



Australian Government
Office of the Chief Scientist



Advice on open access models

Unlocking knowledge for national benefit

Advice from Australia's Chief Scientist

Copyright

© Commonwealth of Australia 2024

Ownership of intellectual property rights

Unless otherwise noted, copyright (and any other intellectual property rights, if any) in this publication is owned by the Commonwealth of Australia.



[Creative Commons Attribution 4.0 International Licence CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)

All material in this publication is licensed under a Creative Commons Attribution 4.0 International Licence, with the exception of:

- the Commonwealth Coat of Arms
- content supplied by third parties
- logos
- any material protected by trademark or otherwise noted in this publication.

Creative Commons Attribution 4.0 International Licence is a standard form licence agreement that allows you to copy, distribute, transmit and adapt this publication provided you attribute the work. A summary of the licence terms is available from <https://creativecommons.org/licenses/by/4.0/>. The full licence terms are available from <https://creativecommons.org/licenses/by/4.0/legalcode>.

Content contained herein should be attributed as Office of the Chief Scientist, Advice on open access: Unlocking knowledge for the national benefit, Australian Government, Canberra.

This notice excludes the Commonwealth Coat of Arms, any logos and any material protected by trademark or otherwise noted in the publication, from the application of the Creative Commons licence. These are all forms of property which the Commonwealth cannot or usually would not licence others to use.

Disclaimer

The purpose of this publication is to outline Australia's Chief Scientist's advice on open access to research literature.

The Commonwealth as represented by the Department of Industry, Science and Resources has exercised due care and skill in the preparation and compilation of the information in this publication.

The Commonwealth does not guarantee the accuracy, reliability or completeness of the information contained in this publication. Interested parties should make their own independent inquiries and obtain their own independent professional advice prior to relying on, or making any decisions in relation to, the information provided in this publication.

The Commonwealth accepts no responsibility or liability for any damage, loss or expense incurred as a result of the reliance on information contained in this publication. This publication does not indicate commitment by the Commonwealth to a particular course of action.

Contents

Executive Summary	2
1. Introduction	5
2. The opportunities created by open access	7
2.1 Publicly funded research should be publicly available	7
2.2 Open access can speed innovation.....	7
2.3 Open access strengthens Australian society more broadly	10
2.4 Open access would support the Australian research sector and lift the profile of Australian research internationally.....	14
3. The evolving academic publishing system	15
3.1 The publishing process	15
3.2 The publishing landscape.....	17
4. Open access models for Australia.....	21
4.1 Openness of information	23
4.2 Benefits.....	24
4.3 Costs	25
4.4 Projected economic benefits of the public access model	27
4.5 Stakeholder consultation	29
5. Recommendations: the role of government and next steps.....	32
6. Appendix: Background and supporting information.....	33
6.1 Methodology.....	33
6.2 List of consultations and stakeholder engagement.....	39
6.3 Glossary	41
6.4 Bibliography	43

Executive Summary

Open access to research outcomes has the potential to accelerate Australia's transition to a knowledge economy, support our domestic innovation system and bring a range of social benefits including improved healthcare, education and social cohesion.

The world's advanced economies are on a trajectory of opening access to their research, moving away from restricting access to journal articles to those who are willing to pay. However, 63% of all Australian journal articles published in the last 15 years still sit behind paywalls,¹ which limits access by the industry, research and government sectors and by the wider public. For those without a subscription, a one-off fee provides access to a single journal article, with charges typically about \$50 per journal article.²

Research literature is where the best available evidence is held. It records the results of experiments and studies, research findings, advances and breakthroughs and new theories and approaches.

Limited access to research literature is a barrier to innovation, particularly for high-tech small and medium enterprises. Open access has the potential to spur innovation and accelerate new discoveries by opening the research literature to a wider audience.

People in industry, people in government, teachers and health professionals are among groups that do not have routine and easy access to the research literature. Giving them, and other members of the Australian community, free access has the potential to inform decision-making; inspire a business decision or industry investment; and improve understanding more broadly about what the evidence shows on any given question. Open access may speed discovery and avoid duplication.

In preparing this advice, Australia's Chief Scientist and her office engaged with more than 70 stakeholder organisations, including in the research community and the publishing industry; reviewed the academic literature; commissioned economic modelling and assessed the costs of four options for enabling open access in Australia. The consultations have confirmed broad support among government, academia, industry and other stakeholders for the development of a national strategy for open access to research literature.

This document examines the three existing models for open access which currently operate at various scales in Australia and internationally:

- **Funder mandate models**, where research funders require grant recipients to publish their research in journals in a way that it is accessible to all, or to deposit copies of their journal articles in open access repositories.
- **Repository models**, where versions of journal articles that have been accepted for publication (but are usually unformatted) are deposited in a freely accessible repository. There may be potential for existing institutional repository infrastructure to be linked through a central national portal.
- **Read and publish agreements** between publishers and institutions or consortia, which allow open access publishing and read access to the publishers' closed access journal articles for participating institutions. Read and publish agreements have not been represented separately in the table below as the 'no intervention' approach includes current read and publish agreements negotiated at institution and consortium levels, and the public access model builds on the current read and publish agreements.

¹ Web of Science, [Web of Science Core Collection](#) [data set], webofscience.com, 2022, accessed 12 July 2023. 'Australian journal articles' here means journal articles with an Australian contributor. 2008-2022.





² For example, most *Elsevier* articles cost US\$31.50 for one-off access and *Nature* articles in the current issue mostly cost US\$39.95 for the ability to save and print. Elsevier, [Pay per view](#), Elsevier website, 2023, accessed 13 July 2023; Nature, [Volume 619 Issue 7969, 13 July 2023](#), Nature website, 2023, accessed 13 July 2023.

Where implemented in Australia, these models increase the proportion of new Australian research that is published open access. However, journal articles involving Australian authors comprise only 4% of publications globally.³ None of these models allow fee-free access by Australian residents to the remaining 96% of the world’s journal articles. To address this challenge, Australia’s Chief Scientist has developed a fourth model:

- A **public access model**, where centralised negotiations for national read and publish agreements (i) allow read access for all of Australia to all the world’s journal articles – past and future; and (ii) include open access publishing for all new, Australian-led research to ensure it is freely accessible to the world.

The key distinction of this new model is in delivering benefits for all of Australia, not just researchers whose subscription fees are often covered by their employers. This would expand the number of Australian residents with access to research literature by more than 10 times.

Table 1 – Models for Open Access for Australia

Name	Description	Increase in Australian-led journal articles open to the world	Increase in international journal articles free to read for all Australian residents
 Public access	National read and publish agreements allow open access publishing and reading, including back catalogues, at no direct cost to users across Australia.	All Australian-led journal articles open to the world	The world’s journal articles free to read for Australian residents
 Repository	Repository infrastructure used to provide open access to Australian-led journal articles into the future.	Some increase in open access versions of journal articles	No increase
 Funder mandate	Australian Government research funders mandate research funded by them is published open access into the future.	Some increase in journal articles published open access	No increase
 No intervention	Government takes no action and allows existing initiatives to continue.	No increase	No increase

³ Web of Science, [Web of Science Core Collection](#) [data set]. Includes journal articles published since 2008.

This report makes two recommendations:

Recommendation 1: The Australian Government should develop and implement a strategy to maximise access to academic journals for the Australian community.

The Australian Government should develop and implement an Australian open access strategy to realise the substantial benefits anticipated to arise from broader access to research literature.

Recommendation 2: The Government should undertake further analysis to develop the preferred model that will deliver the greatest benefit for Australia, from both an economic and social perspective.

In developing the strategy, consideration should be given to the relative benefits and costs of three potential models against a consistent set of desired outcomes (see proposed principles below).

The proposed principles are that an open access model should:

- Maximise the benefits from Australia's existing expenditure on academic subscriptions and publishing.
- Allow people residing in Australia to freely access all peer reviewed journal articles, across all disciplines, including all new journal articles from the date of publication and all previously published journal articles.
- Ensure Australian-led peer reviewed journal articles in all discipline areas are openly accessible internationally from the date of publication.
- Support research integrity by facilitating the provision of quality metadata, keeping versions of record and assisting in discoverability.
- Preserve bibliodiversity and author autonomy regarding where to publish.
- Recognise the role of publishers and ensure the sustainability of their businesses.
- Use infrastructure that is user-friendly, internationally interoperable and designed for future developments in publishing and open research.
- Be equitable for all stakeholders.

1. Introduction

All advances in human capability are built on the foundation of research and discovery. From longer life expectancy, to democracy, to renewable energy sources, all progress is built by ‘standing on the shoulders of giants’.⁴

The benefits come not simply from building knowledge, but from its dissemination – both to other knowledge-makers and to end users. Research literature is one of the most important methods of disseminating cutting-edge research.

However, much of the world’s research literature – including research which is funded by the Australian Government – is published behind paywalls at a cost that restricts access to a fraction of potential users.

A global movement toward open access publishing has gathered momentum over the past decade. Open access to research literature would allow research to be shared and read more widely. It would have positive impacts not only for subsequent research but also for innovation and problem solving across industry sectors, people-centred sectors such as healthcare and education, and policy making.

Open access can be defined as: A set of principles and practices through which research outputs are distributed online, free of cost or other access barriers. These outputs can also be legally shared and reused.⁵

This report makes the case for open access for Australia. It synthesises work undertaken by the Office of the Chief Scientist on the question of broadening access to research literature in Australia and examines feasible frameworks for open access.

In formulating this advice, the Office of the Chief Scientist and consultancies engaged with more than 70 stakeholder organisations across government, industry, the publishing sector, the research sector and open access advocacy groups, nationally and internationally. The Office of the Chief Scientist also commissioned analyses from CSIRO Futures and EY to identify costs, benefits, opportunities and challenges, and compare possible open access models; as well as an independent report on the impacts of open access on specialised publishers.⁶

⁴ Isaac Newton, 1675, [letter to Robert Hooke](#), accessed 31 May 2023.

⁵ Open Access Australasia’s full definition is: ‘Open access is a set of principles and a range of practices through which research outputs are distributed online, free of cost or other access barriers. Through licensing via an open license (usually a Creative Commons License), freely available outputs can also be legally shared and reused. Hence, open access is more than just ‘free access.’ Open Access Australasia, [What is Open Access?](#), Open Access Australasia website, 25 May 2021, accessed 31 May 2023.

⁶ Commonwealth Scientific and Industrial Research Organisation (CSIRO) Futures, *Prospective analysis of a national open access strategy for Australia*, unpublished, report for the Office of the Chief Scientist, November 2021; EY, *A national strategy for open access*, unpublished, report for the Office of the Chief Scientist, 2022; D Ivison, *Analysis of the potential impact of the proposed Office of Chief Scientist Open Access model on the ‘long tail’ of journal publishers*, unpublished, report for the Office of the Chief Scientist, 2022.

Structure of this report. Chapter 1 introduces the context for this report. Chapter 2 highlights the opportunities presented by open access. Chapter 3 provides an overview of the current arrangements in academic publishing and global context. Chapter 4 outlines the details of possible open access models. Chapter 5 summarises the policy advice and proposed next steps. A glossary, list of stakeholders consulted in the development of this advice and methodology for calculating open access rates and costs under various models are provided in the appendices.

Solicitation of advice. In December 2020 the then Minister for Industry, Science and Technology, the Hon Karen Andrews MP, requested that Australia's incoming Chief Scientist, Dr Cathy Foley, advocate for open access to support the work of Government and sector organisations in this area. On 23 December 2022 the Minister for Industry and Science, the Hon Ed Husic MP, requested that Dr Foley continue this work. This paper fulfils this request.

2. The opportunities created by open access

The business case for open access is four-fold:

- It is fair and reasonable that publicly funded research should be publicly available.
- Open access is expected to lead to an uptick in discovery, innovation and productivity through wider dissemination of research findings.
- Open access is likely to engage teachers, health professionals, policymakers, and the wider citizenry more directly with new science and research. It will provide new tools for their work and strengthen democratic resilience.
- Open access would support the Australian research sector and lift the profile of Australian research internationally.

Each is briefly summarised below.

2.1 Publicly funded research should be publicly available

The Australian Government invested \$12.1 billion in science, research and innovation in 2022-23.⁷ There is a strong argument that publicly funded research should be freely accessible to the public⁸ and that taxpayers have the right to access the results of the research that their taxes have paid for – without having to ‘pay twice’ by encountering a further cost to read the research outcomes.

Many nations have already implemented or announced initiatives to make this a reality, including the US and the UK, as has the National Health and Medical Research Council (NHMRC) in Australia. Further details are in Section 3.2.3.

2.2 Open access can speed innovation

Access to research literature is an important factor in driving innovation and productivity. For example, patents are more likely to reference open access journal articles than closed access research.⁹

⁷ Department of Industry, Science and Resources (DISR), [Science, research and innovation \(SRI\) budget tables 2022-23](#) [data set], industry.gov.au, 2023, accessed 31 May 2023.

⁸ For example, the United States Office of Science and Technology Policy (OSTP) states that: ‘Financial means and privileged access must never be the pre-requisites to realizing the benefits of federally funded research that the American public deserves.’ A Nelson, [Ensuring Free, Immediate, and Equitable Access to Federally Funded Research](#), OSTP, 25 August 2022, accessed 8 June 2023.

