ontology issues EDRMS Today Success contracts retrieval thesauri Quality Digital document web 2.0 Information management Achievements Archives computing future end-user Emerging criteria Recordkeeping 6

Increasing the Value of University Research Records by Preserving Context

Roberta A. Cowan and Michelle Lillico

Abstract

It is customary within the University sector that, over the duration of a research project, records will be created and kept by many different stakeholders, both within internal and external administration centres and by researchers on a project. Usually, only research administration records are carefully kept and maintained formally within Universities. Raw data and other project records created by researchers are also valuable University assets, but only as long as the context of the information is maintained. Research project records held by researchers, however, are often managed in isolation and left behind after a project is completed without any identifying contextual information or links to the corresponding records held in administration.

In order to have a complete and accurate record of a research project, the data and the context in which the data were produced should also be kept. Throughout the Western World there are a number of very large digital repositories for research data. This paper argues that data without the associated contextual records, such as how or why data were gathered; how or why data were interpreted; and how or why final conclusions were reached, means that these repositories are not keeping complete and accurate records of the research. This paper proposes the minimum metadata required to ensure contextual information about research records is maintained over time and linked to the research records, ensuring that the ongoing value of the information is preserved for future researchers and the community.

Introduction

Publicly funded research in Australia is carried out in research units within the government sector and in the higher education sector. At the international level (Organization for Economic Co-operation and Development – OECD), the Ministers for Science from member countries including Australia "emphasised the importance of ensuring the long term sustainability of the research enterprise and the need to involve civil society and business more effectively in the governance of public research".[1] Publicly funded research in Australia has a 200-year history[2] but the Working Group on Data for Science of the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) have asked, with respect to the data from this research, are we "adequately aware of what data we already have"?[3]

The shaping of research policy and infrastructure for a country does not occur overnight and is not a cheap budget item. In 1999 the Australian Government released their policy statement *Knowledge and Innovation*[4] with the stated aim of changing the way research was to be done in Australia. This statement set the scene and affected the way higher education was funded, the way research was funded and the way the higher education sector collaborated with other research agencies. In 2001 the Australian Government's action plan, *Backing Australia's Ability*,[5] provided $3 billion for innovation over 2001–2006 and was associated with other initiatives such as the announcement in 2002 of the four national research priorities—an environmentally sustainable Australia; promoting and maintaining good health; frontier technologies for building and transforming Australian industries and safeguarding Australia.

By 2004 the *Backing Australia's Ability* package included an Accessibility Framework to improve access to research information, outputs and infrastructure.[6] Through the National Collaborative Research Infrastructure Strategy (NCRIS), $500 million was made available over seven years (2004–2011) to ensure that national scholarly output and research data derived from public funding was available to researchers and the wider community through the establishment and linkage of electronic digital repositories.[7] NCRIS provided a roadmap which will have major strategic impact on the diffusion of knowledge and provision of support for the national research priorities.[8] The Working Group on Data for Science of the PMSEIC proposed a data commons approach, the National Centre for Data for Science (NCDS).[9] As part of NCRIS, the Platforms for Collaboration put forward the Australian National Data Service (ANDS) model as a cooperative centre with expertise on research management.[10] These models discuss the infrastructure behind data capture and storage but do not discuss what data is and what constitutes a complete and accurate research data record.[11]

What is research?

Research is part of the knowledge infrastructure of a nation. Research in the higher education sector is an activity that leads to outcomes which can be traced publicly. The Australian Government[12] has defined research in the higher education sector and listed activities it considers are included in research and those that are not.

Research and experimental development comprises:

- creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications;
- any activity classified as research and experimental development is characterised by originality; it should have investigation as a primary objective and should have the potential to produce results that are sufficiently general for humanity's stock of knowledge (theoretical and/or practical) to be recognisably increased. Most higher education research work would qualify as research and experimental development.

Research includes pure basic research, strategic basic research, applied research and experimental development.

Activities that support research such as:

- provision of professional, technical, administrative or clerical support and/or assistance to staff directly engaged in research and experimental development;
- management of staff who are either directly engaged in research and experimental development or are providing professional, technical or clerical support or assistance to those staff;
- activities of students undertaking postgraduate research courses;
- development of postgraduate research courses; and
- supervision of students undertaking postgraduate research courses

meet the definition of research.[13]

Using the definitions of information and knowledge expanded by Maier, Hädrich and Peinl[14] researchers are the interpreters of information. The results of research represent different sectors of the knowledge infrastructure.

> Unlike information, knowledge is not easily transferred. The costs for the "distribution" of knowledge can be very high. Unlike information transfer, it takes time for individuals to reconstruct knowledge because this process not only requires interpretation as in the case of information, but also requires learning.[15]

Only data or documented information can be transported or communicated. Knowledge is a human construct. A knowledge infrastructure will enable the transport and communication of data and documented information. In order for the knowledge infrastructure to be working well it should capture all aspects of data and documented information necessary for knowledge formation.

In this paper discussions will be restricted to research carried out in the higher education sector in Australia.

Research code of conduct

The *Australian Code for the Responsible Conduct of Research* (hereafter the *Code*[16])

> is a guide for responsible research conduct in Australia, providing a basic reference for the development of appropriate policies and procedures. It is written specifically for universities and other public sector research institutions. Compliance with this Code is a prerequisite for receipt of National Health and Medical Research Council and Australian Research Council funding.[17]

The *Code* is separated into two parts—Part A: principles and practices to encourage responsible research, and Part B: dealing with breaches of the *Code*. Part A is subdivided into the general principles of research, supervision of researchers, publication of research, authorship, review of research and conflicts of interest but, more importantly, the *Code* discusses "management of research data and primary materials" and "collaborative research across institutions".[18] Under all of these major headings the *Code* makes clear the role of the institution and the role of the researcher.

The *Code* **requires institutions** to:

- retain research data and primary materials;
- provide secure research data storage and record-keeping facilities;
- identify ownership of research data and primary materials; and
- ensure security and confidentiality of research data and primary materials.[19]

Further the *Code* states that

> organisations involved in a joint research project should ensure that an agreement is reached with the partners on the management of the research. …. It should address the protocols to be followed by the partners when disseminating the research outcomes, and the management of primary research materials and research data.[20]

The *Code* goes on to say "The collaborating parties should each identify a person to be involved in the management of research data, primary materials and other items to be retained at the end of the project".[21]

The onus is not entirely upon the institution. The *Code* **requires researchers to**, among other things:

- retain research data, including electronic data, in a durable, indexed and retrievable form; and
- maintain a catalogue of research data in an accessible form.[22]

Scientific and/or medical research data are often the synonym for research data but they are not the only research data. The Working Group on Data for Science was at pains to point out that they included data from the humanities and social sciences in their report to PMSEIC. The working group provided eleven recommendations[23] to PMSEIC, including a strategic framework for data, a network of repositories, changes to regulation and changes in the culture of data management and access.

In its explanation of "why data why now", ANDS stated that we are "in a data deluge".[24] While this may be an overstatement, it is true that technological advances over the last thirty years have meant that even the simplest of experiments may generate more data than similar experiments run in the past. This is not to say that vast amounts of data from thirty-year-old projects do not exist, lying dormant in dusty storerooms, in the offices of researchers, on analogue media and on antiquated digital media. Most of these data have been financed by the Australian taxpayer through the Australian Research Council (ARC) and National Health and Medical Research Council (NHMRC) and could be mined if there was the will to curate them retrospectively.

