

ARDC Institutional Underpinnings

Element: Research Data Management Planning

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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 Research Data Management Planning element of the Framework, providing institutions with guidance to achieving good practice of research data management planning, including standardisation, tooling and applications. Advice on the implementation of research data management planning infrastructure, core elements of a data

management plan, and use of research data management planning outputs are also discussed. Detailed steps for research data management planning are covered, and perspectives on different stakeholder engagement is provided. 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 Planning framework output will be further developed through additional institutional consultation and will be complemented by activities to validate and test the outputs described within.

INTRODUCTION

This national Research Data Management (RDM) framework provides guidance on the objectives and purpose of RDM Planning. Good practice of RDM Planning, including standardisation, tooling and applications are outlined. Guidance on the implementation of RDM Planning infrastructure, core elements of a data management plan, and use of RDM Planning outputs are included, covering aspects where there is a level of agreement.

RDM Planning is the forward planning of the management of data from a research project or projects. This can include identifying the types of data that will be generated, how that data needs to be stored and handled, who can access it, how long it must be stored, and many other factors (see Inclusions for DMPs section below for more detail). Researchers are typically the ones responsible for most RDM planning, as they have the best understanding of their data. Institutions seek to encourage and support good RDM planning, as it results in better RDM. One approach taken by institutions is to require or encourage the writing of a Data Management Plan (DMP), which formally documents the researcher's decisions about their RDM Planning. However, RDM Planning is not restricted to the writing of a specific DMP, and could include other processes that encourage researchers to consider and plan for the management of their data. RDM planning should not be a once-off process, but rather continue through the project to ensure that plans reflect the most up-to-date understanding of the data.

Some institutions will implement DMP tools that guide researchers through the production of a DMP document, especially if an institution is large and requires consistency. For other organisations support of RDM Planning may be ensuring that RDM procedures are followed, for example an agreed/optimised workflow. The framework considers the spectrum across institutions and does not mandate the existence of a DMP tool (eg. a structured template).

Our goal is to advise institutions about how to set up the systems, tools and processes related to RDM Planning across the institution. This element is not intended to be a guide that tells researchers how to plan RDM for an individual project.

There are some institutional challenges associated with RDM Planning:

- Resourcing to develop and implement an institutional approach to supporting RDM Planning, which varies greatly across institutions
- [Culture change](#) is required within institutions and this is likely to be slow
- Institutional recognition of the importance of an institutional approach to RDM Planning
- Incentivising and standardising RDM Planning within institutions
- Different units within institutions are responsible for implementation of an RDM Planning approach - where should the responsibility lie?

The following factors contribute to the variation in institutional approaches:

- institutions are at different stages of maturity in their planning approaches
- [Culture change](#) is required across institutions and change is typically slow
- Institutional recognition of RDM Planning importance varies across institutions
- Incentivising and standardising RDM Planning needs to occur both within institutions and nationally (e.g. Australian Research Council requirements)

Purpose of RDM Planning

All researchers are connected by their use of data. However, accompanying the benefits are risks and responsibilities for creating, storing and sharing data. The purpose of RDM Planning is to plan ahead to ensure institutions and researchers maximise benefits, minimise risks and meet their responsibilities such as adhering to Findable, Accessible, Interoperable and Reusable (FAIR)¹ data management practices. Consequently, RDM Planning facilitates the availability of data and enhances the impact and quality of research outputs.

Successful RDM Planning approaches consist of many components. Institutions are tasked with developing governance and policy, strategic planning, resourcing, roles and responsibilities, staffing, training, and infrastructure. To be successful, RDM Planning approaches need to coordinate between many levels of governance (institution to individual researcher) and in many areas of an institution (across research project teams, research support and central services teams). Engagement with these key stakeholders is critical for the uptake of good RDM by researchers.