⁹ J Najko, T Klebel, D Pride, P Knoth and T Ross-Hellauer, ‘Quantifying the influence of Open Access on innovation and patents’, *Open Research Europe*, 2022, 2(64), doi:10.12688/openreseurope.14680.1; KA Bryan and Y Ozcan, ‘The Impact of Open Access Mandates on Invention’, *The Review of Economics and Statistics*, 2021, 103(5):954–967, doi:10.1162/rest_a_00926.

A recent Productivity Commission report found that the gap between innovation in Australia and leading foreign firms is growing over time. Australia is lagging most OECD countries in the uptake of some of the most advanced technologies.¹⁰

Australia has a highly skilled workforce, with 50% of the working age population having tertiary qualifications.¹¹ This is significantly higher than the OECD average of 40% and can give Australia an important competitive advantage in a global knowledge-based economy – assuming that the knowledge can be appropriately harnessed. At present, Australia has a much lower fraction of researchers employed by businesses than many competitor economies;¹² much lower business expenditure on research and development (BERD) than the OECD average;¹³ and ranks last among OECD countries for the proportion of companies that collaborate with higher education and government institutions on innovation.¹⁴

Lack of access to research literature by industry is a barrier to innovation, particularly for high-tech small and medium-sized enterprises (discussed in more detail below in Section 2.2.1). Researchers with cutting-edge knowledge transitioning from the research sector into industry typically find themselves cut off from access to the most recent literature, and their knowledge quickly dates in fast-moving fields¹⁵ – again stifling innovation. Analysis by EY identified that potential productivity improvements from open access arrangements are likely to be greatest in the industrial (including manufacturing, mining and engineering), medical, agricultural, energy and government services sectors. High-level economic modelling conducted by EY, presented in Section 4.4, indicates that open access could produce a large long-term economic dividend of several tens of billions of dollars.

To grasp these opportunities, the Productivity Commission explicitly recommends ‘open access to research principally funded by governments’ (Recommendation 5.3).¹⁶

A national open access model would be highly valuable to help grow Australia's tech industry and firms. It would aim the dissemination of new knowledge and best practice, and help companies innovate better and faster. Democratising access to knowledge is particularly important for firms without the capacity to pay high costs to access databases or subscription journals, such as young firms, and firms in areas without easy access to research institutions, such as regional Australia. Innovation and commercialisation are vital to grow the economy, and we need to give Australian companies every advantage in doing this.

Kate Pounder, CEO, Technology Council of Australia

¹⁰ Productivity Commission (PC), [5 Year Productivity Inquiry: Innovation for the 98%](#), PC, Australian Government, 17 March 2023, accessed 31 May 2023.

¹¹ Organisation for Economic Cooperation and Development (OECD), [Adult Education Level](#) [data set], data.oecd.org, 2023, accessed 31 May 2023, doi: 10.1787/36bce3fe-en.

¹² B Ferris, A Finkel and J Fraser, ‘[AFR: The right incentives will ensure that our R&D means business](#)’, Australia’s Chief Scientist website, 26 October 2016, accessed 31 May 2023.

¹³ Based on the latest available data (2019), Australian business investment in R&D is 0.92% of GDP, compared to 1.81% OECD average. OECD, [Main Science and Technology Indicators](#) [data set], stats.oecd.org, 2019, accessed 31 May 2023.

¹⁴ Commonwealth Scientific and Industrial Research Organisation (CSIRO) Futures, [Unlocking the innovation potential of Australian companies](#), CSIRO, December 2021, accessed 31 May 2023.

¹⁵ Najko et al. (2022) calculated the median time lag between research publication and citation in a patent to be 5 years.

¹⁶ Productivity Commission, [5 Year Productivity Inquiry](#).

2.2.1 The role of SMEs

Small and medium-sized enterprises (SMEs) are the backbone of Australia's economy. They employ more than two-thirds of the working population, contribute more than half of Australia's GDP and make up 99.8% of all businesses.¹⁷ A report by the Office of the Chief Economist found that SMEs make a disproportionately large contribution to economic growth, and benefit the most from persistent innovation.¹⁸

Compared with bigger companies, SMEs report relying more on open sources of information as a platform for innovation¹⁹ because they typically cannot afford high subscription fees to research journals. Access to research literature has been flagged as both important and challenging by SMEs in the UK, US, Japan and Denmark.²⁰ Empirical data in specific industries supports this self-reported data: for example, a study of over 1,000 pharmaceutical companies showed that smaller companies are consistently more dependent on open access research literature for their internal R&D leading to patents.²¹ In Australia access to knowledge or technology has been identified as a barrier to innovation across sectors, including by 7.8% of businesses in the health care and social assistance sector; 8.0% in professional, scientific and technical services; and 10.7% in financial and insurance services.²²

In the early years of our company, we relied heavily on open access research across a great many technologies and materials sciences to guide our R&D development. Without this research we would not have survived, let alone grow to be a leading space technology company in Australia. We fully support the Chief Scientist's quest for open access to research in Australia.

Adam Gilmour, CEO, Gilmour Space

¹⁷ M Verreyne et al., [Enablers and barriers to industry-research collaboration: A small and medium sized enterprise perspective](#), CSIRO, 2021, accessed 31 May 2023.

¹⁸ L Hendrickson, D Taylor, L Ang, K Cao, T Nguyen and F Soriano, [The impact of persistent innovation on business growth](#), Office of the Chief Economist, Department of Industry Science and Resources, December 2018, accessed 31 May 2023.

¹⁹ Productivity Commission, *5 Year Productivity Inquiry*; M Ware, [Access by UK small and medium-sized enterprises to professional and academic information](#), Publishing Research Consortium, 5 May 2011, accessed 31 May 2023.

²⁰ EH ElSabry and K Sumikura, 'Does open access to academic research help small, science-based companies?', *Journal of Industry - University Collaboration*, 2020, 2(3):95-109, doi:10.1108/JIUC-04-2020-0004; J Houghton, A Swan and S Brown, [Access to Research and Technical Information in Denmark](#), The Danish Agency for Science, Technology and Innovation and Denmark's Electronic Research Library, 2011, accessed 31 May 2023; CIBER, [Access to scholarly content: gaps and barriers](#), Jisc, Publishing Research Consortium and Research Information Network, 2011, accessed 13 May 2023; Ware, [Access by UK small and medium-sized enterprises to professional and academic information](#).

²¹ ElSabry and Sumikura, 'Does open access to academic research help small, science-based companies?'.

²² Australian Bureau of Statistics (ABS), [Innovation in Australian Business](#) [data set], abs.gov.au, 2022, accessed 15 June 2023.

2.3 Open access strengthens Australian society more broadly

The Productivity Commission noted that the benefits of open access go well beyond business and innovation to areas including education, health and climate change.²³ Recent advances in natural language models (e.g. ChatGPT) are a potential game-changer, enabling technical information to be ‘interpreted’ into language that is accessible by non-specialists, including individual citizens and policy makers. In this section, we highlight several important use cases.

2.3.1 Healthcare

Open access can accelerate the uptake of medical methods that are more effective, more accurate and safer. The recent COVID-19 pandemic has highlighted the importance of making high-quality medical research widely accessible in a timely manner, across areas as diverse as vaccine development, diagnostics, treatments and epidemiology.

The Australian healthcare and social assistance industry is highly dependent on the research literature for ideas.²⁴ However, access is uneven across the health professions. Limited access is provided for doctors in the public health system; health professionals linked to universities or research institutes have greater access; health professionals working in small private practices must pay for subscriptions.

Making Australia’s medical research open access would also support access to information in developing countries, where resources to pay for subscriptions are limited.

Having full access to international literature would enable me to deliver better patient care. I have access to some journals through my membership of the Royal Australian and New Zealand College of Ophthalmologists, but too often the papers I need are behind a paywall. This makes it difficult to make good decisions about unusual cases. Working in a small private practice, I cannot justify the extra spending on subscriptions. I suspect many medical specialists have a similar experience.

Ophthalmologist, Tasmania

²³ Productivity Commission, *5 Year Productivity Inquiry*.

²⁴ Productivity Commission, *5 Year Productivity Inquiry*.

2.3.2 Democratic resilience and participation

Access to information helps citizens to participate in discussions and make informed choices, improving the functioning and resilience of democratic institutions.²⁵ Making evidence-based information more widely available can also help promote trust in science and research, and in government decisions informed by research.²⁶ It may also support in countering misinformation.²⁷

Enhanced knowledge facilitated by open access would also make it easier for citizens to contribute directly by engaging in citizen science projects in areas including biodiversity and pollution, humanitarian activities, and even monitoring the UN Sustainable Development Goals.²⁸

As a citizen scientist researching spiders and beetles since 2008, I have had numerous occasions where I have not been able to access scientific papers, predominantly involving taxonomic literature and illustrations (photography). I have invested thousands of hours of unpaid fieldwork, have discovered at least half a dozen new species and expanded the distributions for a variety of taxa all over Australia - though I suspect many more observations would be recorded if access to academic papers was less guarded and more straightforward in process. Many experts I try to consult with are overseas and their knowledge is hidden behind institutional walls.

Stuart Harris, Citizen Scientist, ACT

²⁵ UNESCO (United Nations Educational, Scientific and Cultural Organization), 'UNESCO Recommendation on Open Science', *UNESDOC: Digital Library*, 2021, 21-22, doi: 10.54677/MNMMH8546.

²⁶ L Frischlich and E Humprecht, '[Trust, Democratic Resilience, and the Infodemic](#)', *Facing up to the Infodemic: Promoting a Fact-Based Public Discourse in Times of Crisis*, Israel Public Policy Institute, 2021, accessed 31 May 2023.

²⁷ S Shakeri and S Hawamdeh, 'Chapter 11: Combatting Misinformation in the Open Access Era' in D Alemneh (ed), *Handbook of Research on the Global View of Open Access and Scholarly Communications*, IGI Global, 2022, doi:10.4018/978-1-7998-9805-4.ch011.

²⁸ A de Sherbinin et al., 'The critical importance of citizen science data', *Frontiers in Climate*, 2021, 3, doi:10.3389/fclim.2021.650760.

2.3.3 Education

Unlike university lecturers, school teachers do not have easy access to research, despite the importance of evidence-based support for learning and teaching.²⁹ Less than a third of the overall research literature is openly available (details in Section 3.2); this drops to less than a quarter for the Education and Educational Research category in the Web of Science database.³⁰ Open access would allow Australian teachers to remain up to date with educational research and pedagogical advancements, as well as advances in their subject matter. Students would benefit directly by having access to information developed by experts outside their classroom.

I am a high school teacher in the ACT. I just wanted to let you know how beneficial it would be for me, my colleagues and students if all Australians were able to access academic journals.

The biggest challenge that my students face when completing research assignments, especially in high level physics topics like quantum mechanics, particle physics and relativity is that most websites that are public facing contain simplified explanations of topics and lack detail. Open access to journals would be a game changer for my students and greatly enhance their learning opportunities, especially my highest performing students.

As a science teacher this would also be helpful for me personally. I am able to access most science journals through the ANU, however ANU does not subscribe to many education journals. This means that I am not always able to read articles that would enhance my teaching practice.

High school teacher, ACT

²⁹ G Masters, [The role of evidence in teaching and learning](#), 27 August 2018, Australian Council for Education Research, accessed 8 June 2023.

³⁰ As of November 2022.

2.3.4 Policy making and social change

A national open access strategy would support evidence-based policy making at all levels of government.

Access to academic journals is important for Australia's defence intelligence, which relies on horizon scanning of critical technologies. Global food security programs are informed by research on crop improvement, animal vaccines and other advances in agritech. Access to research on up-to-date climate models, low-carbon technologies and climate adaptation is needed for sound policy making related to climate change.

Having full access to current research literature would be helpful for the compliance officers in the R&D Tax Incentive program, who need to be able to identify whether R&D submissions represent new knowledge. As a former chemist, now public servant, assisting with the administration of the R&D Tax Incentive program, I think the Chief Scientist's proposal to make research literature available not just to other researchers but also the public service, businesses and the general public is a fantastic idea.

Assistant Manager, Department of Industry, Science and Resources

In social research, the share of open access publications is lower than in science, technology and medicine.³¹ This can limit policy at government levels and effective interventions in the care sector. A recent Australian example involved collaborative work between academics and several non-government organisations seeking to optimise grandparents' contact and relationships with their grandchildren after child protection intervention. However, despite being involved in all stages of research, the non-academic partners were unable to directly access the resultant journal article.³²

³¹ 'Publications' here means journal articles, reviews and conference papers. International Association of Scientific, Technical and Medical Publishers (STM Association), [Open Access Uptake by Discipline](#) [data set], stm-assoc.org, 2021, accessed 31 May 2023.

³² S Gair, I Zuchowski and L Beddoe, 'Open Access publishing: A key enabler to research impact, informed practice and social justice', *Advances in Social Work and Welfare Education*, 2021, 22(2):25-38.

2.4 Open access would support the Australian research sector and lift the profile of Australian research internationally

Increased access to research literature would support and promote Australia's research effort and address inequities across the system.

Access to research literature is critical for researchers to remain abreast of the latest developments in their fields, build on the work of others and avoid duplication of effort. Universities, publicly funded research agencies (PFRAs) and other organisations that conduct research subscribe to academic journals to support their research and teaching efforts. However, different organisations across the research system have varying levels of access to research literature depending on their scale, focus and the budgets for their libraries. Increased costs of subscriptions have led to many university libraries reducing the number of journals they subscribe to.³³ One Vice Chancellor at a medium sized metropolitan university has said that they had reduced their library subscriptions by 20% one year due to the higher subscription costs.³⁴

Open access journal articles have a broader reach than journal articles behind a paywall. Open access publishing would raise the profile of Australian-led research, increase the impact of Australia's science diplomacy and make Australia a more attractive destination for international researchers and capital.