The *National Broadband Network*[25] and *Backing Australia's Ability*[26] initiatives are not just programs to provide the nation with faster downloads of movies or push universities into providing digital repositories for their researchers' published works. They also provide the platforms for access to research data and the sharing and reuse of data. In their report to PMSEIC, the Working Group on Data for Science stated what might appear obvious: "publicly funded research should be publicly available".[27] Most would agree with this statement, and also with the ANDS assertion that "all research sponsored by the public is by definition sufficiently valuable that the creation of data management plans for all forms and instances of research data is justified and necessary".[28]

How is University research funded?

Research in Australia's university sector is supported through grants. The majority of the grants are from taxpayer funds, mostly through the National Competitive Grants Program (NCGP) or the NHMRC[29]—although industry-funded research does occur. The costs to the university sector of research are direct and indirect.[30] Direct costs are often those covered by the research grant whereas the indirect costs of research such as information technology infrastructure, for example the cost of desktop computing support for specialised research or information management infrastructure, or the cost of maintaining a digital data repository, are rarely if ever factored into the budget of a research grant. The Allen Group report[31] reveals that the indirect cost of research to the university sector is difficult to assess and is not being met through the NCGP. The

Department of Education, Science and Training (now part of the Department of Innovation Industry Science and Research) in 2004 when they defined "what is research",[32] included "technical, administrative or clerical support", and the *Code*[33] requires that institutions provide both storage and recordkeeping systems for research data which requires technical, administrative and clerical support. At present the costs of providing administrative support to researchers and the costs of retaining their data are part of the hidden cost of research. From anacdotal sources and a comparison of higher education website information, especially the disposal authorities, research policies, and searches for research data, it would appear that no institution has a firm concept of the magnitude of the data produced by their researchers nor the quantity and status of records produced during a research project.

Institutional reporting of research output

Reporting databases

All universities must report on their research grant income and research output as publications, known as *research publication returns*. These data are used to determine the Higher Education Provider (HEP) grants. Universities report to the government, who publish annual specifications for *Higher Education Research Data Collection* (HERDC).[34] Universities will use a carrot and stick approach to help gather the data that are funnelled through research offices but usually entered by the researcher or research unit. The institution will offer an incentive to the researcher for peer-reviewed publications and prestige for particular grant types. The universities will therefore have databases and associated administrative schemes running, such as Research Performance Indicator (RPI) at Curtin University, Research Activity Index (RAI) at Edith Cowan University, Research Management System (IRMA) and Research Grant Management System (RIS) at Murdoch University. These are all reporting systems for HERDC. The institution uses the data entered into the databases to report to the government.

Publication repositories

In many institutions there will be a quite separate (although often linked) database which is the institutional repository of publications produced by the staff of the institution. Examples of institutional repositories are 'e-space' at Curtin University, and the University of Melbourne's 'ePrints Repository' (UMER) which is a subset of the university's Digital Repository. This paper does not discuss the records that reside within this particular type of institutional repository, that is, digital versions of published research output. It is possible, however, that contextual records concerning the production of the items in the repositories will be records that are the subject of this paper. These repositories (or a separate digital repository) may be used for reporting as part of the Excellence in Research for Australia (ERA) Initiative. This paper does not discuss records concerned with the reporting requirements of ERA.[35]

Legislative framework for university records

All higher education institutions have an area within the central administration that deals with research. One of the main functions of the university research office (URO) is to track funding obtained by the university from the NCGP, NHMRC and other granting bodies. Most higher education institutions in Australia are constituted under state legislation and are therefore subject to state laws. Table 1 provides a listing of the records and archives acts under which Australian universities operate. Under the requirements of the legislation applicable to each jurisdiction, the universities will develop and apply appropriate retention and disposal (R&D) schedules or authorities.[36] Some states, such as Victoria, may have a general schedule that applies to all university institutions.[37] In other states such as Western Australia, the universities all have individual disposal authorities approved by the WA State Records Commission.

Note that the following discussion does not take into account the situation where universities have campuses offshore or in a different state.

State	Records Act	Institutions
ACT	*Territory Records Act 2002*	University of Canberra.
NSW	*State Records Act 1998*	Charles Sturt University, Macquarie University, Southern Cross University, University of New England, The University of New South Wales, The University of Newcastle, The University of Sydney, University of Technology Sydney, University of Western Sydney, University of Wollongong.
NT	*Information Act 2003*	Charles Darwin University.
QLD	*Public Records Act 2002*	Central Queensland University, Griffith University, James Cook University, Queensland University of Technology, The University of Queensland, University of Southern Queensland, University of the Sunshine Coast.
SA	*State Records Act 1997*	Flinders University, University of Adelaide, University of South Australia.
TAS	*Archives Act 1983*	University of Tasmania.
VIC	*Public Records Act1973*	The University of Melbourne, Monash University, La Trobe University, Deakin University, RMIT University, Swinburne University of Technology, University of Ballarat, Victoria University of Technology.
WA	*State Records Act 2000*	Curtin University, Edith Cowan University, Murdoch University and the University of Western Australia
National	*Archives Act 1983*	Australian Defence Force Academy; The Australian National University.
Private	*No specific recordkeeping legislation*	Australian Catholic University; Bond University, The University of Notre Dame Australia.

Table 1: Recordkeeping legislation applicable to the higher education sector in Australia

How are research records created?

Projects of any type produce huge amounts of information. Research projects are no different. The information management aspect of research projects is not discussed in this paper. Information management of research is a very broad field that requires an understanding of the complexities of research and the interplay between organisations, as well as an understanding of information management. This paper discusses a subset of the information generated, namely the records.[38] Table 2 indicates some of the types of records created and managed in a research project.

Record Type	Description of Record
Research Records	The research records are *all* of the records concerning a particular research project generated by the funding body, administration of the institution, the administration unit/department within which the research team works, and the research team itself.
Research Project Records	The research project records are those generated by the research project team and consist of project administration records, project context records and project data records.
Project Context Records	The project context records are concerned with the design of the project, design of instrumentation, design of specialised information technology, methods of data collection, design of specialised digital databases, permits, methods of data interpretation. These records surround the project data: • how/why were the primary data gathered in particular way; • how/why was one interpretation in particular preferred; and • how/why was the conclusion reached.

Record Type	Description of Record
Project Data Records	The project data records are: • those records gathered from carrying out the aims of the project (primary data); • those records gathered from interpreting the primary data; and • those records which are the inferences produced from the interpretation of primary data.

Table 2: Record types produced during a research project

The relationships between the record types produced in a research project are illustrated in Figure 1. In Figure 1 the green area indicates all those records produced outside the research project team, such as the administration records produced by the funding body, administration of the institution and the administration unit/department within which the research team works.

