

# ARDC Institutional Underpinnings

## Element: Open Research and Data Publication

30/03/2022

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### EXECUTIVE SUMMARY

Institutional Underpinnings is part of the ARDC's National Data Assets Initiative. In this program, 25 Australian universities are collaboratively developing a national Institutional Research Data Management (RDM) Framework. This Framework is intended to inform institutions' design of policy, procedures, infrastructure and services, and improve coordination of RDM within and between institutions. This output describes the initial findings of the Open Research and Data Publication element of the Framework, providing institutions with guidance to improve research data discoverability and impact, in line with funders and governments increasing demand for greater openness and data re-use to ensure a greater return on investment. The output acknowledges that barriers exist to adopting open research and data publication approaches, and provides recommendations on open research statements,

incentives for making data available and metrics via which to track research data impact. Infrastructure considerations outlining repository features best enabling data publication and discoverability are also explored. Finally, the output provides practical future proofing aspects that aim to enable institutions to respond to the movement towards increasingly open research data. Recommendations for institutions and Calls to action are highlighted throughout the Element. Calls to action specifically identify the need for future collective action from institutions and the community. This initial research data management Framework Open Research and Data Publication output will be further developed through additional institutional consultation and will be complemented by activities to validate and test the outputs described within.

## DESCRIPTION OF THE ELEMENT COMPONENT

There is increasing worldwide support for an open research model from funders and major research bodies (Plan S<sup>1</sup>, UNESCO Recommendations on Open Science<sup>2</sup>, etc). Even previously intransigent publishers are beginning to negotiate transformative agreements that will make a lot of new research more openly available. Therefore, any approach to research data management should future-proof itself by providing pathways for institutions to develop an open research culture and practice.

The higher concept of Open Research comprises not only access to publications and data sharing, but also the documentation of data and research processes to allow the assessment, testing, and reproduction of research results. Open Research metadata includes record-, dataset-, and project-level metadata; administrative metadata; data provenance including version history; whilst research processes include ‘paradata’, e.g., data capture and processing techniques and methods, software, notebooks, samples. Both metadata and paradata are required to enable sharing that is ‘as open as possible, [only] as closed as necessary’. Open research more broadly includes the research process itself and the use of open tools, to improve access, understanding and reproducibility.

Publication of data and data sharing, while increasingly commonplace, does not necessitate that those data are fully ‘open’. For example, there may be no clear licensing of data being shared which means re-use would be problematic. Shared data may also lack the metadata to allow the data to be understood, re-used or usefully interrogated. There is also the risk that publication venues such as websites are vulnerable to a range of cybersecurity threats. In some cases university repositories are taking responsibility for the creation and maintenance of the data record which includes the requisite “wrappers” (metadata) that enables sharing and re-use.

The focus of Institutional Underpinnings Framework discussions has been on publication of research data and data repositories. We acknowledge that guidance around data sharing policies, practice and

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<sup>1</sup> <https://www.coalition-s.org/>

<sup>2</sup> <https://en.unesco.org/science-sustainable-future/open-science/recommendation>

interpretation at institutional and national levels is also required, as is coverage of what institutional and national infrastructure exists to facilitate research and data sharing. Recommendations point towards ideal solutions, which serve to focus institutions towards emerging and future practice.

## Common drivers for researchers

- The Australian Code for the Responsible Conduct of Research<sup>3</sup> (The Code - particularly the guide for the Management of Data and Information) and the NHMRC's National Statement on Ethical Conduct in Human Research<sup>4</sup> increasingly expect research data metadata to be made openly available within a specific time frame. Researchers who do not comply may find themselves disadvantaged in future grant rounds.
- Publishers increasingly expect underpinning data to have a persistent identifier and to be made available (either directly, or via a link to the repository where the data is housed) when manuscripts are submitted. Some publishers will not accept publications where data cannot be provided at lodgement to support conclusions. Researchers who are unable to meet these requirements will increasingly have submissions rejected by major publishers.
- Funders and governments are increasingly demanding greater openness and data re-use to ensure a greater return on investment and enable impact measures.

## Common drivers for institutions

- To drive cultural change and improve research discoverability and impact, some universities are creating and endorsing open research statements (Griffith University<sup>5</sup>, the University of Melbourne Library<sup>6</sup>).
- Universities have strict responsibilities under The Code for the management of data assets for which they have received grant funding. If only for risk management purposes, institutions need to establish robust and appropriate data stewardship standards for the management of those assets in partnership with the researchers who created them.
- Under The Code, research data controlled by the institution and/or its researchers should be stored in facilities provided by or approved by the institution. Research data may be published in international, national, or discipline-based repositories, such as international data banks, in addition to institution-based storage or archiving. Institutions are also advised to maintain a record of the research data generated by their researchers and where it is stored.

