Starting the Conversation: University-wide Research Data Management Policy

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Introduction

This call for action addresses the high-level benefits of adopting a university-wide policy regarding research data management. It identifies the various university stakeholders and suggests that the library initiate a conversation among them in order to get buy-in for a proactive, rather than reactive, high-level policy for responsible data planning and management that is supported and sustainable.

The intended audience for this call for action is library directors, not because they alone can make this happen, but to encourage them to initiate the conversation. They are invested, because the library may be the recipient of data in need of curation and of requests for guidance, but more importantly, library staff have significant skills and experience to contribute to the discussion. This is an opportunity for the library director to play an entrepreneurial role in furthering the mission of the larger enterprise.

Much has been written about research funders requiring data management plans, and universities moving quickly to meet those requirements. The ASERL/SURA document *Model Language for Research Data Management Policies*[1] is an excellent example of a document that addresses the administrative policies necessary to ensure the preservation of and access to research data. Other organizations have taken on the provision of guidance, tools, and services (notably the Digital Curation Centre's policy, tools, and guidance[2] and the California Digital Library's UC3[3]). Now is a good time to reflect on broader issues than those imposed by external requirements.

The word "data" is defined here to mean units of information observed, collected, or created during the course of research. This is not limited to scientific data; it includes social science statistical and ethnographic data, humanities texts, or any other data used or produced in the course of academic research, whether it takes the form of text, numbers, image, audio, video, models, analytic code or some yet-to-be-identified data type. "Responsible data policy and planning" doesn't just mean managing data while the research project is active and storing the data afterwards; it's about the institutional rationale for managing research data and the ensuing implications for the university.

Now that universities have a few years experience preparing data management plans required by grant funding agencies, desirable outcomes are beginning to become apparent. Universities

in Australia, which have no funder mandates for data management plans, have been proactively creating them simply because it is good practice. Making datasets available can support validation of results and the reproducibility of research. Data can be repurposed in ways not foreseen by the originating researchers, inspiring collaborations and new areas of research. Planning for data management early on will make curation activities much easier throughout the data lifecycle. Efficiencies can be achieved when data curation activities are not treated as one-off occurrences.

This experience with funding mandates should prompt university stakeholders to desire these results:

- Clear expectations that will ease the way for data managers.
- Uniform requirements that will facilitate data understandability and sharing among researchers.
- Consistent data management standards, training and tracking programs that can foster harmony within the university.
- A standardized approach to data management that will ease compliance and improve management of and access to the university's intellectual assets.
- Positive impacts and efficiencies that can benefit all research conducted at the university, not just that funded by agencies that require a data management plan.

Assuming that these benefits are appealing, the stakeholders should enter into discussions to make sure their university realizes them.

The Stakeholders

The major stakeholders who should be at the table are:

The University

Research data can be viewed as university assets, stemming from its mission to support quality research. Applying best practices to safeguard such assets protects the university's intellectual, financial, human and material investment in research. The aspiration to commercialize research and patents must be balanced with the desire (in addition to the requirement) to share data. The university will want to be sure that it is a responsible steward for the research outputs of the institution—and will want to find economical and sustainable ways to do so.

Responsible data management, and the resulting access to research data, can contribute to an improved public understanding of university research and thereby of its contributions to the public good. Public support can help ensure future research funding. The university may wish to make a public commitment to open access. A university-wide policy should address how best practices in managing research data and making it publicly accessible (when feasible) contributes to high-quality research, academic integrity, and responsible stewardship.

The Office of Research

The office of research (sometimes known as the division of sponsored programs and by various other names) has broad responsibility for administration of sponsored research and related policies and services. The senior research officer is a key contact with funding agencies and is involved in university and consortial advocacy around legislative and regulatory matters affecting research funding and the conduct of research. Depending on the organizational structure of a specific college or university, the office of research may have responsibility for technology transfer, patent and other intellectual property administration, research integrity, institutional review board, oversight of major research centers, and grants management and administration.

In its capacity as contracts and grants administrator, the office of research typically assists investigators with funder requirements, including for data management and sharing. This is

usually where proposals, awards, progress reports, and project completion are tracked. When a data management plan is required at the proposal stage, the office of research can ensure that those who will implement the plan are involved as early as possible. Its staff should be the first point of contact for researchers and should be able to provide knowledgeable guidance about services for data management, both within the institution and externally, as appropriate. Staff will be key partners in conversations about local services, infrastructure, and practices needed to manage data during the active phases of research, and to ensure its validity as it is transformed, deposited and distributed. They will be concerned with the funding, policy and governance of data management programs, both to maintain good relationships with funders and to contribute to responsible data management. They will also be instrumental in assisting researchers with identifying data management costs for their grant proposals. The research office is also in the best position to embed research data management into grant management workflows, providing an opportunity to track how project reporting aligns with grant requirements for the management of research data.