Engagement between institutions' key stakeholders and researchers occurs at different levels and even across institutions. For example, policies developed by committees or in research administration offices affect roles and responsibilities for data custodians. Policies and resources can be used to engage with data custodians to provide key context and background for effective RDM Planning. RDM Planning tools accompanied by training and support assist researchers achieve their research goals while increasing the uptake and proper use of such tools.

¹ <https://www.go-fair.org/fair-principles/>

Ultimately institutions and researchers benefit from a shift in focus on compliance and DMPs to engagement with the process and practice of RDM Planning. Researchers realise the benefits of RDM Planning and fulfill the responsibilities of RDM when it is part of their research practice. Achieving this level of RDM practice requires support, training and education in RDM Planning and awareness of the variability of research contexts. Thus, understanding the needs and barriers of uptake for stakeholders is critical for ensuring risks and responsibilities of RDM are adequately addressed at all levels within an Institution.

Benefits of RDM Planning

The benefits of RDM Planning can be understood by considering the perspectives of the different stakeholders. Some benefits to institutions may include:

- Increased commercial/community trust and confidence
- Analysis of research and research data holdings can enable a greater understanding of the research landscape at the institution
- Identification of gaps in the research process and where researchers might require support within the research lifecycle
- Retention of institutional knowledge through the tracking and reporting of data
- Identifying, capturing and re-using more research outputs
- Compliance with government and funding agency requirements
- Greater business intelligence capabilities around RDM
- Mitigating risk of reputational damage
- Improving readiness for audits and changes in funding agency strategy towards open access, and demonstrating its commitment to be an institution of influence
- RDM Planning occurring through the research lifecycle can improve RDM practice and culture

RDM Planning benefits researchers in multiple ways such as:

- Having an evidence trail in the case of research integrity investigations
- Data transparency around access, consent and licencing
- Saving time if data is better organised and easier to find
- Reducing the risk that data could be stolen, lost or misused
- Gaining easier access to raw and processed data needed for their research
- Increasing their research profiles and potentially finding new audiences and collaborators through dissemination, citation and re-use of data
- Improves data publication quality and effectiveness of data sharing with project collaborators
- Rapid provisioning of IT resources decreasing unproductive research project lead-in whilst ensuring research data policy and legislative compliance
- Reducing lag-time to data analysis and publication
- Understand roles and responsibilities

- If managing research students, keeping supervisors up to date with evolving RDM Planning

Benefits for researchers are enabled when:

- The process of RDM Planning is easy to use and understand, making it more likely to get buy-in for engaging in the practice
- DMPs are ongoing documentation of the process facilitated by systems that help ensure researchers remain engaged with the practice
- Support for the completion and reviewing of the DMP originates from research supervisors and lead investigators on research projects
- Researchers understand that RDM Planning is more than compliance for obtaining access to resources such as data storage facilities
- RDM processes and systems are linked throughout the life of a project, from RDM Planning at the start to data publishing at the end
- RDM Planning provides a 'chain of custody' for project data, from primary materials through to reduced data. This strengthens project data output and scientific conclusions based on that data

Universities are enabled when:

- They can provide support to their researchers that translates to increase in good RDM practices
- Reporting on research is underpinned by planned data management that applies FAIR practice
- RDM roles are defined which aids in the use of supplied resources such as research data storage

Research Community is enabled when:

- Having a robust approach to the practice of RDM Planning that is agreed across institutions will support the research community and promote good RDM practice nationally even when researchers move across institutions
- Knowledge of FAIR data management will aid the practice of RDM Planning, its documentation through to publication and reporting to funding agencies and communities

RDM PLANNING CONSIDERATIONS

The following is a discussion of common considerations for institutions that would be helpful when embedding RDM Planning practice.