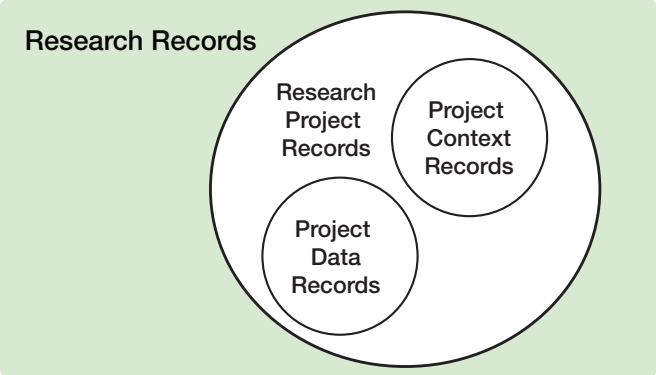

Figure 1: Relationship of record types produced during a research project

We keep records to show that an 'event' or 'activity' has occurred. In the context of a research project, 'events' for which records would be produced are:

- funding received or expended;
- research undertaken;
- data accumulated; and
- results communicated

Many of the records are produced outside the research project team by the administrative arm of the institution, the administrative arm of the unit/ department within which the research team operates or by external bodies such as the funding bodies (green area Figure 1). Some administrative records are generated by the team but these are usually considered copies in the record keeping system of the institution, for example HR records. The records that this paper discusses are the project context records and the project data records which form the major portions of the research project records.

Phases of record creation

Research projects have four phases, some or none of which may be distinct. There is:

1. the grant-writing phase;
2. the data-gathering phase;
3. the final reporting phase; and
4. the moth-balling phase.

Grant-writing phase

During the grant-writing phase the researcher will be working with or communicating with other researchers

- in their unit;
- in their institution but in different units; and/or
- in other institutions.

The records generated during this phase may include:

- research data gathered for the proposal;
- drafts of the proposal;
- communications with the other researchers, the university research office (URO), the funding body;
- presentations and publications;
- a proposal for submission.

At the grant-writing stage the grant has not yet been won or lost. If these records had been registered into the official recordkeeping system (RKS) of a university

in New South Wales or a university in Queensland, for example,[39] then records **could** be registered with the associated sentences given in Table 3.

Record Type	NSW		QLD	
Data gathered for proposal	GDA 6.2.2	Destroy after 3 years	QDAN 601.2/C142 (if successful) QDAN 601.2/C143 (if unsuccessful)	Destroy after 7 years Destroy after 2 years
Drafts of proposal	GDA 6.2.2	Destroy after 3 years	QDAN 601.2/C142 (if successful) QDAN 601.2/C143 (if unsuccessful)	Destroy after 7 years Destroy after 2 years
Communications with URO, other researchers, funding body	GDA 6.2.2	Destroy after 3 years	QDAN 601.2/C142 (if successful) QDAN 601.2/C143 (if unsuccessful)	Destroy after 7 years Destroy after 2 years
Submitted proposal	GDA 23 23.5.1 D7 (if successful) GDA 23 23.5.2 D2 (if unsuccessful) GDA 6.2.2	Destroy after 7 years Destroy after 2 years Destroy after 3 years	QDAN 601.2/C142 (if successful) QDAN 601.2/C143 (if unsuccessful)	Destroy after 7 years Destroy after 2 years

Table 3. Possible disposition codes and disposition action of records produced in grant-writing phase

Obviously there should be a review mechanism built in to record keeping systems to review these types of records, since success of a grant will not be known when the file is created. Grant-writing is a very active phase for a researcher; funding bodies consistently reduce funding and the number of successful grants is low compared to unsuccessful grants.[40] This means that researchers may be writing a number of grant proposals in any one year as well doing the research associated with and writing reports on their existing grants. It appears from the disposal authorities surveyed that the final grant proposal is the only record that would be consistently registered/captured into an RKS at the grant-writing phase. The proposal is usually submitted via the URO and so the most likely scenario is for record registration to begin when a grant application is submitted through the URO. The URO, not the researcher, will be the file owner/generator. If the grant is successful the researcher may be required to register files into a recordkeeping system, for it is then that other sections of the organisation, such as finance and HR become involved. Funding is not granted to the researcher but to the institution to which the researcher is attached.

In terms of records generated at the grant-writing stage, the researcher is custodian of the records. In many cases, preliminary research data will be generated during this time and may be used to produce presentations or publications. While the researcher is the custodian they are at all times an employee of the higher education institution or, if they have other status such as an adjunct appointment, should have signed an agreement which indicates that they are part of the recordkeeping structure of the institution and as such will be required to capture these records into the recordkeeping system.

To add another level of complexity, researchers are

encouraged by the NCGP to collaborate across institutions (note statement from *Code* quoted earlier). This may mean that a researcher is creating records at one institution (in the grant-writing phase) that will ultimately be the responsibility of another institution if the research project is funded by the NCGP or NHMRC.

In addition, researchers do not usually apply for grants in isolation. Researchers are usually working on multiple projects and applying for more than one grant for any given project. Projects may move through a number of grant rounds so that a project may begin as a small grant project (funded by the institution) and subsequently become funded by the ARC or NHMRC or the industry sector.

Data-gathering phase

Once the researcher/chief investigator (CI) or research team has been awarded the grant through their parent institution the data gathering phase commences. Research grants are awarded to higher education institutions for chief investigators, partner investigators (PI) and other research workers to carry out the prescribed research.[41]

The research team, which may consist of a CI, PI and a number of research employees (if the grant is large), now commence work on the project and records will be created. The following is a simplified scenario of a CI, called Researcher A, working with a PI, called Researcher B, within the same institution (see Figure 2). For ease of understanding all records from the research project are shaded blue (*Project Blue*). Research records (Figure 2) for Project Blue will be produced by central administration, in the form of financial, human relations and administration records. Within the institution, at a whole of institution level or at a unit level, there may be one or more databases tracking the records about the project. Simultaneously (and often without any real understanding of recordkeeping protocols within the university or institution), Researcher A and Researcher B have their own set of research records for the project (Figure 2: Researcher A 5 files, Researcher B 5 files). Researchers A and B are engaged on different parts of the project and so each keep different files and certainly different project data. The scenario illustrated in Figures 2, 3 and 4 is based on actual research records and researcher filing systems encountered by the authors.

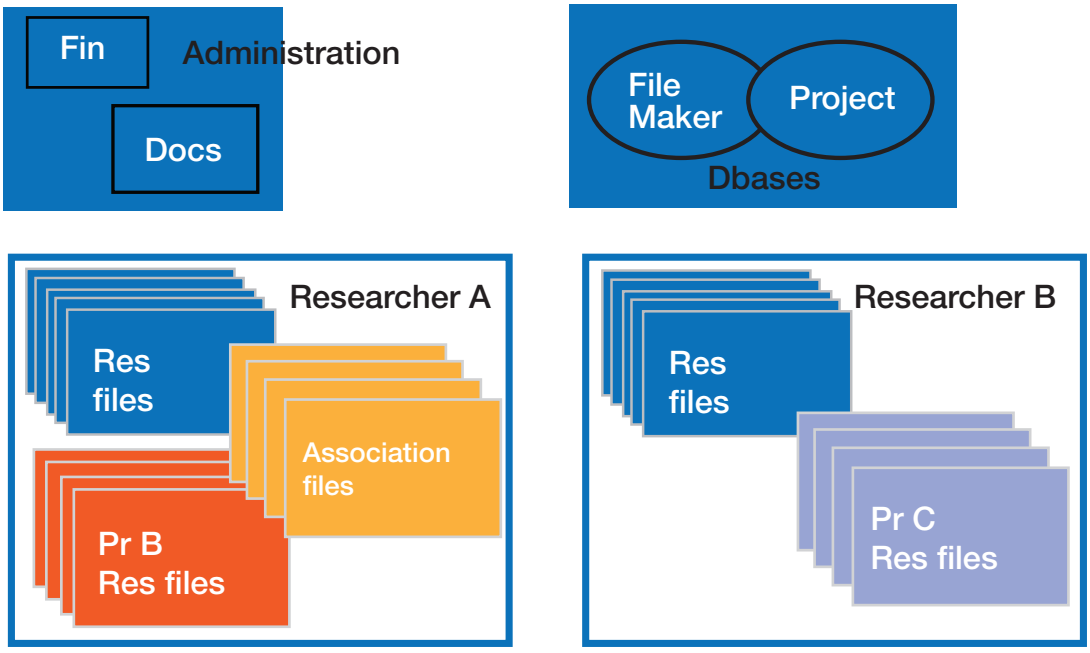

Figure 2: Records for research Project Blue early in project.
Note other records in filing system of Researcher A and B also shown