The Research Compliance Office

It is important to recognize the particular point of view that the research compliance office may represent when approaching policy proposals. An office of compliance ensures that institutional policies are in compliance with sponsor policies and regulations, and carefully reviews proposed institutional policies with a view towards the practical and procedural issues of compliance, weighing both benefits and risks. The office's responsibility for ensuring compliance with institutional policy through training, communication, and enforcement requires their involvement in policy discussions. Some points of consideration may include uniformity of data management expectations, requirements and standards; the measures of validation or support that proposed data management systems will require; the responsibilities of the institution to data housed elsewhere; and the impacts of changing data retention requirements.

New compliance requirements for access to data are continually emerging, as evidenced by the White House Office of Management and Budget Memorandum *Open Data Policy—Managing Information as an Asset*[4] of 9 May 2013, and the earlier memorandum from the Office of Science and Technology Policy on *Increasing Access to the Results of Federally Funded Scientific Research*[5] of 22 February 2013. In the UK, the *Research Councils UK (RCUK) Policy on Open Access and Supporting Guidance*[6] which came into force on 1 April 2013 requires "all research papers, if applicable, to include a statement on how underlying research materials, such as data, samples, or models, can be accessed."

The Information Technology Department

As the use of technology extends the reach of research, there is a corresponding increase in the impact on university services and research technology environments or cyberinfrastructure. Today's cyberinfrastructure must support advanced data acquisition, storage, management, security, integration, mining, and visualization, as well as other information processing services. Many universities' infrastructure is decentralized to research units, departments, and individual laboratories, with varying degrees of coordination by the central information technology department.

Large-scale data storage and data preservation represent the most person-intensive parts of the infrastructure; replicating these functions in multiple locations needs to be considered carefully. While some laboratories may have reasonably reliable systems, many researchers keep irreplaceable data on personal storage devices without documentation, version control, backup, or redundancy. Even where data are handled effectively, the data are not likely to be made available to others for inspection or to enable new innovation. All infrastructure must now include systems for documenting, depositing, managing, archiving and preserving data; facilitating efficient search and retrieval; and providing access.

Rather than depending on individual researchers or labs, these efforts should be based on the premise that long-term stewardship of digital data—the intellectual assets of the university—is a critical responsibility of the university as a whole. Existing technical infrastructure can be coordinated to support data management, but any gaps must be addressed. A coordinated cyberinfrastructure environment can offer advantages such as economies of scale, integration, and a focused approach to coordinating technology and expertise, computing power, and the planning, acquisition, and management of storage space.

Critical to the centralized coordination of technical infrastructure is the cost model used. How can costs be managed to support compliance and good practice rather than hinder the uptake?

Information technology departments are increasingly aware of their role in strengthening university services to adequately support the various stages of research activity and, in particular, how the resulting research datasets are to be managed throughout their existence. As high-performance computing becomes more affordable, services will need to be commoditized to make them more efficient and scalable. Training will also be needed. In order to situate data management in the larger research information environment, technology

leaders may need to integrate the data management system with related systems, such as current research information systems or virtual research environments.

The Researchers

As the producers of the research data that must be managed and preserved, researchers are central stakeholders. They may be especially invested when their career advancement is dependent upon their research outputs. Faculty members and other researchers are confronted with a mix of requirements for data management and open access that are mandated by funding agencies, national and state law, and their own universities. They may negotiate publishing agreements that determine ownership of data—and that in some cases mandate, or preclude, open access. Some researchers may already have experience depositing data in institutional or discipline-based data repositories.

The relationship between researchers and their data is an intimate one. Trust is critical if central university services are to meet the needs of researchers and productively engage them. Researchers are likely to be resistant to new administrative burdens; researcher representatives therefore should be included in policy discussions. All researchers must be clearly informed of resulting decisions and procedures.

The Academic Units

While the office of research is the locus for policies, oversight and other activities regarding research grants, the researchers themselves are generally in academic units overseen by the university provost. At the operational level, research projects are managed by the principal investigator's home department.

Some academic units have support staff to help with proposal writing, administration, budgets, tracking, and compliance. Some may also have their own technology infrastructure. Academic support staff are an important part of the university's research milieu and should be included as stakeholders. They have close relationships with the researchers in their departments and thus can serve as good conduits for communication. They may feel uncertain about how to respond to the new data management requirements and would welcome guidance, including on provision of a more robust and sustainable infrastructure than they can manage independently.