Overarching institutional approach and understanding

- Maintain a focus on the benefits of RDM Planning for researchers and institutions, and enabling to achieve these benefits
- Recognise that some research is multidisciplinary and will require RDM Planning that is synthesised and harmonised and not necessarily standardised

- An RDM Planning approach or framework should reference the Australian Code for the Responsible Conduct of Research (The Code)
- Create a working group or community of practice to support the development of any RDM Planning strategies, tools, support, documents
- RDM Planning is often driven by the requirements of funders and can be influenced by the research lifecycle.

Integration with primary materials management

It is advisable to integrate RDM Planning with primary materials management as this supports the research lifecycle. Primary materials are possibly the largest type of research data generated. RDM Planning must include primary materials management, or it will exclude a significant number of key research areas. RDM Planning cannot be confined to electronic data only, given that significant electronic data is actually derived from primary materials. Data integrity begins with primary materials integrity.

Publication of DMPs

- Publishing of DMPs has been seen to happen in Europe and America.
- It may be stipulated as a requirement of funding
- Publishing documented DMPs may help support knowledge exchange and understanding what happened during the project, highlighting areas related to data context, licencing and IP, management and handling of the data etc
- Documenting RDM Planning facilitates publication of a DMP if required
- Documenting RDM Planning can also support the publishing of a dataset, so being able to integrate the two processes could be beneficial and support data publishing

Making RDM Planning Mandatory

- Some funding bodies have a mandatory clause for DMPs (eg ARC, NHRMC)
- At many universities, the completion of a DMP is mandatory for Higher Degree Research (HDR) students and it is seen as something that needs to be done to enable them to commence with their studies. Students are encouraged to see that the DMP is a 'living document' and that it supports good RDM during their research project
- RDM Planning is best practice, and should be an integral part of high quality research training
- It is generally accepted that RDM Planning and documentation in a DMP is good practice but it is not widely undertaken by researchers

Connecting RDM Planning to other RDM processes

- The information captured in a DMP can influence other decisions related to RDM e.g. storage allocation, data capture tool selection.
- Decisions could be related to the [sensitivity of the data](#) being described and its impact on licence choice. Highly sensitive data may require a more restrictive licence to the data when publishing.
- Another decision making process could be related to the ethics process and impact of any ethics clearance required for the research.

RDM Planning for Training/Culture Change

RDM Planning can be used as a [training/culture change](#) tool, or as a survey tool, or to follow up on actual use of services (more useful than just compliance).

- Understanding and incorporating the development of a RDM Planning into other processes helps with gaining buy-in and engagement and facilitates suitable integration
- Through the practice of RDM Planning students and academics can be trained to understand the requirements for data management, publishing, preservation of data and the FAIR data management in its entirety

Consider stakeholder perspectives

Infrastructure Stakeholder

- Research Infrastructure Managers involvement in RDM Planning aids them (and the institution) in capacity planning, tool integration and support that covers requirements across the research lifecycle

Library Stakeholder

- Involved in various aspects of the RDM Planning aiming to aid researchers early regarding publishing data and metadata, archiving and preserving data as well as collections management to increase impact and citation
- Play a key role in all phases of RDM Planning, knowledge/assistance for access to data, data licences, copyrights, use of third party property
- At some Institutions, the Library is the hub of RDM, staff conduct the training in essential/foundational RDM or provide consultation services for RDM

Graduate Research School

- Need awareness of the RDM Planning as they are point of contact for HDRs (especially new HDRs)
- At UNSW the Graduate Research School manages HDR project information and requires a DMP from students to provide support and manage information on the student, course, supervision, etc which are all tied to the DMP execution. There is an information gap related to DMP when the graduate research school is engaging with the Library

Researchers

- There needs to be a greater balance of incentives and benefits, not just an emphasis on compliance (administrative work), regardless of institutional size, in order to better motivate activity. For example, the University of Wollongong uses data storage as a carrot to be accessed only after completing DMP
- Researchers may only be motivated if they “have to” - compliance with grant conditions