Simultaneously with Project Blue, Researcher A is involved in a different project (Project B denoted in Figure 2 and 3 by orange research project files). They are also involved with a professional association which is relevant to but not a funder of Project Blue (yellow files in Figures 2 and 3). Researcher B is also involved in a different project associated with another research group at another higher education institution (Project C, mauve research project files Figure 2). With respect to the institution that employs Researchers A and B, only the blue and orange research project files should be controlled by that institution, whereas the mauve research project files should be under the control of the institution at which project C is being funded.

At this point the RKS of the institution employing researcher A **should** have 10 Project Blue research project files registered in the RKS, by the CI with locations that may well be physically in the offices or on a network drive on the institution's server infrastructure. The ten files are the five files held by Researcher A and the five held by Researcher B (the number of files is simply an example and may vary with different projects). The RKS **should** also have a number of other relevant research records registered by the URO, HR, finance and the unit to which the research team is attached.

As often happens with large research grants, the research personnel change during the funding period. Researcher B moves to another higher education institution and leaves Project Blue. Only two research project files are found when Researcher B departs. A new member of the project, Researcher C begins with Project Blue. Researcher A retains custody of one research project file and gives custody of the second file to Researcher C. New records have been generated in central administration as a result of the personnel changes and the project databases have been updated.

Researcher C is working simultaneously on Project D (grey research project files in Figure 3) and Project Blue. At this point there are only 7 research project files extant for Project Blue. Researcher A has six files and Researcher C one file (Figure 3). No explicit information is available regarding the other three original research project files for Project Blue. They have simply disappeared.

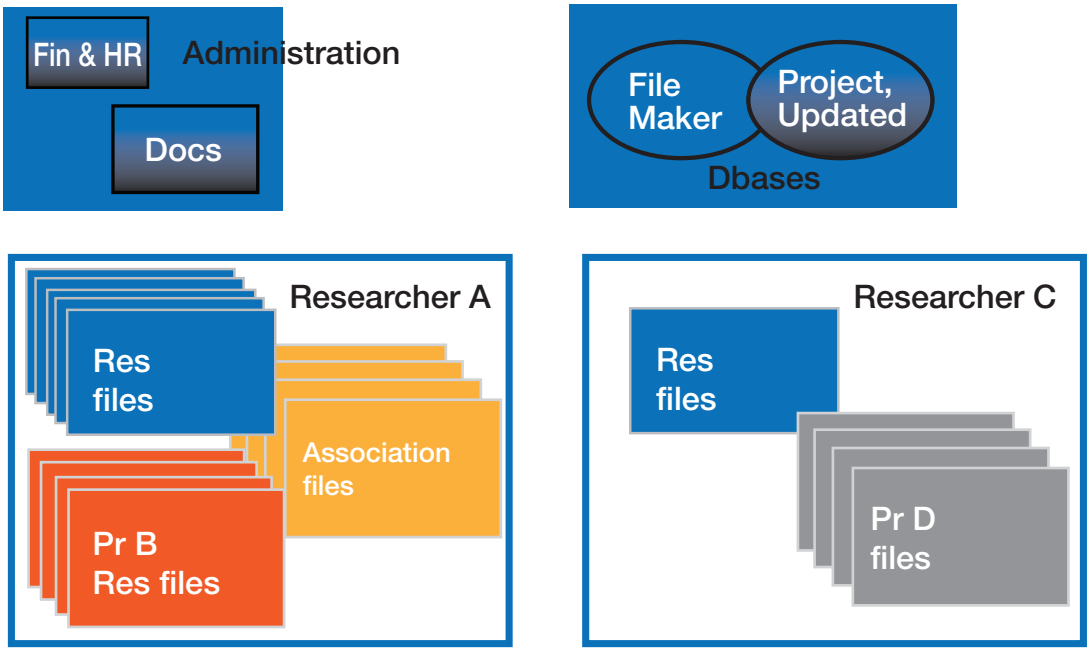

Figure 3: Records for research Project Blue after change of personnel. Note other records in filing system of Researcher A and C also illustrated

Project Blue continues to shine and is awarded further major funding. This enables two higher degree by research (HDR) students to join the team. Researcher A supervises one HDR student (Figure 4: PhD 1). Researchers A and C co-supervise the other HDR student (Figure 4: PhD 2). There are now four researchers creating research project records relating to Project Blue.

Report-writing phase and mothballing phase

The research project funding has ended.[42] The final report has been submitted to the funding body and the two HDR students have been awarded their doctorates. The research project is now ready to be mothballed and the focus shifts to new research projects.

Rarely is this 'mothball' stage done in a careful and considered way. The researchers have known for the past 18 months that funding for this project was not continuing and they have been writing grant proposals for new research projects. The researchers have been losing interest in Project Blue for at least that period because, if it cannot get funding, Project Blue must be placed on the backburner. This means that records will become scattered in filing cabinets, on thumb drives, on external hard drives, on servers, in boxes, in cupboards, and in offices. The researchers will know where the data they believe is important resides; however, each researcher on a project will have a different view on what is really important and what is not. At the time of mothballing, the files listed in Table 4 had been generated for Project Blue.

Records generated by	Type	No. of files	Registered in RKS
Central Administration	HR	1	Yes
	Finance	1	Yes
	Administration	3	Yes
Unit	Administration	Unknown	Unknown
	Database	Unknown	Unknown
Researcher A	Researcher Administration	Unknown	Unknown
(CI)	Project context	5	No
	Project data	Unknown	Unknown
Researcher B	Project context	4	No
	Project data	1	No
Researcher C	Project context	2	No
	Project data	2	No
HDR 1	Project context	1	No
	Project data	1	No
HDR 2	Project context	1	No
	Project data	1	No

Table 4: Total records created for Project Blue

Table 4 reveals that, for Project Blue, at least 18 files of research project records are unaccounted for and unregistered at the end of the project.

If we could trace the history of the project in this scenario (Figures 2, 3, 4) we would locate one file of project data interstate with Researcher B, who admits to having discarded two project context files before leaving the project (Figure 4). PhD 1 has moved to a new unit within the same institution and has two research project files in the system of the new unit. PhD 2 cannot be traced. The remaining 11 research project files that provide the context for the project data, of which we have no explicit account of, are likely to have been compromised during the period that the research team realised that Project Blue was drawing to a close. Records in the 11 research project files have been removed, not copied, to write new grant proposals by the CI, PI and other researchers and these records have been incorporated in the files for the new grant applications. If these grant applications are not funded, then the records may well be discarded. Whatever the future holds the 'story' of Project Blue has been distrupted.