The Library

The Library is well situated to be a key player in data management, curation, and preservation, given its extensive experience with selection, metadata, collections,

institutional repositories, preservation, curation and access. In fact, the library may be the most appropriate place on campus for safe, sustained, and trusted stewardship of research data. Best practice in research data management dictates that research data be actively curated, not just stored or backed up.

The library need not own all the functions, responsibilities, or systems, but by initiating the university-wide conversation, it can be sure to be at the table and contribute its expertise.

ARL has issued a new *Spec Kit 334: Research Data Management Services*[7] that is useful in understanding how academic libraries have already been involved in this arena. The Digital Curation Centre recently produced materials *RDM for Librarians*[8] to help librarians understand the research data management landscape and to identify their place within it. Some research institutions already maintain data archives and their curators provide valued input on how to prepare, acquire, and curate data during the research data life cycle. See, for example, UCLA's *Social Science Data Archive Policy on Acquisitions and Archiving.*[9]

Many components of the library have contributions to make**:**

- Many libraries have subject area liaisons who offer researchers expertise in managing their research projects.
- Research services often provide functional liaisons for research support, and data management activities can build on those existing services.
- The university archives or a digital resources unit can help to address appraisal, deposit, retention, reappraisal, and continued availability of research data over the long term.
- Technical processing staff can offer advice about metadata. The library's experience with name authorities will come into play in the area of researcher name disambiguation.
- Many research libraries already run an institutional repository for research outcomes, and this infrastructure may be extensible to encompass datasets.

The library offers other areas of expertise:

- Most libraries have experience with copyright issues related to ownership of both source materials and research outcomes.
- The library is also familiar with privacy issues and ensuring that any access restrictions are implemented.

- When it makes sense to put the data in an external repository, the library can provide guidance to help researchers meet deposit requirements.
- In many universities, the library has led the way in the creation of data management plans.
- Libraries are experts at providing long-term preservation.
- Libraries are best-suited to make information as widely available as possible.

Elements of the Conversation

In order to achieve maximum benefit (and minimal burden), the conversation among stakeholders, and the resulting policy and procedures, should address these points:

Who Owns the Data?

Many universities assert ownership of research data generated on their campuses, as do some funding agencies. There is, however, widespread misunderstanding among researchers on this issue. Policies on data ownership must be clearly communicated and understood.

What Requirements Are Imposed By Others?

Funding agencies may mandate public distribution of the resulting dataset and require that data management plans be incorporated into the grant proposal. Publishers may require that the data supporting an article be deposited in a particular repository. Collaborative agreements with other institutions may impose stipulations. These requirements should be clarified early in the process.

Which Data Should Be Retained?

No university can, or should, retain all research data generated by its researchers. Curating research data requires significant investment of staff time and financial resources, so universities should aim to ensure that they are investing only in data worth keeping. For example, data from a failed experiment may not merit curation, nor may that derived from secondary analysis of large datasets publicly available and archived elsewhere.

- Who decides which data to keep? Is it the researcher or someone else? Should other domain experts be consulted? Should peers comment on the data management plan?
- Which datasets are likely to be reused in future research?
- In which cases must the underlying data be retained to enable the validation of the research findings by others?

- What data would be prohibitively expensive to recreate?

When a data management plan is required, it is sometimes reasonable that it state that the data do not merit preservation; perhaps the data could be easily recreated, or an algorithm may be more significant than the dataset itself.

How Long Should Data Be Maintained?

Data may have long-term scientific or institutional value (e.g., as evidence in cases of scientific misconduct), but all preserved data should be subject to review.

- How will retention periods be tracked? Can notifications for reappraisal be automated?
- When an agreed-upon retention period is due to expire, how will it be decided whether it should be extended?
- What metrics could assist with reappraising data for long-term retention? Who should be involved in the reassessment?
- What happens when the primary researcher leaves the institution?
- How will re-appraisal of data be managed within the repository system?
- When a dataset is deemed to no longer be worth keeping, who should be notified? Should deaccessioned datasets be offered to others or destroyed? What records should be kept to document the disposition?

The RCUK has recommended data retention periods for various types of research data.[10] The UK Engineering and Physical Sciences Research Council (EPSRC) expects data to be retained for ten years after the period they were last accessed[11] (EPSRC 2013). The *Australian Code for the Responsible Conduct of Research*[12] (NHMRC 2007) acknowledges that data retention periods vary by type of research, but that the minimum recommended retention period be five years from the date of publication.

How Should Digital Data Be Preserved?

For each dataset, it will need to be determined if there are any unique digital preservation needs.

