossary/english/creative_commons/)

Data Re-use

Data Reuse, or Secondary Data Analysis, is the analysis of existing data collected by other individuals or institutions for a new research purpose. It can refer to statistical, quantitative data or descriptive, qualitative data (National Library of Medicine, National Institute of Health (NIH), https://www.nnlm.gov/guides/data-glossary/data-reuse).

Data sharing

Collection of practices, technologies, cultural elements and legal frameworks that are relevant to the practice of making data used for scholarly research available to other investigators. (Framework for Open and Reproducible Research Training (FORRT) https://forrt.org/glossary/data-sharing/).

Decolonization

Decolonization, once viewed as the formal process of handing over the instruments of government, is now recognized as a long-term process involving the bureaucratic, cultural, linguistic and psychological divesting of colonial power (JoLee Sasakamoose, Indigenous Approaches to Evaluation, https://www.justice.gc.ca/eng/rp-pr/jr/eiaer-eaame/appendixd-annexed.html).

Diamond OA

Diamond Open Access refers to a scholarly publication model in which journals and platforms do not charge fees to either authors or readers. Diamond Open Access journals are community-driven, academic-led, and academic-owned publishing initiatives. Serving a fine-grained variety of generally small-scale, multilingual, and multicultural scholarly communities, these journals and platforms embody the concept of bibliodiversity. For all these reasons, Diamond Open Access journals and platforms are equitable by nature and design (Science Europe, https://scienceeurope.org/our-priorities/open-access/diamond-open-access/).

Clinical trial preregistration

Preregistration of an analysis plan is committing to analytic steps without advance knowledge of the research outcomes. That commitment is usually accomplished by posting the analysis plan to an independent registry such as https://clinicaltrials.gov/ or https://osf.io/. The registry preserves the preregistration and makes it discoverable, sometimes after an embargo period. With preregistration, prediction is achieved because selection of tests is not influenced by the observed data, and all conducted tests are knowable. The analysis plan provides constraint to specify how the data will be used to confront the research questions (Nosek et al., https://doi.org/10.1073/pnas.1708274114).

Early career researchers (ECRs)

While definitions differ by country, ECRs include graduate and medical students, young clinical researchers, postdoctoral fellows, and recently appointed independent investigators early in their independent careers. Problems with the scientific system directly affect ECRs, who may have a vested interest in improving the system that they are inheriting (Kent et al., https://doi.org/10.1371/journal.pbio.3001680).

EDI

The University of Ottawa Equity, Diversity, and Inclusion in Research Action Plan (2021) explains that equity means people of all identities are treated fairly. Equity is when we remove systemic barriers and biases so that all individuals have equal opportunity to access and benefit. Diversity consists of the conditions, expressions and experiences of different groups. Inclusion is the practice of ensuring that all individuals are valued and respected for their contributions and equally supported (University of Ottawa Equity, Diversity and

Inclusion in Research Advisory Committee, https://www.uottawa.ca/research-innovation/sites/g/files/bhrskd326/files/2022-02/OVPRI-EDI-research-action-plan.pdf).

Gold OA

Gold open access refers to research being made available for free in its full, original form in the journal where it was published (or, in the case of a book, being made freely available by the publisher). Gold open access journals can either be entirely open access, or they can be 'hybrid', in which subscription publications carry a subset of articles that are free for all to read (Eve, https://doi.org/10.1017/CBO9781316161012.003).

Green OA

Green open access is OA delivered by an institutional or subject repository. An institutional repository is a website, normally administered by a university library, that holds the metadata about and copies of affiliated authors' works (Eve, https://doi.org/10.1017/CBO9781316161012.003).

Hybrid OA

Subscription publications carry a subset of articles that are free for all to read (Eve, https://doi.org/10.1017/CBO9781316161012.003).

Indigenous knowledge

Indigenous knowledge is defined as knowledge which is spatially and/or culturally context specific, collective, holistic, and adaptive. (J. Mistry, International Encyclopedia of Human Geography (Mistry, https://doi.org/10.1016/B978-008044910-4.00101-2).

Knowledge mobilization

Knowledge mobilization is an umbrella term encompassing a wide range of activities relating to the production and use of research results, including knowledge synthesis, dissemination, transfer, exchange, and co-creation or co-production by researchers and knowledge users (Social Sciences and Humanities Research Council, https://www.sshrc-crsh.gc.ca/funding-financement/policies-politiques/knowledge_mobilisation-mobilisation_des_connaissances-eng.aspx).

Narrative CV

While a shared definition of the narrative CV format still needs to be developed, it is generally understood to encompass a structured description of a researcher's contributions and achievements that reflect a broader range of skills and experiences beyond publications and funding record (Fritch et al., https://zenodo.org/records/5799414#.YeM-41lOlPY).

Open access

Open access means making the information which scholars provide without expectation of payment available online at no cost to readers (University of Ottawa Library, https://www.uottawa.ca/library/scholarly-communication/open-access).

Open data

"Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike. (...) Availability and Access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form (Open Knowledge Foundation Data Handbook, https://opendatahandbook.org/guide/en/what-is-open-data/).

Open Educational Resources (OER)

Open educational resources (OER) range from textbooks to entire courses and everything in between, including videos, podcasts, simulations, case studies, slides, and more. The key is that they can be widely distributed and adapted because they are at no cost to the user and are not subject to the usual copyright restrictions. This openness is most often indicated by a Creative Commons licence (University of Ottawa Library, https://www.uottawa.ca/library/open-educational-resources).