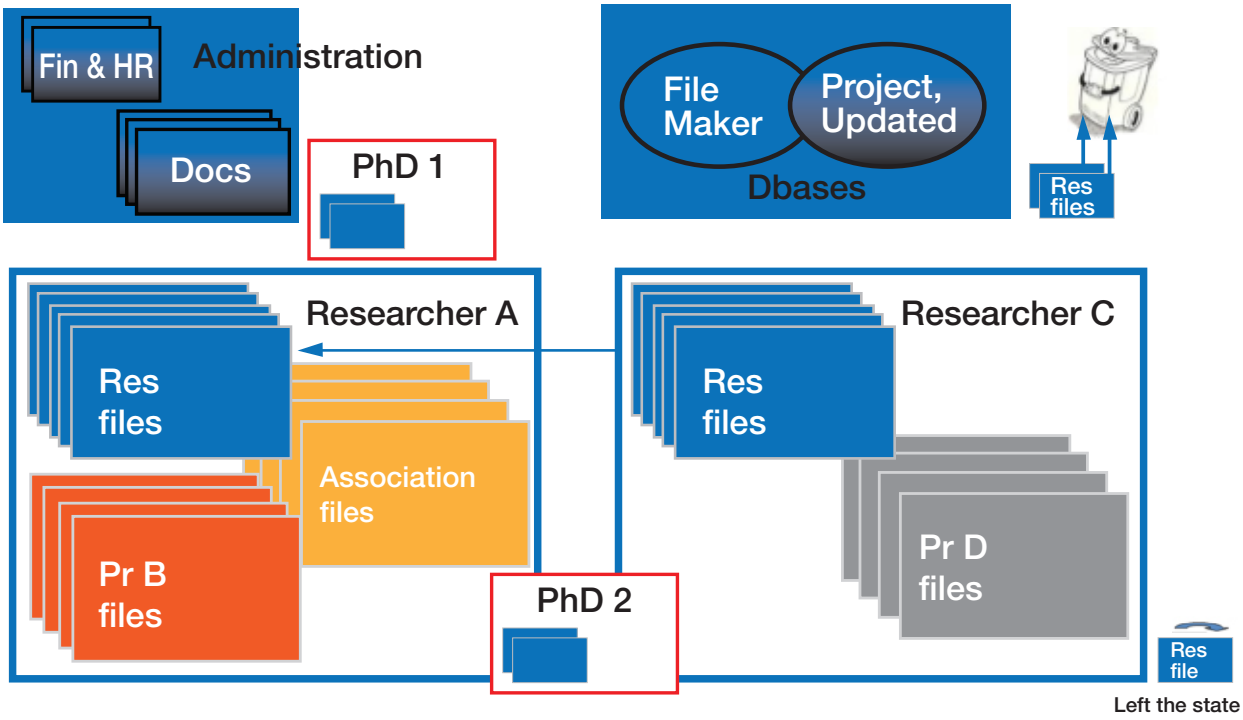

Figure 4: Total files produced for research Project Blue by end of project

A summary of the records created in each phase of the scenario presented above can be found in Table 5. The table is colour-coded to reflect the records types in Figure 1.

Phase	Creator	Storage area	Record type
Grant-writing	Researcher	Research unit Funding body	Data gathering for proposal Presentation and publication Drafts of proposal Communication with URO Submitted Proposal (copies)
Grant-writing	University research office (URO)	URO	Submitted proposal Associated paperwork to fundinging body Communication with researcher
Data-gathering phase	Researcher	Research unit	Project management for project Project context records Project data records Communication with other researchers Presentations Publications Reports to funding body (copies) Reports to University (copies) Financials (copies) Human resources (copies) Information technology (copies)
Data-gathering phase	URO	URO	Communication with researcher Reports to University Reports to funding body Communication with funding body
Data-gathering phase	University administration (UA)	UA	Financials Human resources Information technology
Report-writing	Researcher	Research Unit	Final report to funding body (copy) Financials (copies)
Report-writing	URO	URO	Final report to funding body
Report-writing	UA	UA	Financials
Mothballing	Researcher	Store room	Boxes of paper. Assorted digital / analogue media. Assorted records from data-gathering and report-writing phases. Note: These records may have been pillaged for other grant applications

Table 5: Records produced and by whom during a research project.
Note: shaded areas represent those records usually subject to internal and external audits and are covered in R&D authorities

Disposition of research records

All public universities in Australia are subject to some form of information management legislation which directs the disposition of records (Table 1). The disposition sentences applied to research records vary between jurisdictions and are unlikely to mention all the types of research records described in this paper. For example, in Queensland[43] the master register of successful grants and the data from significant research projects are permanent records. This is not the case for administrative files such as the original proposal or the interim and final reports which would have been written by the research team and sent to the funding body via the research office. These records are retained for 7 years before disposal. There is currently, no retention/disposal sentence in the Queensland schedule for those records described in this paper as project context files, i.e. those records that provide the context for the project data.

Storage and management of research data

There appears to be a general consensus in the developed world that research data, however generated, should be archived. In the US the discussion is around creating cyberinfrastructure to enable future research and future gathering of data.[44] Similarly the ANDS discussion centres on creating an infrastructure for storage and sharing of data that are yet to be gathered. In the EU comparisons have been carried out between UK data archives, some of which have been operating since the 1960s, and the Open Archival Information System (OAIS). OAIS is now part of an international standard.[45]

There is a belief that any worthwhile research will be published. This is not necessarily so. In a research project, it is usual that only selected portions of the research are published. Research is fashion-conscious; research that is out of fashion will not be published. There is sometimes a belief that unpublished data are wrong, that researchers wedded to a particular belief will ignore some data and only accept published 'correct data'.

The real meaning or value of a research project is difficult to assess without all the information pertaining to it. The published version of a research project does not necessarily reflect the whole picture. Fortunately, in some disciplines researchers are expected to 'archive' their data in a universal repository, for example plant scientists who publish gene sequences are expected to archive the sequence at GeneBank and the plant material in a recognised herbarium. This allows any future researcher to check the initial data totally independently. If this independent verification reveals a discrepancy, questions would follow which would be answered by looking at the methods used by the two independent investigations. The logical place to look for information on method is in a publication but, for many reasons, this information is not always explained in publication. As Green *et al*.[46] stated in their discussion of qualitative data, "Given the key role that data analysis plays in assessing the quality of a study, it is surprising how often details about the process of analysing qualitative data are missing from the reporting of studies…". They go on to explain that reporting of data analysis in the literature often lacks detail or includes only broad statements about the analysis which promotes a perception that the "data analysis has been done properly".[47] Primary data without context is like finding a single sheet of paper in a file—the record allows some interpretation of meaning but the reader has no way of knowing that their interpretation is in any way that of the record producer.

The data management proposed by most current initiatives such as ANDS and the OECD[48] do not provide adequate guidelines on the retention of the records which give the data context. While the data gathered may be retained, it may not be clear how/why the primary data were gathered in particular way; or how/why one interpretation of the data was preferred; or how/why a particular conclusion was reached. Quite simply, we have data but know none of the possible assumptions upon which it was gathered, analysed and interpreted. The Working Group on Data for Science provided a number of well-reasoned definitions that parallel those used in recordkeeping, for example:

Data archiving
A curation activity that ensures that data are properly selected and stored, can be accessed, that their logical and physical integrity are maintained over time, and that concerns about security and authenticity continue to be addressed and monitored.