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<sup>3</sup> [Australian Code for the Responsible Conduct of Research](#)

<sup>4</sup> [National Statement on Ethical Conduct in Human Research](#)

<sup>5</sup> [Griffith University](#)

<sup>6</sup> [University of Melbourne Library](#)

## Key challenges

Significant barriers exist to open publication, data sharing and open research. These include:

- A lack of guidance pointing to optimal approaches at both the national and institutional level on pathways/models/goals for open research.
- No clear licensing for a vast range of existing research data, and uncertainties about data ownership.
- A lack of metadata, rendering available data less useful and re-usable
- A lack of institutional support, advice and training on 'best practice' open research approaches
- A lack of suitable publication venues for data sharing and publication
- Restrictive ethics conditions precluding data sharing and open research in many disciplines
- Data sensitivity precluding data sharing and open research in many disciplines
- A lack of awareness of existing national infrastructure facilitating open research and data sharing
- A lack of incentives to practise open research, including recognition of effort by universities and funders
- Commercial constraints, e.g. patents, Intellectual Property (IP) ownership by industry funders
- Inconsistent IP policies in individual institutions
- A lack of clarity on who drives this for institutions, eg. who provides academic leadership, who leads institutional change, who provides day to day support
- A lack of researcher skills and knowledge in open source alternatives to proprietary software that results in approaches not conducive to open research practice
- Third party data providers having explicit licensing, use, storage, and destruction requirements that preclude data sharing and open research.
- Legal regulation requirements in different jurisdictions, e.g., issues that prevent data linkage at a national scale because of different state-based privacy laws, legislation such as the Defence Trade Controls Act 2012, and so on.

## DIFFERENCES IN APPROACH AND NEED

A one-size-fits-all approach is not appropriate as institutions differ markedly in size, scale and funding. The ability of institutions to develop a future-focused data sharing and open research culture will depend on:

- Adequacy of local advice, training and support within the institution
- Skill and knowledge of researchers and research support staff
- Awareness of local systems and processes that facilitate sharing, including local data management systems

- The existence of an institutional repository for sharing data
- Flexibility and adaptability of the local research culture
- Existing policies and frameworks
- Adequacy of supporting infrastructure for data sharing, e.g. metadata capture capabilities, access controls etc.
- Local incentives

## RECOMMENDATIONS AND ADVICE

### Open Research Statement

**Recommendation 1:** Adopt an open research statement as a driver for cultural change on data/research sharing, and enroll influential academics as champions of change

Both Griffith University<sup>7</sup> and the University of Melbourne Library have endorsed an open research statement, Griffith at the institutional level. At Griffith University, a Library-led Open Research Reference Group was established to discuss ways to operationalise the Open Research Statement. Barriers to open research and open data were identified and the Library generated resources to address common questions. The Library now offers consultations to those who still have further questions, e.g., from future-proofing ethics applications to foster subsequent data sharing to answering questions about suitable avenues for data sharing post-project. Senior academics also volunteered to be Open Research Champions within their school or research institute, which aims to help ‘socialise’ the ideas of open research and help interested researchers locate useful information on best practice. Library staff had already collaborated with staff from Griffith’s eResearch Services on developing the ‘9 Reproducible Things’ resource<sup>8</sup>, which goes a long way towards helping people structure their research so as to make it open. The resource is a good primer on the data management / project structure practice that will answer the requirements of The Code and grant-making bodies, and has been useful even in cases where data cannot be shared.