- Are the needs different from the approaches identified by the Open Archival Information System reference model (Lavoie 2004) and the Trustworthy Repositories Audit and Certification process (CRL and OCLC 2007)?
- Should the data management plan be kept with the data? Should it be made public to provide provenance and additional context?
- What other information should be provided, such as project and personnel records or instrument calibration documentation?
- Are the file formats of the data supported by the repository? What descriptors should be applied? What standards (e.g., for identifiers, citation, metadata) will be required?
- What are the ramifications of cloud storage?

Are There Ethical Considerations?

Data should be kept in a way that is compliant with institutional review board requirements, grant conditions, or specific research protocols mandated by laws and regulations. These considerations will come into play:

- How will the institution handle intellectual property rights and privacy issues (e.g., personally identifiable information or protected health information)?
- How will sensitive data be identified and contained?
- Are there access restrictions that must be enforced?
- How can ethical issues be identified during the proposal stage so that consent forms can be developed?
- What sort of risk management is needed for research data?
- How will the impact on sharing data be mitigated?
- Should the same security protocols that pertain to an institution's business data apply to research data?
- Will security measures be applied in a different manner during the course of research than afterward?

How Are Data Accessed?

Depending on who will most likely use the data, and how, it will be necessary to determine how access will be provided.

- Is it necessary only to make the metadata discoverable, with links to the data files, or is deeper support for manipulating the data needed?
- Which indices and catalogs should reference the availability of the data? What service-level assurances (e.g., uptime, support) should be made?
- How will the repository monitor access to ensure that restrictions are being enforced?
- What are the implications of tracking/monitoring data access?
- What are the possibilities for quantifying access and how might this information play into questions of impact, promotion and tenure? Indeed, what is the measure of "access"—the number of clicks, downloads, or citations?

How Open Should the Data Be?

An institution may decide to provide access to its research data unless constrained by law or grant conditions, or it may decide to share only on a case-by-case basis. Data may also be embargoed with the goal to share at some stated date in the future. In situations where data can never be released or shared, what explanation or justification should be provided for not sharing data?

How Will Costs Be Managed?

Data management will incur substantial new costs, and approaches to funding are likely to be controversial.

- Where will the necessary funds come from?
- Will funders permit investigators to include data management costs in their grant proposals?
- If funding is project-based and therefore time-limited, how will the costs of long-term preservation be supported?How will universities fund data curation research that is not grant supported?

Published in 2010, RCUK's *Common Principles on Research Data Policy*[13] states that it is appropriate to use public funds to support the management and sharing of publicly-funded

research data. In 2011, however, the UK Engineering and Physical Sciences Research Council (EPSRC) stated that "Research organizations will ensure adequate resources are provided to support the curation of publicly-funded research data; these resources will be allocated from within their existing public funding streams." [14]

In practice, these principles endorse existing guidance that "all costs associated with research data management are eligible expenditure of research grant funds," although no expenditure can be double-counted (i.e., a service supported by indirect costs cannot also be included as a direct cost on a grant) (Ryan 2013). However, some funders will not cover any data management and sharing costs, as they firmly believe this is just part of good research practice and should be supported within research-intensive institutions.

US funders and researchers may sometimes assume that data curation costs will be covered by the indirect costs that the home university includes in grant budgets. On the other hand, it may become permissible to include data management as a direct cost in proposals. The latter may, however, apply only to in-project costs, not longer-term curation and preservation. Discussion among universities, publishers, and funding bodies is necessary to identify how the longer-term costs can most realistically be shared.

It is important to be clear about which services the university will cover, and which are considered "over and above." The UK Data Service has produced a useful guide, the *UK Data Service—Data Management Costing Tool and Checklist*,[15] to help researchers and their institutions identify a range of costs and determine how savings can be realized throughout the life of the project. Whichever approach to funding is adopted, it should strongly encourage use of centralized cyberinfrastructure, rather than relying on individual unit or lab resources.

Another possibility is co-investment by multiple partners. As demands for research data management and sharing increase, shared services are becoming more and more attractive. 3TU[16] in the Netherlands is an excellent example of three technical universities joining up to develop and deliver data management infrastructure and support.

Ultimately, universities need a better means of assessing curation costs and projecting them into the future to ensure that they can develop scalable and sustainable services. Identifying the costs is not, however, enough. Universities must be able to make a case about the potential return on their investment. The *Keeping Research Data Safe 2—a JISC-funded Project*[17] team developed and tested a cost model. The California Digital Library UC Curation Center is building on this and related work to focus on the nominal costs of digital preservation through Cost Modeling,[18] which will inform the work of the Digital Preservation Network Business Model Working Group. The new European-Commission-funded 4C Project: Collaboration to Clarify the Costs of Curation [19] is working to help improve current cost models and tools and to identify return on investment for organizations across Europe. But

cost models aside, if the university is committed to retaining its research data assets, it must identify funding to do so.