Data preservation
An activity within archiving in which specific items of data are maintained over time so that they can still be accessed and understood through changes in technology. [49]

Curation is a term used more commonly in the museum field, although archivists would argue that much of a curator's work is done during arrangement and description. The important theme in both the museum[50] and archive[51] world is to preserve the provenance. This means that, in order to curate data successfully, one must know about the data creation, about the people, about the research instruments, about the data collection method, and about the institution around the project. Adrian Cunningham described the way a researcher may deal with their research records under pressure[52] when he described the last few days in the offices of William McBride. He watched as McBride, faced with little time, made quick decisions on whether records would be placed in the private McBride collection or in the Foundation 41 collection. Some records were not retained, for reasons only McBride knew. Cunningham could see that the records retained were not separable and yet they are now in separate collections in the National Library of Australia, based on hasty decision-making.

Minimum metadata for managing the context of research data

In light of the discussion thus far, it is clear that minimum metadata should be gathered about a research project in order to maintain the context over time. It is proposed that certain metadata be gathered for each research project. Ideally this should begin at the start of the project and be added to as the project progresses. The following template (Table 6) provides an indication of the minimum metadata required to maintain effectively the context for research project records.

	Template for collection of research context data
1	**Project Title:** Official title in full with any abbreviated titles associated with the project.
2	**Project Team (full names):** Chief Investigator; Other Researchers; Higher Degree by Research students; Research Assistants; Consultants, etc.
3	**Funding:** Organisation A ($ YEAR 1; $ YEAR 2); Organisation B ($ YEAR 1; $ YEAR 2), etc.
4	**Account Code:** Financial account codes for all institutions.
5	**File Code:** Filing codes/numbers of institution and unit for records coded into RKS.
6	**Dates:** (inclusive date of project) DD/MM/YYYY to DD/MM/YYYY.
7	**Project Status:** Completed in YYYY; Not Complete; Abandoned.
8	**Project Summary:** Full summary of project stages as the stages are reached, with final report summary provided at the end of this section.

	Template for collection of research context data
9	**Publications:** Main reports listed first. Other also publications listed here.
10	**Research Project Files:** Where are they? What format? Summary of content. Where they are stored?
11	**Data Gathered from:** name of databases from which the data for this sheet, especially if retrospective, were gathered. Data Gathered by: name of person/s.
12	**Date collected:** the date this metadata was first collected. Date finalised: the date this metadata was finalised.

Table 6: Template for the collection of minimum research data context

Collection of such metadata about the research project ensures that the data in the repository has context and so has enhanced meaning. For example, a researcher can be tracked as using a particular data retrieval method in totally different research projects. If a research team is proposing to use a particular data retrieval method, the method is more robust if it can be shown to have been used successfully in totally different fields. Problem data sets would also be easier to track, especially if the problem was instrumentation which may be revealed early in a research project but not reported in publication. The possibilities are endless for this metadata schema which, in the Web 3.0 world of semantic web, will enable searching across innumerable repositories. An example (completely fictitious) of how the metadata schema may be represented for a research project from the late 1990s is provided in Appendix 1.

Value of research records

Kennedy and Schauder defined vital records as "those records without which an organisation could not continue to operate. ….Vital records are those which protect the assets and interests of the organisation… ".[53] In their chapter on vital records,[54] they included both laboratory notebooks and research records in their list of "potentially vital records".[55] Do the records produced during a research project represent vital records? Obviously, some records do represent "records without which an organisation [a university] could not continue to operate".[56] Without the records gathered for HERDC, the university would not receive their HEP grant. Research outcome is clearly an asset for the higher education sector. This is why, in all higher education institutions there will be a section of central administration devoted to capturing data on the research quality and output as it relates to the institution's eligibility for government funding. As an example, in the Queensland University sector's combined destruction authority, *University Sector Retention and Disposal Schedule: QDAN 601 v2*,[57] there is the following sentence pertaining to research submissions (Table 7):

601.2/ C127	*Submissions to the Commonwealth department responsible for higher education*	Final institution submission to the Commonwealth department responsible for higher education (formerly Department of Education, Science and Training).	Permanent: Retain permanently by the university

Table 7: Example of disposal sentence for research submissions to Commonwealth departments

Conclusion

Universities are the custodians of research project records and the research reporting records both of which are vital records. These records are an asset that represents part of Australia's knowledge infrastructure.[58] The amount of public funds provided to research through the NCGP and NHMRC should mean that the results of the research—the data—are treated like gold or any other precious metal mined and then reused/recycled. Much of the university sector treats this valuable resource more like a ream of paper, something that might be recycled if time permits, but it is much easier to get another ream out of the cupboard. Currently the majority of research records appear to be treated similarly to "consumables and office supplies"[59]—an indirect cost that the sector does not have control over.

In his discussion of knowledge and the CSIRO, Collis stated:

> One of the unique strengths of the CSIRO has been the breadth of scientific fields covered by its Divisions… Over the decades this has led to an extraordinary accumulation of knowledge within one institution… Each generation of scientists in CSIRO has been able to stand on the building blocks created by the previous generation, and in turn lay down new foundations for the next. This is quite different from countries such as the United States where most government-initiated science is put out to contract… While such 'out-sourcing' is lauded by some economists because it allows government to avoid the responsibility and cost of sustaining public research capability, it can, over time, make a national science effort fragmented and inefficient with constant reinventing of the same wheels. [60]

It is hoped that, by proposing the collection of simple metadata around the research project records, which brings together contextual information already in the recordkeeping systems and information management systems of an institution, Universities will be encouraged to retain more than the minimum records that the writers of the *Code* imagined existed by the time a research project reaches the mothballing stage, as indicated by the quote "[research data] may be all that remains of the research work at the end of the project".[61]

This metadata capture, along with good record management practices, will ensure that the context around research data is regarded just as importantly as the data itself.

End notes

1 Organisation for Economic Co-operation and Development (OECD), Committee for Scientific and Technological Policy. (2004). *Science, technology and innovation for the 21st century. Meeting of the OECD Committee for Scientific and Technological Policy at Ministerial Level, 29-30 January 2004: Final communique*. Paragraph 3. Retrieved December 9, 2009, from http://www.oecd.org/document/0,2340,en_2649_34487_25998799_1_1_1_1,00.html

2 See entry for Charles Fraser, government botanist, in George, A. (2009). *Australian botanist's companion*. Kardinya, WA: Four Gables Press. See also Chapter 4, Institutions, organisations, societies, in the same publication for historical information on Australia's research organisations.

3 Working Group on Data for Science. (2006). *From data to wisdom: Pathways to successful data management for Australian science* (p. 32). Canberra: Prime Minister's Science, Engineering and Innovation Committee. A paper prepared by an independent Working Group for the Prime Minister's Science, Engineering and Innovation Council (PMSEIC).

4 Department of Education, Training and Youth Affairs. (1999). *Knowledge and innovation: A policy statement on research and research training*. Canberra: DETYA.

5 Department of Industry Sciences and Resources. (2001). *Backing Australia's ability: An innovation action plan for the future*. Canberra: Australian Government.

6 Department of Education Science and Training. (2005). *The Australian Government's innovation report 2004-05: Real results real jobs*. Canberra: Australian Government.

7 Department of Education Science and Training. (2006). *Knowledge transfer and Australian universities and publicly funded research agencies: A report to the Department of Education, Science and Training*. Byron Bay, NSW: PhillipsKPA Pty Ltd.

8 Department of Education Science and Training. (2006). *National collaborative research infrastructure strategy (NCRIS)*. Canberra: DEST.