### Incentives

**Recommendation 2:** Adopt Incentives for good data management, with open research and data sharing as end aspirations

Ideas for incentives include:

- An internal grants round open only to those practising open research

<sup>7</sup> <https://www.griffith.edu.au/research/about-griffith-research>

<sup>8</sup> <https://guereslib.github.io/Reproducible-Research-Things/>

- Institutional support for making data open - this might involve storage provision, consulting/advisory support, assistance with data cleanup/de-identification/other requirements, help with metadata creation, repository selection advice and assistance with deposit, advice and support on data cleanup/deidentification/other requirements
- Recognition of open research practice in university promotion rounds
- Public relations promotion of academics practising open research to help demonstrate the societal impact of their research
- Tenure prioritisation for academics who practise open research
- Financial support for Article Processing Charges for researchers practising open research
- Development of Open Researcher and Contributor IDs (ORCID) profile metadata feeds for publications and datasets
- Development of standardised metrics for open data publishing
- Open research practice recognised in rankings such as Excellence in Research Australia (ERA) rankings to encourage institutions to support/encourage open research and sharing practice

## Research data metrics

**Recommendation 3:** Create and adopt uniform research data metrics as a mechanism for measuring the impact of data/research sharing

Research metrics generally consist of the following:

- Journal Level - the impact of a journal within a field
- Article Level - the comparative impact of a specific article/data artefact within a field
- Author Level - the impact an author's publications have within a field

To be useful to open research and open data purposes, the above needs to be expanded to include metrics for data, for physical samples, for research software, and also the 'real world' impact, e.g., the release of an important climate or health dataset and how that release drives and underpins future research. Currently, vendor subscription-based tools that manage data metrics (citations) are expensive third-party subscription products that are niche and discipline dependent, and are therefore not appropriate for all researchers.

Additional data metrics could include:

- Research data download counts
- Number of publications citing the data
- Citations of the data outside of traditional publications
- Citations that count the use of the data in teaching as this is an area that is rapidly growing and that needs recognition
- Adoption/use of the data in policy development

**Call to action 1:** Institutions are encouraged to share with one another examples of metrics for data, for physical samples, for research software, and also the ‘real world’ impact

The development of standardised metrics for open data publishing is an important step in incentivising open research practice, ensuring that value can be measured, and informing long term retention practice.

## Data metrics implementation wishlist

- Development of an automated mechanism to use standard identifiers such as DOIs/PIDs to enable data citation tracking.
- Develop a means for services to more easily generate COUNTER<sup>9</sup>-compliant usage metrics for research data, such as the IRUS UK service<sup>10</sup>. COUNTER seeks to ensure consistent and credible reporting of research data usage, important in understanding data reused.
- Develop metrics relating to the FAIRness<sup>11</sup> of datasets in a repository, made visible to both curators of the data (for asset management purposes) but also to researchers who are looking for data to re-use.
- Dataset publication metrics must be linked with researcher profiles just like any other researcher outputs. Currently, DOIs for publications typically come from CrossRef; whereas DOIs for data typically come from DataCite - need to develop the means by which these could be linked?

## Solutions for Data Publication

Greater sharing and openness on a widespread scale can only occur when processes for researchers are clearly stated and supported by local policy, and where researchers can adequately access advice, support and training to enable open / data sharing practice. This necessitates the provision of adequate, well-managed and suitable data storage by the institution. In some petascale data cases, e.g. in astronomy and geophysics, data cannot be stored at a single institution, so a caveat addressing these large data challenges needs to be factored into the Framework.

The optimal solution would be storage in a data repository that provides adequate descriptive, structural and technical metadata, clear licensing and re-use conditions, and a permanent identifier such as a DOI to foster data sharing. The repository must have strong high-level commitment with associated adequate and sustained funding so as to guarantee long term storage for data.

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<sup>9</sup> <https://www.projectcounter.org/counter-code-practice-research-data-usage-metrics-release-1/>

<sup>10</sup> <https://irus.jisc.ac.uk/>

<sup>11</sup> <https://ardc.edu.au/resources/aboutdata/fair-data/>

Repositories have clear advantages over other methods for data sharing as they are institutionally backed and governed, provide the kind of structured metadata required for efficient re-use of data, often manage data curation/preservation, and have support staff to assist researchers with usage.

## Repository Selection

Institutions should encourage the publication of data via appropriate repositories. Where there is no local institutional repository to provide this service, robust disciplinary repositories such as the Australian Data Archive<sup>12</sup> could be used. International recommendations are to use discipline-based repositories first, before considering institutional, particularly where there is a data volume issue, e.g. petascale datasets. Disciplinary repositories also offer discipline-based QA/QC on the content of the data, which very few institutional repositories can.

However, as data volumes continue to grow exponentially, the issue of long term, discipline-focused storage infrastructure needs to be addressed at a national level.