A coordinated national approach to open access would also benefit the domestic research ecosystem by removing inequity between researchers who can afford the high open access publication fees and those who cannot (details in Section 3.1). Increased readership and possibly citations³⁵ of journal articles – important metrics in research funding, award and promotion criteria – would make Australian researchers more competitive internationally.

This could be a real game changer for universities and more broadly.

A Deputy Vice-Chancellor from a regional university

³³ S Bosch, B Albee and S Romaine, '[Costs Outstrip Library Budgets | Periodicals Price Survey 2020](#)', *Library Journal*, 14 April 2020, accessed 11 July 2023.

³⁴ TJ Tillack, 'Pressure, opportunities and costs facing research library acquisitions budgets: An Australian perspective', *The Australian Library Journal*, 2014, 63:206-219, doi:10.1080/00049670.2014.915498.

³⁵ A Langham-Putrow, C Bakker and A Riegelman, 'Is the open access citation advantage real? A systematic review of the citation of open access and subscription-based articles', *PLOS ONE*, 2021, doi:10.1371/journal.pone.0253129.

3. The evolving academic publishing system

This chapter provides an overview of the traditional academic publishing system and the growth of open access models. It provides context for the consideration of options for a national open access strategy in Chapter 4.

3.1 The publishing process

3.1.1 The traditional model

Peer reviewed academic journals are the primary publishers of research literature worldwide.³⁵ Publishers provide crucial functions to help ensure the quality and integrity of published research. These include online platforms for manuscript submission and clear review workflows, including coordination of peer review, editing, a documented history of an article's publication journey, anti-plagiarism checks and, more recently, checks for image manipulation. Publishers provide a single source of truth via a unique DOI for each journal article; importantly, they also link any relevant corrections via errata, corrigenda, or retractions. Some journals provide additional features such as platforms for data and analysis script submission,³⁶ an important contribution to reproducibility and hence research quality. Publishers also provide the foundation for efficient literature searches, and metrics to assess research performance.³⁷

Historically, publishing business models have been based on subscription income from universities and other large institutions, with access to journal content largely limited to people affiliated with those institutions. Since moving to a digital format, many publishers also offer access to individual journal articles for a fee of about \$50.³⁸

3.1.2 The move towards open access

A global transition to open access is progressing, albeit gradually and unevenly. Many journals now have open access policies, which enable journal articles to be made available to non-subscribed readers after an embargo period of 12 to 24 months. Alternatively, authors can choose to pay an Article Processing Charge (APC) to make a paper immediately available. This charge is typically in the range of \$2,400 to \$9,500,³⁹ and is as much as \$15,000 for articles in journals such as Nature.⁴⁰

³⁵ In STEM disciplines, journal articles are by far the primary medium of scholarly communication. In the humanities, books are more common than in STEM – and these have similar challenges relating to open access.

³⁶ E Tsang and G Macioci, [Welcome to a new ERA of reproducible publishing](#), eLife website, 24 August 2020, accessed 31 May 2023.

³⁷ Notable databases include [Web of Science](#) and [Scopus](#); widely used metrics are provided by [Clarivate Analytics](#).

³⁸ For example, most *Elsevier* articles cost US\$31.50 for one-off access and *Nature* articles in the most recent issue mostly cost US\$39.95 for the ability to save and print. Elsevier, [Pay per view](#), Elsevier website, 2023, accessed 13 July 2023; Nature, [Volume 619 Issue 7969, 13 July 2023](#), Nature website, 2023, accessed 13 July 2023.

³⁹ Conversion from USD to AUD in July 2023. M Hagve, 'The money behind academic publishing', *Tidsskr Nor Lægeforen*, 2020, doi:10.4045/tidsskr.20.0118.

⁴⁰ Conversion from EUR to AUD in July 2023. H Else, [Nature journals reveal terms of landmark open-access option](#), Nature website, 24 November 2020, accessed 31 May 2023.

Many publishers have recently moved to read and publish agreements with institutions or consortia in which both aspects are covered by a single fee. Those covered by the agreements have read access to paywalled content and can publish open access journal articles, although depending on the agreement the number of open access journal articles may be capped. Despite this, in 2020 more than 90% of the amount paid to publishers by Australian institutions was for subscriptions.⁴¹

3.1.3 Problems with the current system

The traditional academic publishing model was developed for the print era. While publishers have an important role, their profit margins of up to 37% do not reflect the distribution of inputs in the digital era:⁴² most of the work is done by researchers, who provide content, expert peer review and editing.⁴³ Publishers do not pay researchers for these services, although some journals pay a small honorarium to editors.

A large fraction of research remains locked behind paywalls. The price of subscriptions and individual journal article fees puts them out of reach of most individuals. Many authors and institutions cannot afford to pay APCs (article processing charges) to make their journal articles immediately available to all readers.

Most journals will allow a version of a journal article accepted for publication to be deposited into institutional or discipline repositories, but often only after an embargo period.⁴⁴ This approach offers fewer benefits than immediate open access, as the field has typically evolved by the time of open publication.

The financial model of the academic publishing system has led to a decline of social license of publishers among some stakeholders, notably in the research community. Some stakeholders have suggested dispensing with traditional publishing altogether and relying instead on stand-alone repositories or open research publishing platforms.⁴⁵ However, repositories cannot fulfill all key functions of journal publishers. These functions include quality control, such as version control for any corrections or retractions, and specific research integrity tools including for detecting plagiarism and ‘paper mills’⁴⁶. They also include robust anonymous expert peer review workflows, metadata, and documented history of an individual research output’s journey. These important features all have associated costs.

While many publishers have recently moved to read and publish agreements, these provide access (to closed access journal articles) only for researchers at participating institutions. In Australia, these would typically be universities which are members of the Council of Australian University Librarians (CAUL),⁴⁷ CSIRO and certain government departments. Many potential users, including SMEs, schools and individuals, are not covered by these agreements.

A related problem with the existing publishing model concerns the transfer of copyright from authors to publishers. The terms of most copyright transfer agreements limit the dissemination and use of research, and hence collaboration and innovation.

⁴¹ CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*, unpublished, report to the Office of the Chief Scientist, 2022.

⁴² Hagve, *The money behind academic publishing*.

⁴³ Estimates range from 4-8 hours for a typical manuscript, noting that this can vary substantially depending on the journal article and reviewer. More details are provided in the Appendix.

⁴⁴ The publisher will usually require that the version deposited is the author-accepted manuscript rather than the final typeset version (version of record) – this is often known as ‘green open access’. See glossary for definitions.

⁴⁵ For example, [F1000 Research](#).

⁴⁶ An example is the [STM Integrity Hub](#)’s ‘papermill detector’, a detection tool to screen submissions for key indicators that suggest that the manuscript has or may have originated from a paper mill.

⁴⁷ [CAUL members](#) opt in or out of agreements with individual publishers on a case-by-case basis.

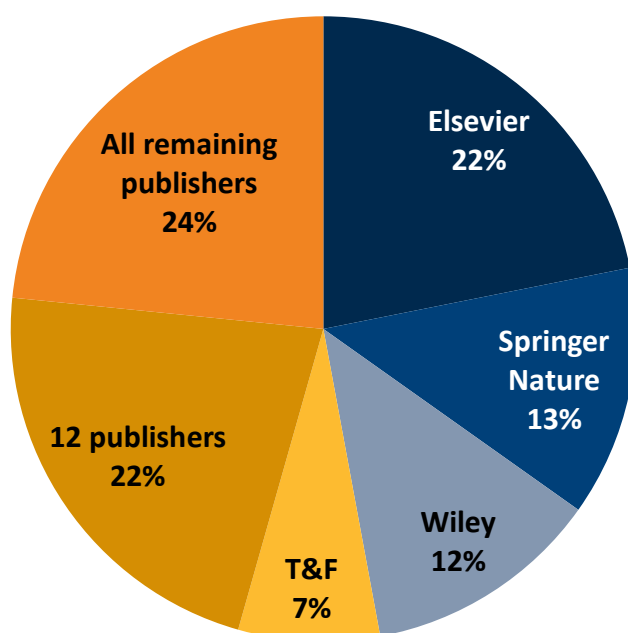
3.2 The publishing landscape

The global publishing market is heavily concentrated. More than half the journal articles are published by just five publishers (Elsevier, Springer Nature, Wiley, Taylor & Francis and Sage). There is a long tail of several thousand publishers which together publish only 10% of academic journals.⁴⁸

The situation is similar in Australia, where just four publishers published 54% of journal articles with at least one Australian author over the past 10 years (*Figure 3.1*). Sixteen publishers published more than three quarters of such papers. Analysis commissioned by the Office of the Chief Scientist shows that the remaining 24% of papers are spread over a ‘long tail’ of around 4,000 diverse publishers, including (i) small and medium sized commercial publishers; (ii) university and faculty publishers; (iii) professional and disciplinary associations and societies; (iv) government departments and research organisations.⁴⁹ The small publishers facilitate high-quality research, often in areas of significance for Australia and our region – topics which may not be well represented in the more mainstream and discipline-specific global journals. Preserving bibliodiversity is an important consideration in any new publishing model.

Australia produces some of the world’s highest-impact research. While Australia contributes to 4% of the world’s publications, it had 7.9% of the world’s most cited publications in 2020, well ahead of the 3.7% OECD average.⁵⁰ Writing journal articles is a highly collaborative endeavour, with 60% of Australian-led journal articles featuring international co-authors.⁵¹

Figure 3.1 – Market share of journal articles with at least one Australian author published by each publisher (2011-2020)⁵²



⁴⁸ EY, *A national strategy for open access*.

⁴⁹ Ivison, *Analysis of the potential impact of the proposed Office of Chief Scientist Open Access model on the ‘long tail’ of journal publishers*.

⁵⁰ ‘Publications’ here refers to a range of scholarly content such as journal articles, reviews and conference proceedings papers. DISR, [Australian Innovation System Monitor: Research Output](#) [data set], industry.gov.au, 2021, accessed 31 May 2023.

⁵¹ Document ratio whose affiliation includes more than one country address (rounded). Scimago Lab, [SJR - Australia](#), ScimagoJR website, 2021, accessed 23 September 2021.

⁵² Web of Science, [Web of Science Core Collection](#) [data set].

3.2.1 The costs of research publishing in Australia

Gross Expenditure on R&D (GERD) in Australia was \$35.6 billion in the 2019-20 financial year. This was split approximately equally between business expenditure and combined funding by the Australian government, non-profit and higher education sectors.⁵³ The GERD provides an estimate for the investment into Australian research, much of which is published in academic journals.

In 2020, Australian institutions paid more than \$321 million to publishers, including \$303 million in subscription fees, \$14.5 million in APCs⁵⁴ and \$4 million for transformative agreement costs such as read and publish agreements.⁵⁵ The proportion of expenditure for transformative agreements will rise in future years due to several new read and publish agreements negotiated by CAUL.

In-kind contributions from Australian researchers and research institutions for peer review are valued at an estimated \$18.3 million to \$36.6 million annually⁵⁶. Institutions also invest around \$40 million a year to maintain repositories;⁵⁷ we note that this provides a low bound on costs associated with any repository-focused open access models, as the estimates do not include smaller research institutions which cannot afford to maintain repositories, and further costs associated with repository interoperability and compliance which are challenging to estimate.

3.2.2 Open access publishing in Australia

Gold open access: Publishing model in which journal articles are published as open access immediately, without an embargo period, in a fully open access journal. There is an associated cost to the authors.

Hybrid open access: Publishing model in which authors may pay an optional APC to the publisher to enable their journal article to be published as open access in a journal that also has paywalled content. The fees can be covered by read and publish agreements.

Green open access: Publishing model in which journal articles are made freely accessible in a repository, typically after an embargo period. There is typically no associated cost to the authors.

The proportion of Australian-led publications that are published open access has increased by about 3% per year for more than a decade. However, in 2021 more than 50% of Australian-led publications were published behind a paywall. Publishers made only 29% of publications gold or hybrid open access, with an additional 6% bronze open access.⁵⁸ Another 14% were made accessible through green open access.⁵⁹

Between 2011 and 2021, the proportion of open access publications in Australia was comparable to countries such as the United States and China, but much less than most leading international research nations (*Figure 3.2*). By contrast, five European countries (Germany, Poland, Netherlands, Switzerland and Sweden) published over half of their research as gold or hybrid open access.⁶⁰

⁵³ Australian Bureau of Statistics (ABS), [Research and Experimental Development, Businesses, Australia](#) [data set], abs.gov.au, 2021, accessed 31 May 2023.

⁵⁴ As discussed in the Appendix, this is an underestimate due to not all stakeholders providing APC data.

⁵⁵ CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*.

⁵⁶ CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*. The lower bound assumes 4 hours of work per review at a wage of \$60 per hour, the upper bound assumes 6 hours of work per review at a wage of \$80 per hour. This approach is consistent with estimates in the peer reviewed literature; details are in the Appendix.