9 Working Group on Data for Science. (2006). *op cit*. e.g. p. 53.

10 Australian National Data Service (ANDS) Technical Working Group. (2007). *Towards the Australian data commons: A proposal for an Australian national data service*. Canberra: Department of Education Science and Training.

11 International Organization for Standardization. (2001). *Information and Documentation–Records Management–Part 1: General (ISO 15489–1)* (p. 3). Geneva: ISO.

12 Department of Education Science and Training. (2004). *Higher education research data collection: Specification for the collection of 2003 data*. Canberra: Higher Education Group, DEST.

13 *ibid*. pp. 5-6.

14 Maier, R., Hädrich, T., & Peinl, R. (2009). *Enterprise knowledge infrastructures* (2nd ed.). Berlin: Springer-Verlag.

15 *ibid.* p. 5.

16 Australian Government, National Health and Medical Research Council, Australian Research Council, & Universities Australia. (2007). *Australian code for the responsible conduct of research*. Canberra: Australian Government.

17 *ibid.* p. 1.

18 *ibid.* pp. 2.1–2.3, 8.1.

19 *Ibid.* p. 2.1–2.2.

[20] *ibid.* p. 8.1.

[21] *ibid.* p. 8.3.

[22] *ibid*. p. 2.3.

[23] Working Group on Data for Science. (2006). *op cit.*

[24] Australian National Data Service (ANDS) Technical Working Group. (2007). *op cit.* p. 4

[25] Commonwealth Department of Education Science and Training. (2002). *A framework for an Australian research and education network:* Final Report of the Systemic Infrastructure Initiative Higher Education Bandwidth Advisory Committee. Canberra: Department of Education Science and Training. This committee reported on the broadband network for higher education including a proposed Australian Research and Education Network (AREN).

[26] Department of Industry Sciences and Resources. (2001). *op cit.* p. 44.

[27] Working Group on Data for Science. (2006). *op cit.* p. 44.

[28] Australian National Data Service (ANDS) Technical Working Group. (2007). *op cit.* p. 5.

[29] The ARC is a statutory authority within the Department of Innovation Industry Science and Research portfolio which "advises the Australian Government on research funding and policy and, through its management of the NCGP, promotes the conduct of research and research training that is of the highest quality for the benefit of the Australian community". The ARC provides statistics on the number of applications made that don't get funding each year (see ARC website Retrieved November 12, 2009, from http://www.arc.gov.au/general/searchable_data.htm). In general the average success rate across Australia is approximately 32%. See Department of Innovation Industry Science and Research. (2009). Australian Research Council (ARC) fact sheet. Retrieved November 9, 2009, from http://www.innovation.gov.au/Section/AboutDIISR/FactSheets/Pages/AustralianResearchCouncil(ARC)FactSheet.aspx) In 2009–10 the ARC controls $652.831 million in NCGP funding. The ARC is currently administering funding provided to almost 4,650 research projects Australia-wide, involving more than 10,200 researchers.

The NHMRC is an independent statutory agency under the amended *National Health and Medical Research Council Act 1992*. See National Health and Medical Research Council. (2008). *NHMRC submission to the review of the National Innovation System*. Retrieved November 2, 2009, from http://www.innovation.gov.au/innovationreview/Documents/271(R)-NHMRC.pdf) The NHMRC is the premier research and development body for health and medical research in Australia. It supports research through grants but also is entrusted to build research capacity.

[30] Allen Consulting Group. (2009). *The indirect costs associated with university research funded through Australian Competitive Grants*. Final Report. Melbourne: Allen Consulting Group. Retrieved December 9, 2009, from http://www.industry.gov.au/Section/Research/Documents/IndirectCostsUniResearch.pdf

[31] *ibid.*

[32] Department of Education Science and Training. (2004). *op cit.* p. 6.

[33] Australian Government, National Health and Medical Research Council, Australian Research Council, & Universities Australia. (2007). *op cit.*

[34] Department of Innovation Industry Science and Research. (2009). *2010 Higher education research data collection: Specification for the collection of 2009 data*. Canberra: Research Funding and Policy Branch, Department of Innovation Industry Science and Research.

[35] For a discussion of ERA see Pember, M., & Cowan, R. A. (2007). Promoting records management and archives research in Australia. *Informaa Quarterly, 23*(4), 32–36 and http://www.arc.gov.au/era/default.htm

[36] Disposal Authorities are documents approved by the national and state records authorities which define the minimum periods of time that different records must be kept so that they are maintained for as long as they have administrative, legal, financial or research value.

[37] Public Records Office Victoria. (2002). *General retention and disposal authority for the records for higher and further education institutions* (PROS 02/01). Retrieved December 9, 2009, from http://www.prov.vic.gov.au/records/pdf/edutraining/prov_a02-01.pdf

[38] Records are defined as "information created, received, and maintained as evidence and information by an organisation or person, in pursuance of legal obligations or in the transaction of business". See International Organization for Standardization. (2001). *op cit.* p. 3.

[39] State Records New South Wales. (2005). *General retention and disposal authority: University records GDA 23.* Sydney: RecordsNSW. Retrieved November 12, 2009, from http://www.records.nsw.gov.au/recordkeeping/resources-for/universities/universities; Queensland State Archives. (2009). *University sector retention and disposal schedule: QDAN 601v.2*. Brisbane: QSA. Retrieved November 12, 2009, from www.archives.qld.gov.au/downloads/Universities.pdf

[40] In general the average success rate across Australia for grants is approximately 32%. See data schedules retrieved December 10, 2009, from http://www.arc.gov.au/general/searchable_data.htm.

[41] While the grant is awarded not to an individual researcher but to the higher education institution, it is possible that grants may move between higher education institutions if the chief investigator moves to a new institution (see funding rules and variation to funding agreements). Retrieved December 9, 2009, from http://www.arc.gov.au

[42] Note the fact that funding has finished does not necessarily mean that the research has finished in the mind of the researcher. Funding is needed to continue research in most cases.

[43] Queensland State Archives. (2009). *op cit*. This Queensland practice is reflected in some other jurisdictions, for example New South Wales but not in all, for example, the University of Western Australia Records Disposal Authority recommends archiving proposals of successful research grants and disposing after 1 year those that are unsuccessful.

[44] Jones, E. (2008). *E-science talking points for ARL deans and directors*. Washington D.C.: Association of Research Libraries.

[45] International Organization for Standardization. (2003). *Space data and information transfer systems–Open archival information system–Reference model (ISO ISO 14721).* Geneva: ISO. See also Doorn, P., & Tjalsma, H. (2007). Introduction: Archiving research data. *Archival Science 7*: 1–20.

[46] Green, J., Willis, K., Hughes, E., Small, R., Welch, N., Gibbs, L., *et al*. (2007). Generating best evidence from qualitative research: The role of data analysis. *Australian and New Zealand Journal of Public Health, 31*(6): 546.

[47] Green, J., Willis, K., Hughes, E., Small, R., Welch, N., Gibbs, L., *et al*. (2007). *op cit.* p. 546.

[48] Australian National Data Service (ANDS) Technical Working Group. (2007). *op cit.*; Organisation for Economic Co-operation and Development (2007). *OECD principles and guidelines for access to research data from public funding*. Paris: OECD.

[49] Working Group on Data for Science. (2006). *op cit.* pp. 15–17.