Research Office

- At small institutions the Research Office has a broad scope of activities across the institution. The Research office is involved in DMP as it covers a broad spectrum of activities ultimately responsible for good reporting for internal and external stakeholders. DMPs give insights into the institution’s research assets, capabilities and strengths. Example from Bond University - the need for High Performance Computing (HPC) identified from DMP led to purchase of HPC service access
- The idea of research ‘data stewards’ (can be operationalised as a position or a role as dictated by the institution budget and/or research strategy). They would be a significant stakeholder and perhaps an example of best practice support for effective RDM Planning

Community

- Greater transparency around what research is being undertaken
- Greater confidence in scientific research outcomes and recommendations that drive public policy

RDM PLANNING RECOMMENDATIONS

Based on the information presented above and the detailed review of the considerations presented for this core element, the following next steps are recommended:

Recommendation 1: Recommended Data Management Planning Next Steps

- Institutions should create an understanding of the purpose and benefits of RDM Planning
- If implementing DMPs, eg. a tool or standardised documentation, institutions should agree internally on the business drivers/purpose.
- Institutions should make a conscious decision as to when and for whom RDM Planning and its documentation are mandatory
- Clear definition and description of what constitutes RDM Planning is required to help researchers to understand why they are engaging in the process and for institutions to understand how they can resource, support and leverage the RDM Planning process
- Further investigation into the idea of publishing DMPs is required. Understanding the potential benefits this could bring to the publishing of datasets and knowledge exchange
- Consider methods for interrogating and analysing the content of DMPs to determine their usefulness and any gaps in the research lifecycle at the institution
- Provide an online presence to allow for [support and training activities](#) in relation to RDM Planning
- Undertake a RACI² to understand who is Responsible and Accountable as well as who needs to be Consulted and Informed in relation to RDM Planning
- Consider the research project lifecycle to determine sources of truth for information
- Attempt to represent the core elements on a spectrum or matrix so institutions can see the 'gold standard' properties or components and also have a pathway for progression if they are at the 'lower' end of that scale

Tooling Research Data Management Planning

This section discusses tooling considerations for best practice RDM Planning. Consideration was given to the different stages of digital integration each institution will be at for RDM Planning tooling and each recommendation can be independently actionable.

Call to action 1: Institutions are encouraged to develop agreement around the following considerations:

- What goes in Ethics system and what goes in the DMP? And in what order?
- Using standard lab-operating procedures in RDM planning
- How might we define a minimum standard with RDM planning tools?
- How might the national data management framework better support institutions in meeting the minimum standard?
- How to share and standardise DMPs and/or planning documentation across collaborators, institutions?

² <https://www.teamgantt.com/blog/raci-chart-definition-tips-and-example>

- How do we represent the scalable nature of the framework and the reality that different organisations are in very different places (e.g on DMPs from an optional word doc to a technical, integrated, machine readable plan) and many of these components rely on funding to implement developments or solutions?

The tooling component of RDM Planning relates to the method by which RDM Planning is documented, managed, published and referenced.

Tooling RDM Planning can and should be integrated with other systems at institutions such that DMP information can be shared and decisions automated accordingly (e.g. Ethics Management and Grants Management systems). These integrations help to build the bigger picture of RDM and the components that need to be considered when planning a project. The FAIR principles should also be considered when it comes to integrating with other processes. The FAIR principles can inform the adoption of strategies to support RDM. For examples, see the ARDC’s recent guidelines for making project data outputs fair³. Another process to be considered is that of making RDM Planning and its documentation machine actionable. When selecting a tool, consider stakeholder perspectives:

Researchers

- If the RDM Planning tool can be integrated with other systems at the institution then the completion of fields in some forms might be automated, reducing the effort of the researchers in completing forms