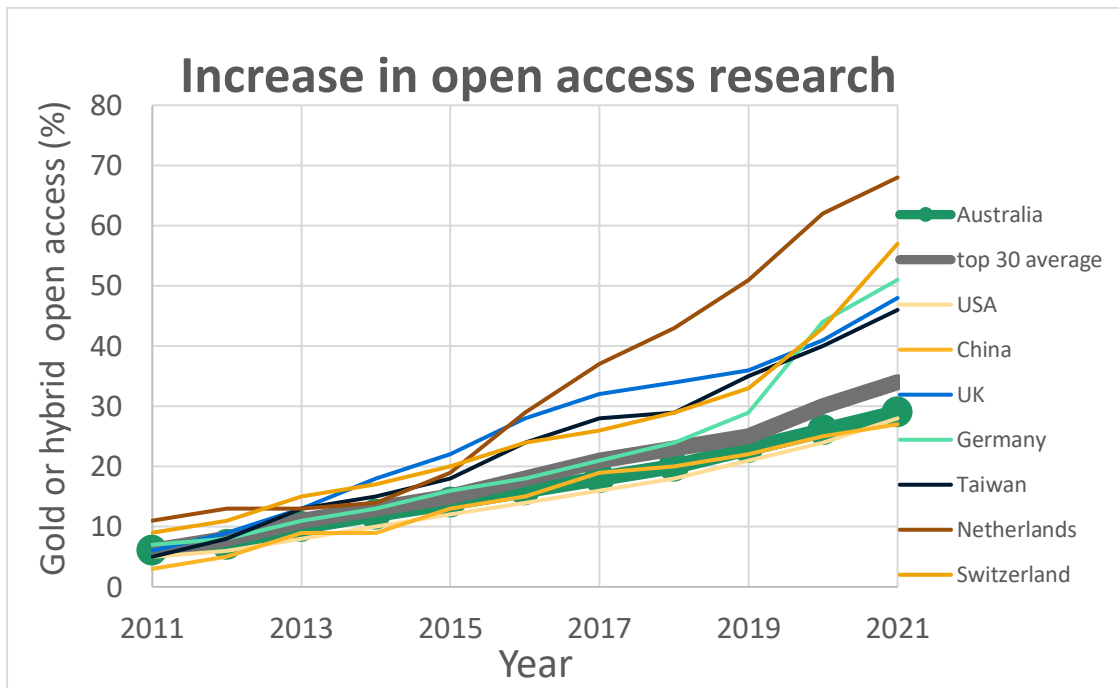
⁵⁷ Calculation based on stakeholder consultation and historical data; details in Appendix.

⁵⁸ STM Association, [Open Access Uptake by Countries/Regions](#) [data set]. 'Bronze open access' refers to free to read on the publisher page but without an open licence. 'Publications' here means journal articles, reviews and conference papers, accessed 31 May 2023.

⁵⁹ STM Association, [Open Access Uptake by Countries/Regions](#) [data set]. 'Publications' here means journal articles, reviews and conference papers, accessed 31 May 2023.

⁶⁰ In 2021. STM Association, [Open Access Uptake by Countries/Regions](#) [data set]. 'Publications' here means journal articles, reviews and conference papers. accessed 31 May 2023.

Figure 3.2 – Australian and international trends in open access publishing in gold open access and hybrid journals⁶¹



In 2018, the House of Representatives Standing Committee on Employment, Education and Training recommended that ‘the Australian Government develop a more strategic approach to Australia’s open scholarship environment’.⁶² More recently, in 2023 the Productivity Commission explicitly recommended ‘open access to research principally funded by governments’ to improve the diffusion of ideas throughout the economy, particularly by small business.⁶³

There has been recent progress in Australia towards open access. The CAUL consortium, which includes most of Australia’s universities and major Australian Government-funded research agencies such as the CSIRO, Defence Science and Technology Group (DSTG) and the Australian Nuclear Science and Technology Organisation (ANSTO), has negotiated open access agreements with 21 publishers since 2020. These agreements are mostly read and publish agreements for hybrid open access journals that allow employees at participating institutions to read paywalled journals articles covered by the agreements and to publish in those journals as open access.⁶⁴

Two of the major funders of competitive research grants in Australia, the Australian Research Council (ARC) and the NHMRC, have open access policies that require work they fund to be open access. The ARC policy includes a 12-month embargo period while the NHMRC requires immediate open access.⁶⁵ However, journal articles associated with NHMRC and ARC funded research only comprised 20% of Australian journal articles in the last five years.⁶⁶ Institutional repositories are hosted by all Australian universities and some other research

⁶¹ International Association of Scientific, Technical and Medical Publishers (STM Association), [STM OA Dashboard 2023 Data File](#) [data set], stm-assoc.org, 2021, accessed 31 May 2023.

⁶² Parliament of the Commonwealth of Australia, House of Representatives Standing Committee on Employment, Education and Training, [Inquiry into Funding Australia’s Research](#), 2018, accessed 31 May 2023.

⁶³ Productivity Commission, *5 Year Productivity Inquiry*.

⁶⁴ Council of Australian University Librarians (CAUL), [Read and Publish Agreements Negotiated by CAUL](#), CAUL website, 2023, accessed 6 June 2023.

⁶⁵ Australian Research Council (ARC), [ARC Open Access Policy](#), ARC website, n.d., accessed 31 May 2023; National Health and Medical Research Council (NHMRC), [NHMRC Open access Policy](#), NHMRC website, n.d., accessed 31 May 2023.

⁶⁶ Web of Science, [Web of Science Core Collection](#) [data set].

institutions, and in principle provide a mechanism for implementing such funder mandates. However, deposit rates are relatively low⁶⁷ and many smaller research institutions do not have their own repositories.

3.2.3 Overseas open access models and policies

The international trajectory towards open science is highlighted by the 2021 recommendation by UNESCO that 'Member States collaborate in bilateral, regional, multilateral and global initiatives for the advancement of open science'.⁶⁸ Open access publishing is part of this effort and several countries have developed a range of open access models and policies.

In the US, a new federal policy mandates that all federally funded research is to be published immediately as open access from 2026.⁶⁹ This builds on earlier efforts by a large international group of research funders known as cOAlition S, whose 'Plan S' requires that all peer reviewed publications arising from research funded by the cOAlition S members must be open access. Under Plan S, journal articles and other publications should be immediately available for reading without a paywall and be published under a liberal licence enabling anyone to reuse or republish the content.⁷⁰ In 2022, the NHMRC joined cOAlition S.⁷¹

Another approach makes a subset of publicly funded research open access by transitioning existing journals to a fairer business model. For example, library consortia have negotiated nationwide open access agreements in European countries including the UK, Germany, Sweden and Switzerland, covering universities as well as some other academic and government organisations.⁷² Papers published by authors covered by these agreements are immediately available to everyone as open access. Several of these involve agreements that were negotiated with publishers on a cost-neutral basis.⁷³

However, none of these national approaches addresses the issue of access to international research literature for readers in the broader community. An alternative approach was suggested in India, where a 'One nation, one subscription' proposal advocated for a nationwide subscription enabling read access to the global research literature.⁷⁴

⁶⁷ N Kirkman and G Haddow, 'Compliance with the first funder open access policy in Australia', *Information Research*, 2020, 25:2.

⁶⁸ United Nations Educational, Scientific and Cultural Organisation (UNESCO), [UNESCO Recommendation on Open Science](#), UNESCO, 2021, accessed 31 May 2023.

⁶⁹ J Tollefson and R van Noorden, 'US Government reveals big changes to open-access policy', *Nature*, 2022, 609:234-235, doi:10.1038/d41586-022-02351-1.; White House Office of Science and Technology Policy (2022), [Memorandum for the Heads of Executive Departments and Agencies](#), Memorandum prepared by A Nelson, OSTP, United States of America Government

⁷⁰ In 2020, around 5% of total publications and 12% of highest impact publications were outputs of funding provided by cOAlition S members; H Else, 'A guide to Plan S: the open-access initiative shaking up science publishing', *Nature*, 2021, doi:10.1038/d41586-021-00883-6.

⁷¹ NHMRC, [NHMRC's revised Open Access Policy released](#), NHMRC website, 20 September 2022, accessed 31 May 2023.

⁷² N Gruenpeter, N Ryccko, K Siewicz and J Szprot, [Transformative Agreement: Overview, Case Studies, and Legal Analysis](#), 2021, Wydawnictwa ICM, Warszawa. UK's national approach is coordinated by the [UKRI](#), Germany's by [Projekt DEAL](#), Sweden's by the [National Library of Sweden](#). Websites accessed 31 May 2023.

⁷³ ESAC Initiative, [wiley2019deal](#), ESAC Initiative website, n.d., accessed 31 May 2023; ESAC Initiative, [sn2020deal](#), ESAC Initiative website, n.d., accessed 31 May 2023; H Else, 'Elsevier strikes its first national deal with large open-access element', *Nature*, 2019, doi:10.1038/d41586-019-01349-6.

⁷⁴ India Today, ['One Nation One Subscription initiative by education ministry to allow open access to research papers from April 1'](#), *India Today*, 19 November 2022, accessed 31 May 2023.

4. Open access models for Australia

As a relatively small but important member of the international research community, Australia is well-placed to lead internationally on the transition to open access.

Any national approach to open access must consider two aspects:

- (1) Access by Australian residents to journal articles which do not involve Australian researchers (96% of papers)
- (2) Access by Australian residents and the global community to journal articles with Australian-based authors (4% of papers)⁷⁵

Three models of open access are used at various scales in Australia and internationally.

- **Funder mandate models**, where research funders require grant recipients to publish their research in journals in a way that the research is accessible to all, or to deposit copies of their journal articles in open access repositories.
- **Repository models**, where accepted (but usually unformatted) versions of journal articles are deposited in a freely accessible repository. There may be potential for existing institutional repository infrastructure to be linked through a central national portal.
- **Read and publish agreements** between publishers and institutions or consortia, which allow open access publishing and read access to the publishers' closed access journal articles for participating institutions.

All three approaches increase read access to Australian-led research, either through payments to publish open access (read and publish agreements), maintaining repositories for Australian-led research (repository model) or mandating open access through grant guidelines and funding agreements (funder mandate model). Because Australia contributes to only 4% of the world's journal articles,⁷⁶ policies that increase open access domestically would only result in an incremental increase in overall journal article availability for the Australian public and businesses. Only the read and publish agreement approach increases access to international research literature for Australian residents – but even then, only for employees of subscribed institutions, typically universities and public research agencies.

To address these challenges, Australia's Chief Scientist has developed a fourth model.

- A **public access model**, where the government centralises negotiations for national read and publish agreements that (i) allow read access to all published research across all disciplines in academic journals – past and future; and (ii) include open access publishing for all new, Australian-led research to ensure it is freely accessible to the world.

The key distinction of this model is in delivering benefits for all Australian residents, not just researchers.

The public access model builds on the approach taken by CAUL but broadens read and publishing access beyond the current consortia members. It is anticipated that this model will support all publishers, including

⁷⁵ Web of Science, [Web of Science Core Collection](#) [data set]. Over the last 5 years.

⁷⁶ Web of Science, [Web of Science Core Collection](#) [data set]. Over the last 5 years.

small and micro publishers that are critical for bibliodiversity and will enable them to have a wider readership, less administration and greater certainty of income.⁷⁷





A centralised model to access research literature has the potential to reduce cost burden and the duplication of costs, providing access to all journal articles to all research organisations and all Australian residents.

The additional implementation costs associated with the public access model would be largely offset by existing subscription fees paid by institutions. The issue of cost is explored in more detail in Section 4.3 below.

The four options are summarised below in Table 4.1.

Read and publish agreements have not been represented separately in the summary or analysis of the models, as the ‘no intervention’ approach includes current read and publish agreements negotiated at institution and consortium levels. The public access model builds on these agreements.

Table 4.1 – Models for open access for Australia

Name	Description	Increase in Australian-led journal articles open to the world	Increase in international journal articles free to read for all Australian residents ⁷⁸
 Public access	National read and publish agreements allow open access publishing and reading, including back catalogues, at no direct cost to users across Australia.	All Australian-led journal articles open to the world	The world’s journal articles free to read for Australian residents
 Repository	Repository infrastructure used to provide open access to Australian-led journal articles into the future.	Some increase in open access versions of journal articles	No increase
 Funder mandate	Australian Government research funders mandate research funded by them is published open access into the future.	Some increase in journal articles published open access	No increase
 No intervention	Government takes no action and allows existing initiatives to continue.	No increase	No increase





⁷⁷ Some of the challenges faced by small publishers are discussed in HR Jamali, S Wakeling and A Abbasi, ‘Why do journals discontinue? A study of Australian ceased journals’, *Learned Publishing*, 2022, 35:219-228, doi:10.1002/leap.1448

⁷⁸ Refers to increases directly attributed to the respective models and excludes increases in open access publishing due to other open access publishing initiatives.

4.1 Openness of information

The level and type of access, and therefore the likely impact and benefits, of each model varies. These are benchmarked in Table 4.2 below against a no-intervention counterfactual, where open access to research continues to increase slowly due to international and domestic initiatives. Detailed calculations, including assumptions, are provided in Appendix A.