Open peer review

A scholarly review mechanism providing disclosure of any combination of author and referee identities, as well as peer-review reports and editorial decision letters, to one another or publicly at any point during or after the peer review or publication process. It may also refer to the removal of restrictions on who can participate in peer review and the platforms for doing so. Note that 'open peer review' has been used interchangeably to refer to any, or all, of the above practices (Framework for Open and Reproducible Research Training (FORRT), https://forrt.org/glossary/open-peer-review/).

Open scholarship

'Open scholarship' is often used synonymously with 'open science', but extends to all disciplines, drawing in those which might not traditionally identify as science-based. It reflects the idea that knowledge of all kinds should be openly shared, transparent, rigorous, reproducible, replicable, accumulative, and inclusive (allowing for all knowledge systems). Open scholarship includes all scholarly activities that are not solely limited to research such as teaching and pedagogy (Framework for Open and Reproducible Research Training (FORRT), https://forrt.org/glossary/open-peer-review/).

Open science

Open science is a set of principles and practices that aim to make scientific research from all fields accessible to everyone for the benefits of scientists and society as a whole. Open science is about making sure not only that scientific knowledge is accessible but also that

the production of that knowledge itself is inclusive, equitable and sustainable (UNESCO, https://www.unesco.org/en/open-science/about).

Open source (software and code)

Free and Open source software (FOSS) --software whose source code is published and made available to the public, enabling anyone to copy, modify and redistribute the source code without paying royalties or fees. Open source code evolves through community cooperation. These communities are composed of individual programmers, users as well as very large companies. Some examples of open source initiatives are GNU/Linux, Eclipse, Apache, Mozilla, and various projects hosted on SourceForge (UNESCO, https://unesdoc.unesco.org/ark:/48223/pf0000229391#:~:text=Background%20Most%20Important%20Definitions%20Free,code%20evolves%20through%20community%20cooperation).

Preprint

Draft or manuscript shared by researcher in a preprint repository or dedicated channel (outside of a specific journal) (IFLA Open Access Working Party, https://repository.ifla.org/handle/20.500.14598/3272).

Predatory publishing

Identifying legitimate publishers is challenging due to a spectrum of questionable practices, and variable standards. Some publishers are clearly predatory, prioritizing revenues over research validation, while others fall into "grey" publishing with dubious practices that fail to consider best practices, research integrity, and scientific robustness. These include paper mills, peer review rings, and citation cartels (Cantanzaro, https://www.science.org/content/article/citation-cartels-help-some-mathematicians-and-their-universities-climb-rankings; Nicholas et al., https://doi.org/10.3145/epi.2023.sep.09).

Repository

An institutional repository is a digital archive which centralizes, preserves, and provides access to an institution's intellectual output. They benefit institutions by raising their profiles and scholars by bringing broader dissemination, increased use, and enhanced professional visibility of scholarly research (Canadian Association of Research Libraries (CARL), https://www.carl-abrc.ca/advancing-research/institutional-repositories/).

uO Research is the University of Ottawa's digital archive for research and teaching materials created by the uOttawa community and our partners. It provides open, permanent access to uOttawa scholarship, ensuring wide dissemination and increased visibility (uO Research, https://ruor.uottawa.ca/uoresearch).

Research assessment

Research assessment is the evaluation of research output by funding agencies, universities, and other stakeholders. An evaluation typically examines the impact and quality of research

output, as well as the fit with research objectives and priorities (Bowman, https://doi.org/10.3389/frma.2023.1179376).

Research data management (RDM)

Research data management (RDM) refers to the processes applied through the lifecycle of a research project to guide the collection, documentation, storage, sharing, and preservation of research data (Government of Canada, https://science.gc.ca/site/science/en/interagency-research-funding/policies-and-guidelines/research-data-management/tri-agency-research-data-management-policy-frequently-asked-questions#1d).

Rights retention

The Rights Retention Strategy (RRS) enables authors to exercise the rights they have on their manuscripts to deposit a copy of the Author Accepted Manuscript (AAM) in a repository on publication and provide open access to it (cOAlition S, https://www.coalition-s.org/).

Self-archiving

Self-archiving is the process of depositing your scholarly work into a digital repository (UBC, https://open.ubc.ca/access/authors-guide-to-self-archiving-publication-versions-and-permissions/). Green open access typically involves the author taking the initiative to make their article published in a subscription journal openly available by placing a version of it online in an open repository (The University of Ottawa, https://www.uottawa.ca/library/scholarly-communication/open-access/practice-open-access). uOttawa's repository is uO Research (https://ruor.uottawa.ca/home).

Scholarly communication

Scholarly communication is an ongoing process that involves the creation, evaluation, dissemination and preservation of knowledge related to teaching, research and scholarship (University of Ottawa Library, https://www.uottawa.ca/library/scholarly-communication).

Scholarly metrics

Scholarly metrics refer to the quantification of research outputs and their impact. However, determining the impact of research is not a straightforward task and there is debate as to whether it is even possible to quantify the impact of research. It is important to use metrics critically. Scholarly metrics include journal metrics, article metrics, author metrics, and altmetrics (The University of Ottawa Library, https://www.uottawa.ca/library/scholarly-communication/research-impact).

Transformative agreements

"Transformative agreements are those contracts negotiated between institutions (libraries, national and regional consortia) and publishers that transform the business model

underlying scholarly journal publishing, moving from one based on toll access (subscription) to one in which publishers are remunerated a fair price for their open access publishing services" (Coalition S, https://www.coalition-s.org/faq/what-is-a-transformative-agreement/).