Institutions

- Institutions will benefit from this development of a National Framework for RDM Planning tools as this will provide guidance and a structured approach to the development of the RDM Planning tools
- Standardising RDM Planning tools across Institutions will help potential interoperability with other systems
- A solution that works for several Institutions (Leveraging the potential benefits of a community forming around this solution and community influence on solution development)
- Having common approaches to the development of RDM Planning tools across Institutions will enhance conversations surrounding RDM Planning and the support institutions can provide for each other
- Of particular importance is the integration with ethics and HR feeds to ensure data quality and consistency in the tool used is correct

³ https://ardc.edu.au/about_us/policies-and-guidelines/fair-data-guidelines-for-project-data-outputs/

Community

- The development of a RDM Planning tool Portal can support the community in understanding RDM Planning tool required capabilities, processes, applications etc. And will allow enhanced interactions between Institutions, enabling sharing of thoughts and issues
- Development of a collaborative community of practice

Other stakeholders:

- Library: They will need to work with the researchers to help them to understand the RDM Planning tools.
- Research Office: They should also be consulted in relation to the development of the framework as they support various processes related to RDM Planning tools

Research Data Management Planning Tooling Recommendations

Recommendation 2: Recommended Tooling Next Steps

- Institutions to identify existing tools in use & map automation opportunities
- Enable RDM Planning to be an ongoing process through integration with relevant systems
- Create a roadmap of progression around tooling. It could go from a simple word document through to a fully integrated system to show best practice no matter what level of digital integration the individual institute is at

MINIMUM STANDARDS FOR RDM PLANNING

RDM Planning practices vary widely across Institutions due to differences in resourcing, research specialisations and capacity. RDM Planning and its documentation will inherently differ across fields of research as it is dependent on the information and data being captured within research projects. However, there are essential elements which all RDM Planning should include.

The aim of this component is to provide an understanding of the requirements of planning and initial application of minimum standards of DMPs in line with the FAIR and CARE guiding principles for scientific RDM and stewardship. Institutions should review existing systems and processes to benchmark against recommendations.

As discussed in Section two of this document, there are significant benefits for both institutions and researchers to invest in best practice RDM Planning. The Code states that researchers must retain clear, accurate, secure and complete records of all research, including research data and primary materials.

RDM Planning should therefore be seen as a necessity for best practice research and be embedded in the research culture of Institutions.

At a granular level, RDM Planning should be seen as a practice that supports and strengthens research quality and output, and recognised as an ongoing process, ideally documented, with the core foundations of being user friendly, flexible, trackable and reportable. The ability to provide a clear curation of project RDM Planning and associated data and publications, will strengthen Australia's global position in the open access and reproducible research environment.

Recommendation 3: Minimum Standards and Best Practice Recommendations	
Minimum Standards	Best Practice Recommendations
Institutions will define persistent RDM Planning documentation identifiers (e.g. RAID, DOIs, RAiD, ROR, ORCiD or institution defined identifier) which clearly link the RDM Planning with project data and publications referencing that data.	Equipment identifiers e.g. Asset numbers will be added to the RDM Planning documentation to identify the equipment used to generate data.
Institutions will include management of primary materials as a part of RDM Planning.	RDM Planning will be linked to or referenced in Laboratory Information Management Systems (LIMS) and electronic lab notebooks to provide contiguous data associations with a project. RDM Planning will identify primary materials storage location and retention and disposal schedule appropriate for those primary materials.
Institutions will provide support for the curation of data, provision of training and assistance with RDM Planning practice and documentation. They will clearly identify the responsible group within the institution for RDM support and development to ensure a 'single source of truth'.	Institutions will support the curation and development of RDM Planning by appointing or identifying persons responsible for this support e.g Data Stewards. Institutions will establish RDM teams specifically to support RDM, including primary materials management.
RDM Planning will be required for all research projects and reviewed regularly. RDM Planning should be considered part of high quality research training for Higher Degree Research students.	RDM Planning development, review and updating will be done within an online platform to provide ease of tracking, and version control. This could be an integrated LIMS or electronic notebook system.