Table 4.2 – Estimated rates of access to Australian-led and international research through different open access models

Estimated accessibility of publications across open access models	 Public access	 Repository	 Funder mandate	 No intervention
Proportion of new Australian-led journal articles available as open access	> 96%	43% – 47%	49% - 55%	43%
Proportion of all journal articles (existing and future, Australian-led and international) available to all Australian residents	> 90%	35% - 50%	35% - 49%	35% - 48%
Proportion of Australian residents ⁷⁹ that can access currently closed access journal articles (existing and future, Australian-led and international)	> 90%	7%	7%	7%

The public access model delivers the greatest benefits. The no-intervention approach delivers the lowest benefits, with funder mandate and repository models showing only a modest improvement on the no-intervention baseline.

Access to Australian-led research: The public access model makes almost all Australian-led research open access, more than double the no-intervention counterfactual. In the high scenario, the repository and funder mandate models improve access compared to the no-intervention case by 10% and 28% respectively, leaving approximately half of Australian-led research not widely available. The funder mandate model is relatively inefficient because the majority of Australian-led research is not funded by the Australian government.⁸⁰ Furthermore, both international and domestic experience suggests low rates of compliance for the repository model, which limits its impact.

Access by Australian residents to the world’s research: There is no appreciable improvement under the funder mandate or repository scenarios, with half to two thirds of all research inaccessible to non-subscribed Australian residents. This is because both these models only impact accessibility of Australian-led research, which is a small fraction of the global output. By contrast, the public access model provides access to more than 90% of the literature to all Australian residents.

⁷⁹ Over 15 years old.





⁸⁰ Universities undertake almost 80% of Australia’s public sector research – Universities Australia, [Research & Innovation](#), Universities Australia website, n.d., accessed 31 May 2023. The Australian government provided 29% of total university R&D funding (\$3.7 billion out of \$12.7 billion in the 2020 calendar year). Australian Bureau of Statistics, [Research and Experimental Development, Higher Education Organisations, Australia](#) [data set], abs.gov.au, 2022, accessed 31 May 2023.

4.2 Benefits

The increased access to information has a range of benefits. Analysis of economic benefits is deferred to computable general equilibrium (CGE) modelling. Table 4.3 below summarises non-economic benefits of each model compared with the present day.

The increasing prevalence of read and publish agreements would gradually increase the profile of Australian-led research internationally over time even under the no-intervention model. However, all other benefits rely on access to research by Australian resident non-subscribers, and hence are directly related to the access rates reported in Table 4.2. The ‘public access’ model therefore clearly provides the greatest range of benefits.

Table 4.3 – Comparison of non-economic benefits to Australia across open access models

Comparison of non-economic benefits across open access models	 Public access	 Repository	 Funder mandate	 No intervention
Increase the profile of Australian-led research internationally	High	Some increase	Some increase	Little increase
Increase the accessibility of research to professionals, including teachers and medical professionals	Full access	Some increase	Some increase	No increase
Support democratic resilience and counter misinformation	High	No increase	No increase	No increase
Strengthen evidence-based policy	High	Some increase	Some increase	No increase
Empower individual Australian residents and citizen scientists	High	Some increase	Some increase	No increase

4.3 Costs

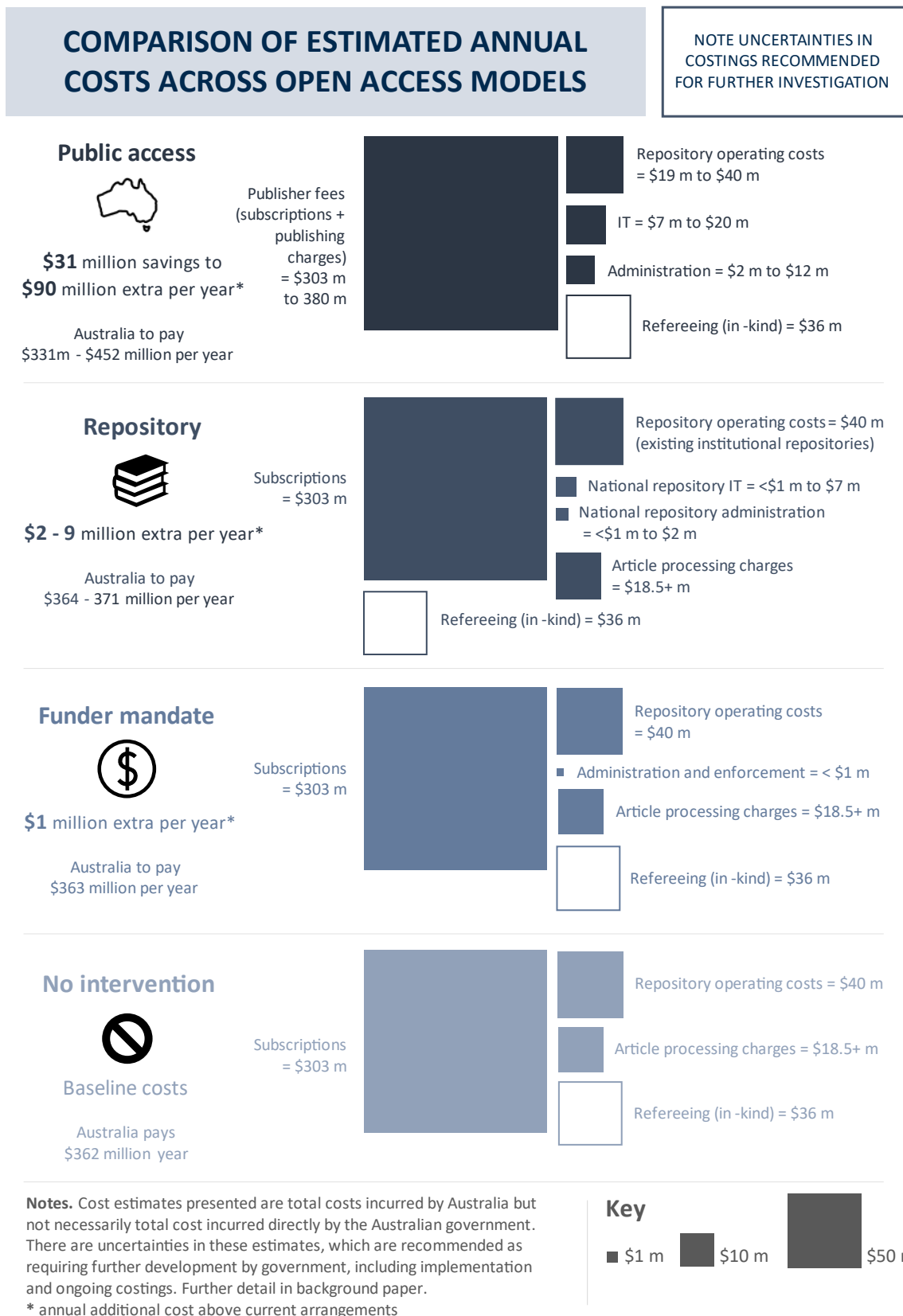
The major cost component (more than 80%) in all models is subscription costs, which are already being paid by research institutions.

The estimated annual costs of the models are presented in Figure 4.1 (further detail in Appendix A). For the repository, funder mandate and no-intervention models, these are similar to current spending. The estimated cost of the public access model has larger uncertainty, and further work is needed to quantify the likely cost. On the one hand, the model may attract higher subscription costs due to expanded access. On the other hand, almost all new subscribers – Australian residents who are not researchers – represent an untappable portion of the market, and preliminary discussions with publishers who have read-and-publish arrangements with CAUL suggest that there should not be a significant cost premium associated with transitioning to this model. Implementation of the public access model may even deliver an overall cost saving due to increased bargaining power in negotiations with publishers, and opportunities for scaling back investment in repositories which often duplicate infrastructure.⁸¹ An example of a model which has successfully delivered equitable nationwide access to international and domestic products, leveraging Commonwealth bargaining power, is the Pharmaceutical Benefits Scheme (PBS), which provides access to over 900 medicines in more than 5000 brands.⁸²

⁸¹ L J Hinchcliffe, [‘The Double-Cost of Green-via-Gold’](#), *The Scholarly Kitchen*, 25 April 2023, accessed 31 May 2023.

⁸² There were 925 different medicines in 5178 brands listed on the PBS as at 30 June 2022. Department of Health and Aged Care (DHAC), [PBS Expenditure and Prescriptions Report 1 July 2021 to 30 June 2022](#), DHAC, Australian Government, 2022, accessed, accessed 9 June 2023.

Figure 4.1 – Comparison of estimated annual costs across open access models



4.4 Projected economic benefits of the public access model

The Office of the Chief Scientist commissioned EY to assess the economic impact of the proposed public access model. EY used its in-house (CGE) model of the Australian economy to estimate an economic uplift of up to \$2.3 billion in GDP growth and up to 1,000 new jobs over an eight-year period (2022-2030), as a consequence of opening access to all research literature.

The core economic impact of a national open access regime is the productivity dividend associated with the increase in R&D investment (with an associated productivity boost), better policy making and the broader dissemination of quality academic research into the community and business sector.

This economic impact assessment is based on the following assumptions:

- Each industry increases R&D by the proportion of firms for which access constraints to academic journals form a barrier to innovation, in line with ABS data⁸³
- The increase in R&D is in line with the average R&D expenditure for each industry
- For every 1% increase in R&D, the increase in productivity is assumed to be 0.07% for industry and 0.28% for government, consistent with studies by the OECD and Productivity Commission.⁸⁴

The modelling in Figure 4.2 and Table 4.4 considered two scenarios. The high scenario assumes constant compounding of the productivity dividend, meaning that the benefits of open access remain constant over time. The low scenario assumes a linear decay in productivity improvements over time, with most of the gains achieved in the first several years of the new model.⁸⁵

Figure 4.2 – Potential economic impacts of a public open access model⁸⁶

⁸³ EY, *A national strategy for open access*.

⁸⁴ EY analysis, derived from S Torok and P Holper, *Securing Australia's Future: Harnessing Interdisciplinary Research for Innovation and Prosperity*, CSIRO Publishing, 2017, doi:10.1071/9781486306701. Qualitative adjustments were made based on EY experience to develop proxies for this modelling exercise. These productivity figures broadly align with the Productivity Commission, OECD reports and EY's work on similar engagements.

⁸⁵ EY has estimated the annual linear rate of decay to sit between -9% and -12% percent for GDP, Investment and employment.

⁸⁶ EY, *A national strategy for open access*.

Table 4.4 – Potential economic impacts of a public open access model⁸⁷

Year	2030	2040	2050
GDP (\$m)	400 – 790	1,400 – 2,800	2,900 – 5,800
Employment (FTEs)	520 – 1,030	1,450 – 2,900	2,650 – 5,300
Investment (\$m)	210 – 430	490 – 975	880 – 1,770

In summary, the preliminary work by EY (presented in Figure 4.2 and Table 4.4) indicates that there may be significant economic benefits from the proposed public access model, while the costs are comparable to other models. While CGE modelling may have limited applicability to such a (relatively small) policy change, in the absence of alternatives and noting the novelty of the model (no comparable international experience exists), it is included here. Further work should consider whether other approaches, for example econometric analysis, should be applied to all models under consideration.

⁸⁷ EY, *A national strategy for open access*.

4.5 Stakeholder consultation

4.5.1 General feedback

A prospective analysis in 2021 confirmed broad stakeholder support for open access, including with reference to benefits outlined in Chapter 2, and for the development of a national strategy. This was confirmed through further consultation by EY in 2022.

Stakeholders were consulted across sectors including government, publishers, academia and industry.

Discussions highlighted the range of open access initiatives underway in Australia and internationally, with some stakeholders noting that the different models are not mutually exclusive – for example, the funder mandate model could be pursued alongside other models.

Stakeholders also noted, as in Section 4.1 above, that neither the repository nor funder mandate models would increase the amount of freely accessible international literature.

Below, we briefly summarise key consultation insights relating to each model.

4.5.2 The public access model

There is significant support across stakeholder groups for the proposed public access model and, in particular, the negotiation of access to journal articles for all Australian residents. Stakeholder feedback undertaken for the CSIRO Futures *Prospective analysis* indicated broad support for the principles underpinning the public access model (see Section 6.3 in the Appendix).

CSIRO Futures, EY and the Office of the Chief Scientist consulted with stakeholders on the risks, costs and implementation of the public access model. Stakeholders suggested that the benefits, as noted in Sections 4.1 and 4.2, are likely to outweigh the risks and implementation challenges.

Three aspects of the model were discussed in detail by stakeholders.

4.5.2.1 Negotiating agreements with publishers

Publishers noted that they would save negotiation and administration costs as a result of having a single agreement to replace multiple read-and-publish arrangements individually negotiated with institutions across Australia.

Discussions with large publishers have indicated that the public model is of interest to them. Some have indicated there is enough money in the system to support this model.

A medium sized publisher confirmed that it could enter into a national read-and-publish agreement on a cost-neutral basis. This publisher has established read and publish agreements with individual institutions and consortia internationally and has a template agreement that allows for the setting of a total fee per year.

Publishers recognised that some organisations and individuals who currently do not pay for subscriptions (e.g. SMEs, members of the public) would never be in a position to do so. They therefore represent an ‘untappable’ market from which publishers would not be able to extract revenue. Some stakeholders expressed concern that major publishers would be prioritised as the first agreements negotiated under this framework. The model could, therefore, consolidate the publishing market and disadvantage small publishers in the ‘long tail’. This should be taken into consideration when designing an implementation plan.

Several stakeholders have also pointed to the importance of building on CAUL’s work in negotiating read and publish agreements.