The following is a baseline for data sharing platforms (the ARDC Data Quality Interest Group<sup>13</sup> provides advice in this area):

- Data quality reviews of published data and published metadata should occur, if possible (At the level of the institution, discipline-specific quality reviews will be hard to resource, but could involve departments/colleges participating in peer review of data, the way they already do for papers and grant applications).
- High quality curation in data repositories should be preferred (a minimum standard needs to be agreed).
- Accommodate minting and/or publication of all PIDs (Digital Object Identifiers (DOI), International Geo Sample Numbers (IGSN), Open Researcher and Contributor IDs (ORCID), Research Activity Identifiers (RAiD), Research Organization Registry (ROR) codes, handles etc) and licences. All items within compound objects need to be identified, possibly with individual identifiers.

Ideally, repository features should include:

- A statement that covers data curation, preservation and repository required compliance around data deposited (eg. appropriate sharing must be supported by research ethics)
- Minimum community agreed profiles of metadata standards, e.g., the ARDC Registry Interchange Format - Collections and Services Schema (RIF-CS) or the Australian Government agreed profile of the Geographic Information - Metadata Standard (ISO-19115) to foster data discovery
- Standardised data citation provided
- Citation counts that meet a standard for reporting, e.g., COUNTER-compliant
- Globally Unique Persistent Resolvable identifiers provided

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<sup>12</sup> <https://ada.edu.au/>

<sup>13</sup> <https://sites.google.com/ardc.edu.au/australian-data-quality-ig>

- Continuity/viability of service
- Cybersecurity of service
- Data integrity checks, i.e. checksum
- Storage size/file size limits
- Physical location, e.g. Australia, offshore
- Licence options
- Documented storage procedures eg. storage provisioning and operations in place, leveraging of existing storage operations, recovery procedures in place, technology and hardware migration planning.
- Deposit agreement (i.e. correct permissions)
- Term of deposit/retention periods
- Funding source, e.g. data affected by ARC/NHMRC policy
- A range of access controls, including the availability of mediated access, which would also include levels of access, e.g., access to summary metadata only
- Documented methods of versioning data
- Provision/development of functionality for open peer review to help improve quality of data

**Recommendation 4:** Implement an Institutional Data Repository with metadata capture capabilities

## Solutions to Discourage

### Publish data on a website

Publication on an institutional web page is not recommended. Institutions frequently go through reorganisation and restructures, which means the data's home may be ephemeral. The data will also lack metadata, and a website location is far less discoverable than a more structured service like a repository.

A personal website is even less preferred as a publication venue. Not only is it likely to be ephemeral, lack metadata, and have the same difficulties of discovery as an institutional website, but it would be much more prone to cyber-insecurity, given its location in a commercial space.

Data publication on a website will not meet most journal submission requirements for data that supports a publication to be stored in a repository and linked via a unique persistent identifier.

### Deposit with publisher as part of publication

While this may be superior as a publication and sharing venue to a website, the risk is also great that the data could be removed or lost. If data does need to be deposited with a publisher, the researcher should have other arrangements to store data long term and securely (publisher agreements dependent). Also, increasingly, many journals will no longer accept data as supplements.

## Deposit in preprint archive along with preprint

While this may be superior as a venue to a website, the risk is also great that the data could be removed or lost. If data does need to be deposited along with a preprint the researcher should have other arrangements to store it long term and securely.

## Future proofing

Here we provide practical actions that an institution can take now that will enable them to better keep up with the movement towards increasingly open data.

Recommendation 5: Future Proofing recommendations
<ul style="list-style-type: none"> <li>● Embed sharing practice in institutional RDM policy</li> </ul>
<ul style="list-style-type: none"> <li>● Embed sharing practice in ethics applications to foster future data sharing:               <ul style="list-style-type: none"> <li>○ Encourage non-specific and extended consent with ethics committees so that data re-use can encompass wider research use than the original research idea. Ethics applications need to be future-proofed to enable data re-use. Currently there is little understanding around the type of consent sought and what implications that has for sharing data later. Researchers need to better understand the pathways they create for themselves from the outset.</li> <li>○ Ethics approvals should be stored/captured within data set metadata</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>● Teach greater awareness of data licensing and the different licences. The Open Data Handbook<sup>14</sup> by the Open Knowledge Foundation provides a list of Conformant Licences<sup>15</sup>. This ARDC guide is also comprehensive<sup>16</sup>.</li> <li>● Publish all data with a licence and a recommended citation to deter misuse. This would include the licensing of commercial data compilation mechanisms – such as commercially controlled psychological tests/data visualisation software</li> </ul>
<ul style="list-style-type: none"> <li>● As each licence, agreement or contract is potentially unique, it might be beneficial for the researchers to see a visible snapshot of what they can and can't do with their data, eg. on a some kind of dashboard, or even included in the DMP. Make it possible for MOUs, data sharing agreements, and other agreements and contracts to be saved together alongside the research data</li> </ul>
<ul style="list-style-type: none"> <li>● Establish a desirable baseline of requirements for data sharing platforms</li> </ul>