<p>RDM Planning practice and its documentation will be flexible to accommodate and adapt to the needs of different disciplines and include the CARE⁴ principles of RDM.</p>	<p>Prompting the review and update of RDM Planning will be linked to an existing governance process(es) or processes such as ethics, grants management reporting or risk management systems. Review of RDM Planning will be automatically triggered by set date, and updating notifications sent to the RDM Planning documentation author.</p>
<p>Institutions will endeavour to provide researchers clarity on the documentation to be included on RDM Planning.</p>	<p>Where appropriate, and in accordance with confidentiality restrictions, RDM Planning key indicators should be used for reporting purposes by the institution to inform strategic planning of supporting infrastructure and/or resources. Where appropriate and in accordance with confidentiality restrictions, RDM Planning documentation may be made available as open access resources e.g. for collaboration.</p>
<p>Institutions will provide secure digital storage for RDM Planning information.</p>	<p>Institutions should, where possible, link the RDM Planning to the allocation and generation of digital data storage. Greater engagement with RDM Planning and its documentation will provide insight into the need for and future planning of infrastructure requirements, such as data storage.</p>

INCLUSIONS FOR DATA MANAGEMENT PLANS

Project specific DMPs will differ between institutions and fields of research depending on the information and data that needs to be captured within each research project. However, there are essential elements which all DMPs should include. ‘Management of Data and Information in Research’ (NHMRC 2018), one of the supporting guides to *The Code*, sets out recommended inclusions for DMPs:

- Physical, network, system security and any other technological security measures
- Policies and procedures
- Contractual and licensing arrangements and confidentiality agreements
- Training for members of the project team and others, as appropriate
- The form in which the data or information will be stored
- The purposes for which the data or information will be used and/or disclosed
- The conditions under which access to the data or information may be granted to others

⁴ <https://www.gida-global.org/care>

- What information from the DMP, if any, needs to be communicated to potential participants

In addition to these essential elements identified by *The Code*, and to align with the minimum standards identified in this document, institutions should include the following information:

- Project Details
- Persistent data Identifier
- Data Governance
- IP and Copyright Data storage
- Primary materials storage plan and appropriate retention schedule
- Data organisation
- Review schedule

In order to further support DMP development, a table in [Appendix 2](#) identifies components of DMPs from the institutions who participated in the development of this framework.

WORKING GROUP ACKNOWLEDGEMENTS

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APPENDIX 1: RESOURCES

These links provide examples for Institutions to consider:

- <https://www.ands.org.au/working-with-data/data-management/data-management-plans>
- https://dmptool.org/about_us - a tool to support planning
- <https://dmponline.dcc.ac.uk/> - tool for creating a plan
- <https://libguides.federation.edu.au/rdm/checklist> - example DMP checklist
- <https://ardc.edu.au/resources/aboutdata/> - ARDC documentation on RDM considerations

APPENDIX 2: DMP INCLUSIONS FROM THE INSTITUTIONAL UNDERPINNINGS CONTRIBUTING INSTITUTIONS

	Bond University	Edith Cowan University	University of Southern Queensland	University of Tasmania
Project title / ID	X	X	X	X
Project Description		X		X
FOR and SEO Codes	X			X
Chief Investigator details	X	X	X	X
Supervisor Details (if applicable)	X	X		X
Ethics approval number	X	X		X
Grant funding details (if applicable)	X	X	X	
Estimated costs of data management storage			X	
Data collection and/or project dates	X	X	X	X
Sensitive data	X	X	X	X
Data Identifiability		X		X
Restrictions on data or ownership / IP issues	X		X	X
Digital data storage location	X	X	X	X
Data processing requirements/ resources	X		X	
Digital data size and format	X	X	X	X
Physical data storage and type	X	X		
Retention period and/or dates	X	X	X	
Data access (project team)	X	X		X
Data sharing or institutional repository	X	X	X	X
Future use of data	X	X	X	