4.5.2.2 Funding the public access model

Detailed considerations around how funding would be invested or redirected to this model are outside of the scope of this advice. Below, we briefly outline some potential considerations for further exploration.

Some stakeholders expressed concern that the university sector may lose funding and autonomy over publishing and subscription expenditure. The concerns centre on the fact that while the government funds universities, universities also have other sources of revenue. Because of this, some stakeholders expressed the view that caution should be taken to avoid creating ‘winners’ and ‘losers’, or creating potential cash flow issues in universities, as a consequence of any changes to the government funding model. This issue is not insurmountable, but would require consideration by a delivery team.

Some stakeholders also expressed concerns that if the model was funded by the Australian government, it could be at the expense of other R&D programs. If this were the case, the potential benefits of the public access model would need to be weighed against the benefits of other R&D programs.

One Vice-Chancellor noted that subscription and publishing costs are an important component of the indirect costs of research and, while several Australian Government portfolios provide research funding to universities for the direct costs of research, only the education portfolio currently supports indirect costs through the Research Support Program. They suggested that it would be important for all portfolios across government that fund and benefit from research to contribute to the cost of the public access model.

Some stakeholders suggested that as there is a shift globally towards open access, investment in a public access model may not be necessary. However, as outlined in this advice paper, the global transition is slow and uneven. The public access model accelerates Australia’s move to open access and aligns with complementary international initiatives.

4.5.2.3 Setting up and maintaining the IT system

Some stakeholders highlighted the risk of a single point of failure for the IT system providing access to the research literature. Publishers expressed concerns over the potential difficulty of authenticating prescribed users and in limiting the leakage of journal articles to non-prescribed users. Both of these risks are likely to be manageable given the proven capability for delivery of high uptime in online government services, such as MyGov, and existing authentication protocols. Moreover, a national approach is likely to reduce duplication and inefficiencies in current approaches.

4.5.3 Funder mandate and repository models

Stakeholders noted that both the funder mandate and repository models are well-established, and therefore low risk.

However, stakeholders also noted that a major drawback of both models is that neither provides access to previously published closed access journal articles or any international research literature that will be published closed access in the future.

4.5.3.1 Funder mandate model

The funder mandate model was noted to be most closely aligned with international open access developments. Some stakeholders supported the funder mandate model for its flexibility in relation to platinum, gold, hybrid or green open access routes.

Stakeholders identified additional publication costs, and not all Australian-led (and no international) research being made available as major drawbacks of the funder mandate model. Other risks identified by stakeholders include potential inconsistencies in approaches between funders, optics of ‘double paying’ to publish and also access research, and ongoing costs for maintaining institutional repositories. Overall, this model was judged to deliver only marginal improvements over existing arrangements.

4.5.3.2 Repository model

Some stakeholders commented on the flexibility of the repository model because of its opt-in architecture. Stakeholders also noted that repositories complement journals in supporting the longer-term goals of open science, by facilitating open access to data and also making available research outputs other than journal articles.

Many stakeholders identified quality control of research literature as a major challenge for the repository model. Duplication of effort, challenges in interoperability between institutional and national repositories, and enforcing compliance were mentioned as further risks for the repository model. Some stakeholders also noted that a system where publishers are unable to recoup revenue from journal articles that were free to publish is unsustainable for publishers. Overall, this model was viewed by stakeholders as delivering the lowest benefits.

5. Recommendations: the role of government and next steps

As detailed in previous chapters, a transition to open access publishing is likely to unlock significant benefits for Australia, at an estimated cost which is broadly comparable to existing expenditure. A nationally coordinated approach would therefore be beneficial.

The four approaches considered in this advice provide different levels of access to published research by Australian-based individuals and organisations, and by the rest of the world to Australian-led research.

The total cost in each case is expected to be similar to current arrangements. However, uncertainties remain about the costs of each model and more work is needed to identify detailed costings. Timeframes, cost savings and incentives also need to be considered.

Two recommendations arise from this analysis.

Recommendation 1: The Australian Government should develop and implement a strategy to maximise access to academic journals for the Australian community.

The Australian Government should develop and implement an Australian open access strategy to realise the substantial benefits anticipated to arise from broader access to research literature.

Recommendation 2: The Government should undertake further analysis to develop the preferred model that will deliver the greatest benefit for Australia, from both an economic and social perspective.

In developing the strategy, consideration should be given to the relative benefits and costs of three potential models against a consistent set of desired outcomes (see proposed principles below).

The proposed principles are that an open access model should:

- Maximise the benefits from Australia's existing expenditure on academic subscriptions and publishing.
- Allow people residing in Australia to freely access all peer reviewed journal articles, across all disciplines, including all new journal articles from the date of publication and all previously published journal articles.
- Ensure Australian-led peer reviewed journal articles in all discipline areas are openly accessible internationally from the date of publication.
- Support research integrity by facilitating the provision of quality metadata, keeping versions of record and assisting in discoverability.
- Preserve bibliodiversity and author autonomy regarding where to publish.
- Recognise the role of publishers and ensure the sustainability of their businesses.
- Use infrastructure that is user-friendly, internationally interoperable and designed for future developments in publishing and open research.
- Be equitable for all stakeholders.





6. Appendix: Background and supporting information

6.1 Methodology

This section presents methodology used to calculate data presented in Chapter 4.

6.1.1 Openness of information

Table 4.2 – Estimated rates of access to Australian-led and international research through different open access models

Estimated accessibility of publications across open access models	 Public access	 Repository	 Funder mandate	 No intervention
Proportion of new Australian-led journal articles available as open access	> 96%	43% – 47%	49% - 55%	43%
Proportion of all journal articles (existing and future, Australian-led and international) available to all Australian residents	> 90%	35% - 50%	35% - 49%	35% - 48%
Proportion of Australian residents ⁸⁸ that can access currently closed access journal articles (existing and future, Australian-led and international)	> 90%	7%	7%	7%

⁸⁸ Over 15 years old.

6.1.1.1 Proportion of new Australian-led journal articles available as open access

Repository: As outlined in Section 3.2.2, 43% of Australian-led publications published in 2021 were open access – 29% published as open access by publishers and another 14% available through institutional repositories.⁸⁹ Even in universities which mandate research outputs being placed in institutional repositories, compliance rates are low. They can stand at about 30%, five years after the mandate was introduced.⁹⁰ International experience highlights similarly low repository deposit rates.⁹¹ Noting that the repository-deposited fraction includes journal articles already made openly accessible by publishers, we estimate a potential uplift in total open access content from the current 43% to 47%. Extensive additional compliance requirements, and associated costs, would be needed to further increase the open access fraction.

Funder Mandate: Universities undertake almost 80% of Australia’s public sector research.⁹² Research funding to universities is used to estimate the impacts of the funder mandate model. The lower bound on the impact of the funder mandate model is 14.7% over the baseline, representing the amount of research funded to universities through competitive Australian Government grants.⁹³ The upper bound of 29% represents the share of all Australian Government R&D funding to universities (\$3.7 billion in the 2020 calendar year) in overall university R&D expenditure (\$12.7 billion). Using the current 43% of openly available Australian-led research as a baseline, the projected range of open access research under the funder mandate model is therefore 49%-55%. Higher open access rates would require mandates that include research that is not directly funded by the Australian Government, for example research that is cross-subsidised by universities.

No intervention: As outlined in Section 3.2.2, in 2021, 29% of Australian-led journal articles were published as gold or hybrid open access. Additionally, another 14% are deposited in repositories, bringing the total to 43% open access journal articles. An additional 6% were published on publishers’ websites without clear reuse rights.⁹⁴

6.1.1.2 Proportion of all journal articles (past and present, Australian-led and International) available to the general public

Public Access: The largest 10% of global publishers have published more than 90% of all journal articles globally over the past seven years.⁹⁵ The lower limit of 90% assumes that these publishers would sign up to the new model.

Repository: The vast majority of global research literature is not led by Australian researchers. The repository model would improve marginally on existing arrangements, by making open access some fraction of the 2% of the world’s research which is led by Australian researchers and is currently closed access. In the lower limit, we assume that none of the currently closed access Australian-led literature would be made available; in the upper limit we assume all of this literature would become available.

Funder Mandate: Estimate derived similarly to Repository above, noting that the Australian government funds less than half of the research conducted by universities.

No intervention: The most recent data show that in 2021, 31% of global publications were published as gold or hybrid open access, with another 17% accessible in repositories or publisher websites but in many cases with

⁸⁹ Publications’ here means journal articles, reviews and conference papers. STM Association, [Open Access Uptake by Countries/Regions](#) [data set].

⁹⁰ B Narayan and E Luca, ‘Issues and challenges in researchers’ adoption of open access and institutional repositories: a contextual study of a university repository’, *Information Research*, 2017, 22(4).

⁹¹ J A Lovett, A J Rathemacher, D Boukari and C Lang, ‘Institutional Repositories and Academic Social Networks: Competition or Complement? A Study of Open Access Policy Compliance vs. ResearchGate Participation’, *Journal of Librarianship and Scholarly Communication*, 2017, 5(1):eP2183, doi:10.7710/2162-3309.2183; A Borrego, ‘Institutional repositories versus ResearchGate: The depositing habits of Spanish researchers’, *Learned Publishing*, 2017, 30(3):185-192, doi:10.1002/leap.1099.

⁹² Universities Australia, [Research & Innovation](#), Universities Australia website, n.d., accessed 31 May 2023.

⁹³ Australian Bureau of Statistics, [Research and Experimental Development, Higher Education Organisations, Australia](#) [data set], abs.gov.au, 2022, accessed 31 May 2023.

⁹⁴ STM Association, [Open Access Uptake by Countries/Regions](#) [data set].

⁹⁵ Web of Science, [Web of Science Core Collection](#) [data set] cited in EY, *A national strategy for open access*, unpublished, report to the Office of the Chief Scientist, 2022.

an embargo period and limited re-use license.⁹⁶ The freely available fraction of older journal articles is lower, for example 16% gold or hybrid open access, and 19% repository or limited access on publisher website, for journal articles published in 2016. We adopt the total (i.e. gold and hybrid and repository/limited publisher website access) in our estimates, with the lower limit provided by the 2016 numbers (16+19=35%), and upper limit (31+17=48%) by the most recent 2021 data. We note that these are optimistic estimates (i.e., upper bounds) for the actual fraction of literature which is available to all readers.

6.1.1.3 Proportion of Australian residents that can access closed access journal articles (past and present, Australian-led and international)

Public Access: Under this model, all Australian residents would be eligible for access to research literature. Assuming that this access is facilitated by an online platform, a relevant comparison is with the myGov system. Over 90% of the eligible (aged 15 and over) Australian population have access to myGov, hence we adopt this as a lower bound.⁹⁷ The upper bound is all eligible Australian residents.

Repository, funder mandate, no intervention: Comprehensive access to research literature in Australia is currently available only at universities and publicly funded research agencies. Australian universities have approximately 130,000 employees and 1.4 million students;⁹⁸ publicly funded research agencies have approximately 20,000 employees.⁹⁹ This corresponds to 6.5% of Australia's population over 15 years of age. The fraction of Australians with access to the global research literature would not improve under measures which only impact Australian-led journal articles (which are a small fraction of the global output), such as the funder mandate or repository models.

6.1.2 Model costs

6.1.2.1 Public access model

Ongoing costs

Annual costs for the public access model are estimated to be in the range \$331 million - \$452 million per year, as follows.

Publication fees: \$303 million - \$380 million

Commissioned analysis by EY estimated the costs of the public access model to be between \$303 million and \$380 million. The lower bound corresponds to current read and publish fees, consistent with international experience of open access agreements being negotiated on a cost-neutral basis.¹⁰⁰ The upper bound incorporates a 20% premium over the total subscription costs (\$303 million for read and publish, and \$18.5 million for other transformative agreements and APCs), reflecting potential new costs associated with the opening of research literature to a broader readership.

CSIRO benchmarked these cost estimates to Germany's Projekt DEAL's agreement with Springer Nature, the world's largest transformative agreement at the time of its signing in 2020.¹⁰¹ That agreement provides centralised read and publish access for German researchers, similar to the CAUL consortium in Australia. Projekt DEAL also includes explicit publish-and-read fees of €2750 per published journal article, from which the

⁹⁶ 'Publications' here means journal articles, reviews and conference papers. STM Association, [Open Access Uptake by Countries/Regions](#) [data set].

⁹⁷ There were over 20 million active users of myGov in 2021. Digital Transformation Agency (DTA), [Australian Government Architecture: myGov website](#), DTA, Australian Government, accessed May 2023.

⁹⁸ Universities Australia, [Facts and publications](#), Universities Australia website, n.d., accessed 31 May 2023.

⁹⁹ Staffing figures compiled from annual reports.

¹⁰⁰ For example, in Germany and Norway. A Borrego, L Anglada and E Abadal, 'Transformative agreements: Do they pave the way to open access?', *Learned Publishing*, 2020, 34(2):216-232.

¹⁰¹ Max-Planck-Gesellschaft, [Springer Nature and Projekt DEAL finalise world's largest transformative open access agreement](#), Max-Planck-Gesellschaft website, 9 January 2020, accessed 31 May 2023.

CSIRO analysis derived a cost estimate of between \$250 million and \$440 million per year for Australia's current publication volume.¹⁰² This approach validates the \$303 million - \$380 million estimate above.