<sup>14</sup> <http://opendatahandbook.org/guide/en/what-is-open-data/>

<sup>15</sup> <https://opendefinition.org/licenses/%20and%20definitions>

<sup>16</sup> <https://ardc.edu.au/wp-content/uploads/2019/05/Research-Data-Rights-Management-Guide.pdf>

- Automate a plain English, decision-tree-style, licence-choosing workflow to help researchers identify an appropriate licence for their data
- Negotiate data sharing agreements early in the project as these are critical to resolving ownership / IP / right to publish and re-use.
- Take appropriate measures to protect data from inappropriate access loss, theft, misuse.
  - Accidental publication of sensitive data.
    - Mitigation: Store data classification as part of metadata. Consider processes to check for sensitive data before publication.(e.g., automation, and through APIs)
  - Misuse of data
    - Mitigation: publish data with a license and a recommended citation to deter misuse.
  - Theft of data
    - Mitigation: publish data with a license and a recommended citation to deter theft and provide proof of ownership and priority. Use existing systems to report offenders, e.g., notifying publishers and funders of the theft.

## WORKING GROUP ACKNOWLEDGEMENTS

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## APPENDIX 1: DEFINITIONS

The following commonly used terms were defined to allow group discussions to proceed with discussions, based on a shared understanding of the topic in question.

### Archiving

- A curation activity that ensures that data are properly selected, stored, and can be accessed, and for which logical and physical integrity are maintained over time, including security and authenticity.

### Copyright

- A legal right over intellectual property belonging to the creator of the work. A copyright holder may use a licence to grant other people rights in the protected material, perhaps subject to specified restrictions.

### Curation

- The activity of managing and promoting the use of data from their point of creation to ensure that they are fit for contemporary purpose and available for discovery and reuse.

### Data

- Data may be thought of as unprocessed atomic statements of fact. It very often refers to systematic collections of numerical information in tables of numbers such as spreadsheets or databases. <https://opendatahandbook.org/glossary/en/>

### Data publishing

- The publication of research data on the Web, whether for sharing, to satisfy grant or publisher requirements for openness, or otherwise. Publication alone does not make the data 'open' - without associated metadata, documentation and software code, and clear licensing, the data may well be available but not usable. In some cases, university repositories take responsibility for the creation of a dataset record which includes the requisite 'wrappers' that enable sharing and re-use.

#### Data quality

- A measure of the "useableness" of data.

#### Intellectual property

- Intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce. IP is protected in law by, for example, patents, copyright and trademarks, which enable people to earn recognition or financial benefit from what they invent or create.  
<https://www.wipo.int/about-ip/en/>

#### Licence

- A legal instrument by which a copyright holder may grant rights over the protected work. Data and content is open if it is subject to an explicitly-applied licence that conforms to the Open Definition. A range of standard open licences are available, such as the Creative Commons CC-BY licence, which requires only attribution.

#### Mediated access

- Mediated access refers to research publications and data that are not open, but access can be requested of a mediator. Levels of mediated access exists, including:
  - Access is managed by a researcher.
  - Access is managed by a research team, or their delegate.
  - Access is managed by a data repository.
  - Access is managed by an institution.

#### Open access

- 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.

#### Open data

- *Short version*: Structured data that are accessible, machine-readable, usable, intelligible, and freely shared.
- *Long version*: Data is open if it can be freely accessed, used, modified and shared by anyone for any purpose - subject only, at most, to requirements to provide attribution and/or share-alike. Specifically, open data is defined by the Open Definition and requires that the data be
  - A. Legally open: that is, available under an open (data) license that permits anyone freely to access, reuse and redistribute
  - B. Technically open: that is, that the data be available for no more than the cost of reproduction and in machine-readable and bulk form.