What Are the Alternatives to Local Data Management?

Not all data need be stored at the researcher's own institution; in some cases a more appropriate home exists. Should the dataset be deposited in a national, international or discipline-based data center? Many funders require data to be deposited in large national or international repositories that hold other like data (e.g., the National Climatic Data Center[20] or the RCSB Protein Data Bank[21]). In some cases, there is a data repository used by researchers in a particular field, where a disciplinary culture is developed around data sharing (e.g., Inter-university Consortium for Political and Social Research[22] for social science data, or Open Context[23] for archaeology data). New services such as Digital Science's figshare[24] and OpenAire's Zenodo[25] may offer a home for "orphaned" datasets. The Australian government is funding the Research Data Storage Infrastructure Project[26] to support retention and integration of nationally significant data assets.

Some research is collaborative and involves investigators at different institutions. A decision must be made as to which institution will take responsibility for the data, both during and after the project. This decision should be made explicit during data management planning.

If the dataset is to be stored elsewhere, the ingest requirements and retention policy of the off-site repository should be reviewed. Most likely the university will want to include in its local institutional repository a metadata record describing the data along with a link to the dataset where it resides, thus enabling the university to keep a complete record of its research assets.

Many universities are developing data catalogs to contain references to all research outputs regardless of where they reside. The Australian National Data Service (ANDS) has created a cohesive national window into research resources through *Research Data Australia*.[27] JISC and the Digital Curation Centre are developing a national research data registry that will harvest data information to make it more visible at a national level; it will use the ANDS code as a starting point and will investigate the Comprehensive Knowledge Archive Network system as a potential technical platform. In Europe the European Union (EU) is investing heavily in top-down research cyberinfrastructure development as part of its *European Strategy Forum on Research Infrastructures (ESFRI)*.[28] *Databib*[29] is an international tool for finding repositories of research data. The US data discovery picture is much more fractured.

One home may be appropriate for preservation and another for access. These two main components of data curation can be accommodated independently, but they are interrelated

and should be linked. Preservation enables access, and active use of the data is often the best justification for continued preservation.

With the recent US Office of Science and Technology Policy mandate, other players may emerge in the US data management milieu. The Association of Research Libraries, the Association of American Universities, and the Association of Public and Land-grant Universities have issued a proposal called *SHared Access Research Ecosystem (SHARE)*[30] that imagines a workflow architecture implemented across a network of university-operated repositories fulfilling the mandate's requirements. Representatives of 25 organizations that archive scientific data released a *Call for Action*[31] (ISCPR 2013) urging the creation of sustainable funding streams for domain repositories that are closely tied to the scholarly communities. Regardless of how this settles out, universities will still want to have a record of their own research output—and it could be that these data repositories will be important nodes in the evolving US research data network.

Conclusion

It is important to recognize the current uncertainty as to how data management support and services will be distributed among university, disciplinary, funder, national and international stakeholders. In this complex environment, an institution must actively determine how data services will be managed and distributed internally. Various university players are important stakeholders in determining the appropriate governance structure to ensure efficient coordination, adequate security and regulatory compliance, and scalable, sustainable, and useful data management services to researchers.

The University of Melbourne has a university-wide policy, Management of Research Data and Records Policy[32] that may serve as an example for those developing their own policies. It lays out the responsibilities of several parties; links to legislation, policy, and procedures; and definitions of terms.

Effective data management is just one aspect of achieving the ultimate goal of ensuring on-going access to the outputs of academic research. This goal can only be achieved if the right questions have been asked and answered along the way. The library is just one of many stakeholders but should be a key player in data management. The library's expertise makes its director a logical spokesperson to initiate high-level discussions about data management at an institution that has not yet engaged in them. This is important for the university—and important for the library to firmly establish its support of the university's research mission.

First Steps Toward Adopting a University-wide Research Data Management Policy:

- Introduce the issue and propose a level-setting discussion to your stakeholders via e-mail.
- Identify a stakeholder whose interests and contributions complement yours. Coordinate in advance with them on the meeting agenda. Enlist their help to ensure the right attendees are there at the kickoff.
- Co-host the initial meeting.
- Share with each other your current state of thinking and readiness to act.
- Identify issues using the questions in this article. Identify where key responsibilities have already been lodged. Agree on gaps and on teams that will recommend actions in a future session.
- Follow up individually on assignments and progress.
- Make the most motivated stakeholders your key allies in forward progress.

Notes

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