IT platform: \$7 million - \$20 million

Costs for a national IT platform are uncertain but can be estimated using a comparable previous large government IT project. Annual reported costs for the MyGov platform are between \$13.6 million and \$20.2 million per year.¹⁰³ The lower bound of \$7 million per year corresponds to the initially approved MyGov budget of \$29.7 million over 4 years, reflecting the additional MyGov costs being due to a larger than expected uptake of the program. It is worth noting that even the upper bound represents less than 10 percent of the total cost of any of the open access models considered in this advice and would not be the main cost driver.

Administration: \$2 million - \$12 million

Administration costs are highly uncertain. The lower bound is taken as equivalent to the high bound for the national repository administration (below), once established. This would primarily involve the renewal and negotiation of contracts. The high bound of \$12 million is estimated by EY.

Repositories: \$19 million - \$40 million

The upper bound is the current cost of institutional repositories. The lower bound is calculated assuming a reduced workload by a factor of 2 compared to the current institutional repositories, because of efficiency due to scale and a reduction in focus to research outputs other than journal articles.

Fixed costs

A total of \$32 million in fixed setup costs is calculated as follows.

Central Implementation body: \$12 million

EY analysis estimates a cost of \$11.9 million to set up a central implementation body.

IT platform: \$20 million

EY analysis estimates a setup cost of \$20 million for the national IT system. This is broadly consistent with MyGov setup costs of \$86.7 million over four years.

6.1.2.2 Repository model

Ongoing costs

The ongoing costs include all costs of the no intervention model, with additional components as below. The total cost is in the range \$364 million - \$371 million per year.

National repository administration: <\$1 - \$2 million

The lower bound of around \$0.5 million per year corresponds to staffing costs associated with a large university repository, as reported during stakeholder consultations. The upper bound of \$2 million includes a significantly larger number of FTEs, reflecting the larger volume of administered journal articles.

National repository IT: \$2 million - \$7 million

The upper bound of \$7 million per year corresponds to the annual cost of the initially approved MyGov budget of \$29.7 million over 4 years. We note that the uncertainties in these estimates are not critical to the overall cost of the model.

¹⁰² CSIRO Futures, *Prospective analysis of a national open access strategy for Australia*.

¹⁰³ The Digital Transformation Office quotes \$45.1 million over four years for the 'core operational component'. P Hamilton, [Selected government ICT projects](#), Australian Parliament House website, n.d., accessed 5 June 2023. Adjusting for 24% inflation since 2016 yields \$13.6 million per year. Database search of expenditure related to MyGov across all agencies yields a higher estimate of \$20.2 million.

Fixed costs

Fixed costs are dominated by the cost of setting up a new national IT system for the repository, at a minimum of \$20 million.

National repository IT: above \$20 million

The cost of setting up a new national repository IT system is assumed to be at least equal to the cost of the IT platform for the public access model, estimated above at \$20 million. We note that \$25.5 million in funding was provided by the Australian government for the Australian Scheme for Higher Education Repositories (ASHER) in 2007-2009 under which university repositories were set up.¹⁰⁴

National repository administration: up to \$1 million

EY analysis estimates setup costs of less than \$1 million. We note that this estimate does not include some important costs which are difficult to quantify, such as the costs related to publications from small research institutes which do not currently host repositories, and costs associated with compliance and interoperability.

6.1.2.3 Funder mandate model

Costs include all costs of the No intervention model, with an additional component of administration and enforcement of the mandate. EY analysis estimates this to be <\$1 million per year, for a central office responsible for drafting of the funding policies and coordinating between several organisations. The total cost of this model is \$363 million per year.

6.1.2.4 No intervention counterfactual

By construction, this counterfactual does not contain any new infrastructure. The ongoing costs are estimated to be \$362 million per year, as follows.

Subscriptions

Journal subscriptions are the major ongoing cost, at \$302.9 million per year. 90% of this cost is covered by universities through the CAUL consortium, 3% by publicly funded research agencies, 2.5% by state governments, 2.4% by the health sector, 1% by the Federal government and 1% by other entities.¹⁰⁵

Transformative agreements and Article Processing Charges (APCs)

Through stakeholder consultations, CSIRO Futures identified a national contribution of \$14.5 million in APC costs, and another \$4.1 million in transformative agreements in 2020. Given the trends towards open access, these numbers are likely to have increased since 2020, however we are basing the present advice on this most recent set of robust data. We note that even taking into account any reasonable increase in APC and transformative agreement costs, the total publication costs would be overwhelmingly dominated by subscription fees.

Repository operating costs

Little is known about the costs of implementing and maintaining institutional repositories. Consultations with librarians at a major Australian university suggest a reasonable estimate is 6 FTE staff per repository (as would also be typical for medium and large research institutions overseas).¹⁰⁶ Assuming 60 repositories (i.e. all universities and large research institutes) across Australia yields a cost estimate of \$40 million. This value is consistent with the lower limit provided by an old 2006 study, which estimated typical annual costs of \$320,000 (inflation-adjusted to present day), and sometimes as high as \$340,000, per institution, yielding an estimate of around \$20 million per year in total repository costs¹⁰⁷ – at a time when these repositories hosted

¹⁰⁴ M Borchert, [Review of Australian Repository Infrastructure](#), Council of Australian University Librarians (CAUL), 15 March 2019, accessed 9 June 2023.

¹⁰⁵ CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*.

¹⁰⁶ CS Burns, A Lana and JM Budd, 'Institutional Repositories: Exploration of Costs and Value', *D-Lib Magazine*, 2013, 19(1/2), doi:10.1045/january2013-burns.

¹⁰⁷ J Houghton, C Steele and P Sheehan, [Research communication costs in Australia: emerging opportunities and benefits](#), Department of Education, Science and Training, Australian Government, 2006, accessed 31 May 2023.

significantly less content. We note that these estimates do not include some important costs which are difficult to quantify, such as the costs associated with compliance and interoperability.

In-kind contributions

A further indirect cost comes from in-kind contributions by researchers through peer review. Following the methodology in the CSIRO prospective analysis, this is calculated by considering the in-kind cost of 76,328 verified peer reviews in 2021.¹⁰⁸ The time to peer review a journal article depends substantially on the journal article and experience of the reviewer. Representative values range from 4-6 hours per review, at \$60 to \$80 per hour, giving a total of \$18 to \$36 million per year.¹⁰⁹ Because many researchers opt to not record their reviews in platforms such as Publons, these numbers are lower limits. We therefore adopt the upper bound of \$36 million as the best estimate.

¹⁰⁸ Clarivate, [Publons: Countries/Regions](#) [data set]. accessed 20 October 2021. As cited in, CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*.

¹⁰⁹ An estimate of 6 hours per review is found in research by Aczel et al. and LeBlanc et al. (2023). The latter authors estimate US\$46.2 per hour, i.e. approximately A\$70, per review. B Aczel, B Szaszi, AO Holcombe, 'A billion-dollar donation: estimating the cost of researchers' time spent on peer review', *Research Integrity and Peer Review*, 2021 6(14), doi:10.1186/s41073-021-00118-2; AG LeBlanc, JD Barnes, TJ Saunders, et al., 'Scientific sinkhole: estimating the cost of peer review based on survey data with snowball sampling', *Research Integrity and Peer Review*, 2023, 8(3) doi:10.1186/s41073-023-00128-2.

6.2 List of consultations and stakeholder engagement

In formulating this advice on open access, the Office of the Chief Scientist and consultancies engaged with over 70 stakeholders across government, industry, the publishing sector, the university sector, and open access advocacy groups:

- Academy of Social Sciences in Australia
- AI Group
- ARC Centre of Excellence for Automated Decision-Making and Society (ADM+S)
- Association of Learned and Professional Society Publishers (ALPSP)
- AULIVE
- Australian Academy of Health and Medical Sciences (AAHMS)
- Australian Academy of Science
- Australian Academy of Technology and Engineering (ATSE)
- Australian Academy of the Humanities
- Australian Competition & Consumer Commission (ACCC)
- Australian Council of Learned Academies (ACOLA)
- Australian Hydrogen Council
- Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)
- Australian Library and Information Association (ALIA)
- Australian Publishers Association (APA)
- Australian Research Council (ARC)
- BHP
- Brill Publishers
- Clarivate
- cOAlition S
- Cooperative Research Centre for Transformations in Mining Economies (CRC TiME)
- Copyright Agency
- Council of Australian University Librarians (CAUL)
- CSIRO Futures
- CSIRO Publishing
- CSL Limited
- Curtin Open Knowledge Initiative (COKI)
- Deakin University
- Department of Defence
- Department of Education
- Department of Finance
- Department of Health and Aged Care
- Department of Industry, Science and Resources
- Department of Infrastructure, Transport, Regional Development, Communications and the Arts
- Department of Prime Minister and Cabinet
- Digital Transformation Agency
- EBSCO
- Ecological Society of Australia
- Elsevier
- Emapper
- Ernst & Young
- F1000
- Fair Open Access Alliance (FOAA)
- Flinders University
- Gilmour Space Technologies
- Go Science
- Imperial College London (UK)
- Institute of Physics Publishing

- Jisc
- MTP Connect
- Multidisciplinary Digital Publishing Institute (MDPI)
- National Health and Medical Research Council (HNMRC)
- National Library of Australia (NLA)
- Octopus
- Office of the Chief Science Advisor, Canada
- Office of the Prime Minister's Chief Science Advisor, NZ
- Open Access Australasia
- Outsell
- Queensland University of Technology (QUT)
- Quintessence Labs
- Royal Australian College of General Practitioners (RACGP)
- Science and Technology Australia
- Springer Nature
- Standards Australia
- STM Association
- Taylor & Francis
- Technology Council
- Tenacious Ventures
- Treasury
- Universities Australia
- University of New South Wales (UNSW)
- University of Sydney
- University of Technology Sydney
- V2food
- Walter and Eliza Hall Institute (WEHI)
- Wikimedia Australia
- Wiley
- Woodside

6.3 Glossary

APC	Article Processing Charge is a fee charged for journal articles to be published open access in gold or hybrid journals.
Australian-led	A journal article with a corresponding author whose primary affiliation is with an Australian institution.
Author-submitted	A version of a journal article prior to undergoing the peer review process. Author-submitted journal articles may be available to view prior to the publication of the final peer reviewed version in a journal. Hosting repositories for author-submitted articles can be either institutional or subject-based, such as arXiv , SocArXiv and bioRxiv .
Author-accepted	An edition of a journal article that has undergone the peer review process but has not been typeset and formatted by the journal.
Bibliodiversity	The diversity of journals and publishers, services and platforms, funding mechanisms, and evaluation measures in scientific publishing and academic communications.
CAUL	Council of Australian University Librarians.
Embargo period	A publisher restriction on the public release of an author-accepted manuscript. The embargo period must be followed for author-accepted manuscripts deposited into a repository. The length of an embargo period can differ according to funding sources, subjects and publishers.
Green open access	Publishing model in which journal articles are made freely accessible in a repository, typically after an embargo period. Authors retain the right to reuse their journal article.
Gold open access	Publishing model in which journal articles are published as open access immediately, without an embargo period in fully open access journals.
Hybrid open access	Publishing model in which authors may pay an optional APC to the publisher to enable their journal article to be published as open access in a journal that also has paywalled content. The fees can be covered by read and publish agreements.
Journal article	An academic, peer reviewed research article that is typically published in an academic journal but may instead be published on another platform.
Open access	Literature that is freely available on the public internet, where any user is permitted to read, download, copy, distribute, print, search or link to the full texts of these journal articles, pass them as data to software, crawl them for indexing or use them for any other lawful purpose.

Open data	Freely available, anonymous, and easily discoverable information that anyone can assess, explore, and reuse. The data must be provided under licensing terms that allow reuse and redistribution.
Open science	A movement to improve science by opening scientific processes and products to everyone. Open access and open data are elements of open science.
Paywall	A mechanism to restrict access to journal articles without payment of a subscription or per-article fee. Journal articles are paywalled in traditional academic publishing models.
Peer review	The process in which journal articles submitted for publication are reviewed by independent members of the research community to assess their quality, validity, and originality. Peer reviews are organised by journal editors with publishers owning the business and managing the entire process. Peer reviewers are often not paid for these services.
Publicly funded research agency	An Australian Government research agency that conducts long term basic, strategic, or applied research across priority areas for government and the economy.
Read and publish agreement	An agreement in which an institution pays a publisher for the rights to access journal content and to publish open access journal articles in their journals under a single payment. The 'publish' aspect can be either capped (reflecting a maximum number of journal articles that can be published without further costs) or uncapped. Read and publish agreements are a subset of transformative agreements.
Repository	An archive in which research outputs are stored (including but not limited to journal articles). Repositories are commonly administered by research institutions, publishers, and other organisations. Institutional repositories may also contain an institution's intellectual property and other assets.
Transformative agreement	An umbrella term used to describe different kinds of agreements that seek to encourage a transition away from subscription publishing models. Typically, these agreements' licences are more transparent than traditional journal licenses, allow authors to retain copyright, and facilitate open access.
Version of record	The version of an article that has been published in a journal, in print and/or online. This article will include any editorial improvements such as copy editing, or typesetting, made after the peer review process is complete.