#### Open research

- Open research comprises not just open access to publications and data sharing that is 'as open as possible, [only] as closed as necessary', but also documentation of data (metadata, e.g., record-, dataset-, and project-level metadata; administrative metadata; data provenance including version history) and research processes ('paradata', e.g., data capture and processing techniques and methods), sufficient to allow the assessment, testing, and reproduction of research results.
- Some definitions:
  - [https://en.wikipedia.org/wiki/Open\\_research](https://en.wikipedia.org/wiki/Open_research)
  - <https://osc.cam.ac.uk/open-research>
  - [www.exeter.ac.uk/research/openresearch/about/explained/](http://www.exeter.ac.uk/research/openresearch/about/explained/)

- [https://en.wikipedia.org/wiki/Open\\_science](https://en.wikipedia.org/wiki/Open_science)

#### Open science

- The movement to make scientific research (including publications, data, physical samples, and software) and its dissemination accessible to all levels of an inquiring society, amateur or professional. 'Open research' is preferred as it is more inclusive of disciplines such as the humanities.

#### Open source

- Software for which the source code is available under an open licence.

#### Preservation

- Long-term preservation of present day datasets is more difficult to ensure owing to uncertainty about the future of file formats, computer architectures, storage media and network connectivity. Projects that put particular stress on data preservation take a variety of approaches to solving these problems.  
<https://opendatahandbook.org/glossary/en/>

#### Research sharing and re-use

- Data can be re-used again and again, in ways that were never envisaged when it was collected, provided only that the data-holder makes it available under an open licence to enable re-use.

## APPENDIX 2: RESOURCES LIST

- CASRAI Research Data Management Glossary <https://casrai.org/rdm-glossary/>
- Open Data Handbook Glossary <http://opendatahandbook.org/glossary/en/>
- Parsons, M. A., & Fox, P. A. (2013). Is Data Publication the Right Metaphor? Data Science Journal, 12, WDS32 - WDS46. <https://doi.org/10.2481/dsj.WDS-042>
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- CoreTrustSeal Trustworthy Data Repositories Requirements: Glossary 2020–2022 <https://zenodo.org/record/3632563>
- Sorbonne Declaration on Research Data Rights <https://sorbonnedatadeclaration.eu/>
- Joint FORCE11 & COPE Research Data Publishing Ethics Working Group Recommendations <https://zenodo.org/record/5391293>
- The Open Research Toolkit: <http://bit.ly/open-research-toolkit>
- Research Data Alliance: Interest Groups <https://rd-alliance.org/groups/interest-groups>
- RDA Research Data Metrics Article: <https://www.rd-alliance.org/group/data-usage-metrics-wg/outcomes/rda-data-usage-metrics-wg-recommendations>
- Data Citation <https://ardc.edu.au/resources/working-with-data/citation-identifiers/>
- Lowenberg, Daniella, Chodacki, John, Fenner, Martin, Kemp, Jennifer, & Jones, Matthew B. (2019). Open Data Metrics: Lighting the Fire (Version 1). Zenodo. <http://doi.org/10.5281/zenodo.3525349>
- ARDC FAIR Self Assessment Tool <https://ardc.edu.au/resources/working-with-data/fair-data/fair-self-assessment-tool/>
- ARDC FAIR Data Guidelines for Project Outputs <https://ardc.edu.au/wp-content/uploads/2020/07/FAIR-Data-Guidelines-for-Project-Outputs.pdf>
- Versioning Data Is About More than Revisions: A Conceptual Framework and Proposed Principles <https://datascience.codata.org/articles/10.5334/dsj-2021-012/>

- IRUS-ANZ <https://irus.jisc.ac.uk/irus-anz/portal/>
- ARDC DataCite DOI service: <https://ardc.edu.au/services/identifier/doi/>
- ARDC IGSN minting service for physical (material) samples: <https://documentation.ardc.edu.au/display/DOC/IGSN+Service>
- CSIRO 5-star data rating tool: <https://data.csiro.au/collections/collection/Cicsiro:27133v5/Dtrue>
- Beijing Declaration on Research Data: <https://www.codata.org/uploads/Beijing%20Declaration-19-11-07-FINAL.pdf>
- ARDC Research Data Management Guides: <https://ardc.edu.au/wp-content/uploads/2019/05/Research-Data-Rights-Management-Guide.pdf>
- Pasquetto, I. V., Borgman, C. L., & Wofford, M. F. (2019). Uses and Reuses of Scientific Data: The Data Creators' Advantage. Harvard Data Science Review, 1(2). <https://doi.org/10.1162/99608f92.fc14bf2d>
- Australian Code for the Responsible Conduct of Research, 2018, in particular the Guide to the Management of data and information in research: [Management of Data and Information in Research: A guide](#)