6.4 Bibliography

1. Web of Science, [Web of Science Core Collection](#) [data set], webofscience.com, 2022, accessed 12 July 2023.
2. Elsevier, [Pay per view](#), Elsevier website, 2023, accessed 13 July 2023.
3. Nature, [Volume 619 Issue 7969, 13 July 2023](#), Nature website, 2023, accessed 13 July 2023.
4. Isaac Newton, 1675, [letter to Robert Hooke](#), accessed 31 May 2023.
5. Open Access Australasia, [What is Open Access?](#), Open Access Australasia website, 25 May 2021, accessed 31 May 2023.
6. Commonwealth Scientific and Industrial Research Organisation (CSIRO) Futures, [Unlocking the innovation potential of Australian companies](#), CSIRO, December 2021, accessed 31 May 2023.
7. EY, *A national strategy for open access*, unpublished, report to the Office of the Chief Scientist, 2022.
8. D Ivison, *Analysis of the potential impact of the proposed Office of Chief Scientist Open Access model on the 'long tail' of journal publishers*, unpublished, report for the Office of the Chief Scientist, 2022.
9. Department of Industry, Science and Resources (DISR), [Science, research and innovation \(SRI\) budget tables 2022-23](#) [data set], industry.gov.au, 2023, accessed 31 May 2023.
10. A Nelson, [Ensuring Free, Immediate, and Equitable Access to Federally Funded Research](#), OSTP, 25 August 2022, accessed 8 June 2023.
11. J Najko, T Klebel, D Pride, P Knoth and T Ross-Hellauer, 'Quantifying the influence of Open Access on innovation and patents', *Open Research Europe*, 2022, 2(64), doi:10.12688/openreseurope.14680.1.
12. KA Bryan and Y Ozcan, 'The Impact of Open Access Mandates on Invention', *The Review of Economics and Statistics*, 2021, 103(5):954–967, doi:10.1162/rest_a_00926.
13. Productivity Commission (PC), [5 Year Productivity Inquiry: Innovation for the 98%](#), PC, Australian Government, 17 March 2023, accessed 31 May 2023.
14. Organisation for Economic Cooperation and Development (OECD), [Adult Education Level](#) [data set], data.oecd.org, 2023, accessed 31 May 2023, doi: 10.1787/36bce3fe-en.
15. B Ferris, A Finkel and J Fraser, '[AFR: The right incentives will ensure that our R&D means business](#)', Australia's Chief Scientist website, 26 October 2016, accessed 31 May 2023.
16. OECD, [Main Science and Technology Indicators](#) [data set], stats.oecd.org, 2019, accessed 31 May 2023.
17. Commonwealth Scientific and Industrial Research Organisation (CSIRO) Futures, [Unlocking the innovation potential of Australian companies](#), CSIRO, December 2021, accessed 31 May 2023.
18. M Verreyne et al., [Enablers and barriers to industry-research collaboration: A small and medium sized enterprise perspective](#), CSIRO, 2021, accessed 31 May 2023.
19. L Hendrickson, D Taylor, L Ang, K Cao, T Nguyen and F Soriano, [The impact of persistent innovation on business growth](#), Office of the Chief Economist, Department of Industry Science and Resources, December 2018, accessed 31 May 2023.
20. M Ware, [Access by UK small and medium-sized enterprises to professional and academic information](#), Publishing Research Consortium, 5 May 2011, accessed 31 May 2023.
21. EH ElSabry and K Sumikura, 'Does open access to academic research help small, science-based companies?', *Journal of Industry - University Collaboration*, 2020, 2(3):95-109, doi:10.1108/JIUC-04-2020-0004.
22. J Houghton, A Swan and S Brown, [Access to Research and Technical Information in Denmark](#), The Danish Agency for Science, Technology and Innovation and Denmark's Electronic Research Library, 2011, accessed 31 May 2023.

23. CIBER, [Access to scholarly content: gaps and barriers](#), Jisc, Publishing Research Consortium and Research Information Network, 2011, accessed 13 May 2023.
24. Australian Bureau of Statistics (ABS), [Innovation in Australian Business](#) [data set], abs.gov.au, 2022, accessed 15 June 2023.
25. D Sackett, 'Evidence-based medicine', *Seminars in Perinatology*, 1997, 21(1):3-5, doi:10.1016/S0146-0005(97)80013-4.
26. R Youngs, 'COVID-19 and democratic resilience', *Global Policy*, 2023, 14:149-156, doi:10.1111/1758-5899.13137.
27. L Frischlich and E Humprecht, '[Trust, Democratic Resilience, and the Infodemic](#)', *Facing up to the Infodemic: Promoting a Fact-Based Public Discourse in Times of Crisis*, Israel Public Policy Institute, 2021, accessed 31 May 2023.
28. S Shakeri and S Hawamdeh, 'Chapter 11: Combatting Misinformation in the Open Access Era' in D Alemneh (ed), *Handbook of Research on the Global View of Open Access and Scholarly Communications*, IGI Global, 2022, doi:10.4018/978-1-7998-9805-4.ch011.
29. A de Sherbinin et al., 'The critical importance of citizen science data', *Frontiers in Climate*, 2021, 3, doi:10.3389/fclim.2021.650760.
30. G Masters, [The role of evidence in teaching and learning](#), 27 August 2018, Australian Council for Education Research, accessed 8 June 2023.
31. International Association of Scientific, Technical and Medical Publishers (STM Association), [Open Access Uptake by Discipline](#) [data set], stm-assoc.org, 2021, accessed 31 May 2023.
32. S Gair, I Zuchowski and L Beddoe, 'Open Access publishing: A key enabler to research impact, informed practice and social justice', *Advances in Social Work and Welfare Education*, 2021, 22(2):25-38.
33. S Bosch, B Albee and S Romaine, '[Costs Outstrip Library Budgets | Periodicals Price Survey 2020](#)', *Library Journal*, 14 April 2020, accessed 11 July 2023.
34. TJ Tillack, 'Pressure, opportunities and costs facing research library acquisitions budgets: An Australian perspective', *The Australian Library Journal*, 2014, 63:206-219, doi:10.1080/00049670.2014.915498.
35. A Langham-Putrow, C Bakker and A Riegelman, 'Is the open access citation advantage real? A systematic review of the citation of open access and subscription-based articles', *PLOS ONE*, 2021, doi:10.1371/journal.pone.0253129.
36. E Tsang and G Maciocci, [Welcome to a new ERA of reproducible publishing](#), eLife website, 24 August 2020, accessed 31 May 2023.
37. M Hagve, 'The money behind academic publishing', *Tidsskr Nor Legeforen*, 2020, doi:10.4045/tidsskr.20.0118.
38. H Else, [Nature journals reveal terms of landmark open-access option](#), Nature website, 24 November 2020, accessed 31 May 2023.
39. CSIRO Futures, *Prospective Analysis of a national open access strategy for Australia*, unpublished, report to the Office of the Chief Scientist, 2022.
40. DISR, [Australian Innovation System Monitor: Research Output](#) [data set], industry.gov.au, 2020, accessed 31 May 2023.
41. Scimago Lab, [SJR - Australia](#), ScimagoJR website, 2021, accessed 23 September 2021.
42. Australian Bureau of Statistics (ABS), [Research and Experimental Development, Businesses, Australia](#) [data set], abs.gov.au, 2021, accessed 31 May 2023.
43. Parliament of the Commonwealth of Australia, House of Representatives Standing Committee on Employment, Education and Training, [Inquiry into Funding Australia's Research](#), 2018, accessed 31 May 2023.

44. Council of Australian University Librarians (CAUL), [Read and Publish Agreements Negotiated by CAUL](#), CAUL website, 2023, accessed 6 June 2023.
45. Australian Research Council (ARC), [ARC Open Access Policy](#), ARC website, n.d., accessed 31 May 2023.
46. National Health and Medical Research Council (NHMRC), [NHMRC Open access Policy](#), NHMRC website, n.d., accessed 31 May 2023.
47. N Kirkman and G Haddow, 'Compliance with the first funder open access policy in Australia', *Information Research*, 2020, 25:2.
48. United Nations Educational, Scientific and Cultural Organisation (UNESCO), [UNESCO Recommendation on Open Science](#), UNESCO, 2021, accessed 31 May 2023.
49. J Tollefson and R van Noorden, 'US Government reveals big changes to open-access policy', *Nature*, 2022, 609:234-235, doi:10.1038/d41586-022-02351-1_
50. H Else, 'A guide to Plan S: the open-access initiative shaking up science publishing', *Nature*, 2021, doi:10.1038/d41586-021-00883-6.
51. NHMRC, [NHMRC's revised Open Access Policy released](#), NHMRC website, 20 September 2022, accessed 31 May 2023.
52. N Gruenpeter, N Rycko, K Siewicz and J Szprot, [Transformative Agreement: Overview, Case Studies, and Legal Analysis](#), 2021, Wydawnictwa ICM, Warszawa.
53. ESAC Initiative, [wiley2019deal](#), ESAC Initiative website, n.d., accessed 31 May 2023
54. ESAC Initiative, [sn2020deal](#), ESAC Initiative website, n.d., accessed 31 May 2023
55. H Else, 'Elsevier strikes its first national deal with large open-access element', *Nature*, 2019, doi:10.1038/d41586-019-01349-6.
56. India Today, '[One Nation One Subscription initiative by education ministry to allow open access to research papers from April 1](#)', *India Today*, 19 November 2022, accessed 31 May 2023.
57. S Cramond et al., '[Affordable and Open Access to Knowledge: The CAUL Collection and Reporting of APC Information Project](#)', [conference presentation], *Annual International Association of Scientific and Technological University Libraries*, Western Australia, 23-27 June 2019, accessed 10 July 2023.
58. HR Jamali, S Wakeling and A Abbasi, 'Why do journals discontinue? A study of Australian ceased journals', *Learned Publishing*, 2022, 35:219-228, doi:10.1002/leap.1448.
59. V Lariviere, S Haustein and P Mongeon, 'The oligopoly of academic publishers in the digital era', *PLOS ONE*, 2015, 10(6):1-15, doi:10.1371/journal.pone.0127502.
60. Australian Bureau of Statistics, [Research and Experimental Development, Higher Education Organisations, Australia](#) [data set], abs.gov.au, 2022, accessed 31 May 2023.
61. L J Hinchcliffe, '[The Double-Cost of Green-via-Gold](#)', *The Scholarly Kitchen*, 25 April 2023, accessed 31 May 2023.
62. Department of Health and Aged Care (DHAC), [PBS Expenditure and Prescriptions Report 1 July 2021 to 30 June 2022](#), DHAC, Australian Government, 2022, accessed, accessed 9 June 2023.
63. S Torok and P Holper, [Securing Australia's Future: Harnessing Interdisciplinary Research for Innovation and Prosperity](#), CSIRO Publishing, 2017, doi:10.1071/9781486306701.
64. B Narayan and E Luca, 'Issues and challenges in researchers' adoption of open access and institutional repositories: a contextual study of a university repository', *Information Research*, 2017, 22(4).
65. J A Lovett, A J Rathemacher, D Boukari and C Lang, 'Institutional Repositories and Academic Social Networks: Competition or Complement? A Study of Open Access Policy Compliance vs. ResearchGate Participation', *Journal of Librarianship and Scholarly Communication*, 2017, 5(1):eP2183, doi:10.7710/2162-3309.2183

66. A Borrego, 'Institutional repositories versus ResearchGate: The depositing habits of Spanish researchers', *Learned Publishing*, 2017, 30(3):185-192, doi:10.1002/leap.1099.
67. Universities Australia, [Research & Innovation](#), Universities Australia website, n.d., accessed 31 May 2023.
68. Australian Bureau of Statistics, [Research and Experimental Development, Higher Education Organisations, Australia](#) [data set], abs.gov.au, 2022, accessed 31 May 2023.
69. ABS, [3101.0 - Australian Demographic Statistics, Jun 2019](#) [dataset], abs.gov.au, 2019, accessed 31 May 2023.
70. Universities Australia, [Facts and publications](#), Universities Australia website, n.d., accessed 31 May 2023.
71. A Borrego, L Anglada and E Abadal, 'Transformative agreements: Do they pave the way to open access?', *Learned Publishing*, 2020, 34(2):216-232.
72. Max-Planck-Gesellschaft, '[Springer Nature and Projekt DEAL finalise world's largest transformative open access agreement](#)', Max-Planck-Gesellschaft website, 9 January 2020, accessed 31 May 2023.
73. P Hamilton, [Selected government ICT projects](#), Australian Parliament House website, n.d., accessed 5 June 2023.
74. M Borchert, [Review of Australian Repository Infrastructure](#), Council of Australian University Librarians (CAUL), 15 March 2019, accessed 9 June 2023.
75. CS Burns, A Lana and JM Budd, 'Institutional Repositories: Exploration of Costs and Value', *D-Lib Magazine*, 2013, 19(1/2), doi:10.1045/january2013-burns.
76. J Houghton, C Steele and P Sheehan, [Research communication costs in Australia: emerging opportunities and benefits](#), Department of Education, Science and Training, Australian Government, 2006, accessed 31 May 2023.
77. B Aczel, B Szaszi, AO Holcombe, 'A billion-dollar donation: estimating the cost of researchers' time spent on peer review', *Research Integrity and Peer Review*, 2021 6(14), doi:10.1186/s41073-021-00118-2.
78. AG LeBlanc, JD Barnes, TJ Saunders, et al., 'Scientific sinkhole: estimating the cost of peer review based on survey data with snowball sampling', *Research Integrity and Peer Review*, 2023, 8(3) doi:10.1186/s41073-023-00128-2.