[50] Tibbo, H. R., & Duff, W. (2008). Toward a digital curation curriculum for Museum Studies: A North American perspective. In *The digital curation of cultural heritage*. 2008 Annual Conference of CIDOC Proceedings (pp. 1–26). s.l.: CIDOC.

[51] Bettington, J., Eberhard, K., Loo, R., & Smith, C. (Eds.). (2008). *Keeping archives* (3rd ed.). Canberra: Australian Society of Archivists.

[52] Cunningham, A. (2007). Collecting archives and the Australian series system. In Australian Society of Archivists Committee on Descriptive Standards. (Ed.). *Describing archives in context: A guide to Australasian practice* (pp. 71–75). s.l.: Australian Society of Archivists.

[53] Kennedy, J., & Schauder, C. (1994). *Records management: A guide for students and practitioners of records and information management with exercises and case studies* (p. 287). Melbourne: Longman Australia.

[54] Kennedy, J., & Schauder, C. (1998). *Records management: A guide to corporate recordkeeping* (2nd ed.). (Chapter. 11). Melbourne: Addison Wesley Longman Australia.

[55] Kennedy, J., & Schauder, C. (1998). *op cit.* p. 243.

[56] Kennedy, J., & Schauder, C. (1994). *op cit.* p. 287.

[57] Queensland State Archives. (2009). *op cit.*

[58] Maier, R., Hädrich, T., & Peinl, R. (2009). *op cit.*

[59] Allen Consulting Group. (2009). *op cit*. p. 31.

[60] Collis, B. (2002). *Fields of discovery: Australia's CSIRO* (p. 478). Crows Nest, NSW: Allen & Unwin.

[61] Australian Government, National Health and Medical Research Council, Australian Research Council, & Universities Australia. (2007). *op cit.* p. 2.1.

Appendix 1: Example of metadata collected for a fictitious research project

Collection of Research Context Data
Project Title: Marine Survey of Fictitious Place (Marine flora of Fictitious Place), (Marine vertebrates of Fictitious Place), (Marine invertebrates of Fictitious Place) (Marine protists of Fictitious Place).
Project Team: Professor D.R. Who (CI), Professor D. Vader, Assoc. Prof. Jacqueline [Jac] Daniels, Yasim Persoon, Christopher Robin, Edward [Ted] Bear, Seethree P. Oh, Timothy Tam, Glen Phidick, Mr Y.O. Yo.
Funding: Museum Victoria ($150,000 1996-1997; $150,000 1997-1998), Victorian Institute of Marine Science (VIMS) ($40,000 1997; $20,000 1998), Australian Biological Resources Study (ABRS) ($30,000 1998-2000).
Account Codes: 1465 3478 (University of Southern Victoria); UOQAC 000465896 (University of Outback Queensland).
File Codes: Exonvaldez Marine Institute File #: 6.9
Dates: 1/12/1996 to 1/06/2000.
Project Status: Completed in 2000.
Project Summary: 1995 (from original grant proposal): The area of Fictitious Place has been proposed for international environmental heritage listing. The port of No Name City is an important import and export transit point for the farming and mining communities of southern Victoria. A proposal has been made by the AOK Regional Council to dredge the port of No Name City. A number of previous flora and faunal studies have indicated that there is at least one mammal, five seaweeds, and one seagrass on the 'red list'. The Exonvaldez Institute proposes to fully survey the marine biota of Fictitious Place so that the decision to deepen the port can made based on more information. The survey will also provide the federal government with information regarding the proposal for international heritage listing. 1998 (from interim report): ….. 2000 (from final report): ……

Collection of Research Context Data
Publications: Note this is a sample. There would be many more listed in a project of this size. The clause 'note this is a fictitious reference' has been added in case these references are picked up and indexed by a search engine in the future. Reports can tell a story, for example. the move of EMI from Cape Otway to Weipa. Who, D.R.; Vader, D.; Daniels, J., & Tam, T. (1998). *Report to the Department of Sustainability: Fictitious place marine survey*. Melbourne: Exonvaldez Marine Institute, University of Southern Victoria. Vader, D.; Daniels, J.; Who, D.R., & Persoon, Y. (1999). *Fictitious place marine survey: The marine vertebrates*. Melbourne: Exonvaldez Marine Institute, University of Southern Victoria. Who, D.R.; Vader, D.; Daniels, J., & Tam, T. (2000). *Final report to the Department of Sustainability and Energy: Marine survey of fictitious place.* Weipa: EMI, University of Outback Queensland. Bear, T. (1999). Microalgal identification in southern Victoria using digital guides. *Australasian Society for Phycology and Aquatic Botany, 19*(1): 6–37 (note this is a fictitious reference). Bear, T., & Townsend, B. (1999). An account of common non-geniculate coralline algae (Corallinales, Rhodophyta) from macrophyte communities at Ficticious Place, Southern Victoria. In A.H. Wookie, & T. Ardis. (Eds.). *The seagrass flora and fauna of the Cape Otway region* (pp. 395–408). Melbourne: Museum Victoria (note this is a fictitious reference). Yo, Y.O. (2000). Running DELTA on an SQL server. *DELTA Technical Reports* No. 10 (pp. 1-67). (note this is a fictitious reference). Ardis, T.; Persoon, Y., & Robin, C. (2004). A new rare and endangered stomatoporid from southern Victoria. *Zoologia, 3*(23): 177–186. (note this is a fictitious reference).
Research Project Files: *Project Context files:* 5 Archive boxes of paper records stored UOQ, Weipa Campus; Bldg 3G Rm G110. 1 MB digital information stored in the form of MSOffice 2000 files, Mindmap™ files, CorelDraw files stored S://imt.unioqu.edu.au/research/groups/emi/emi_project 1old files. *Project Data files:* 3 GB digital information stored in the form of DELTA files, JPEG images, MSExcel file index to images, MapMaker™ files, EMI survey dataset stored S://imt.unioqu.edu.au/research/groups/emi/emi_project 1old data *Museum Victoria:* 500 marine vertebrate specimens including 235 DNA vouchers. 7300 marine invertebrate specimens including 4200 DNA vouchers. 1500 marine protist specimens including 1200 DNA vouchers. *National Herbarium of Victoria.* 900 marine plant specimens including 478 DNA vouchers *Genebank* 6113 DNA sequences registered.
Data from: Exonvaldez Marine Institute Project Dta base (EMI.mdb); UOQ Grants.mdb; UOQ e-Publish. **Data gathered by:** R-two Deetwo.
Date data collected and finalised 31 December 2001

ROBERTA A. COWAN – Murdoch University

PhD(UniSydney), MIM(Curtin), GradDipLIS(Curtin), BScHons(Univ Melb.), CertMusStud (ECU).

Roberta has a doctorate in biological taxonomy, a masters in archives and records management, postgraduate qualifications in librarianship, and a certificate of museum studies. In her adjunct role at Murdoch University School of Biological Sciences and Biotechnology and Murdoch Library, Roberta conducts research in biological taxonomy and information management. Roberta was employed at University Information Management, Curtin University of Technology, until the end of 2009 and continues to volunteer in the Curtin University Archives. She is also the Archivist at Santa Maria College (WA) and for the Pallottine Community of Australia. She has published widely in the fields of botany, biological systematics, history of science, librarianship, business history, information systems, information literacy and record keeping.

Roberta can be contacted at r.cowan@murdoch.edu.au

MICHELLE LILLICO – Curtin University of Technology

BA(ECU), GradDipR&A (Curtin), GradCertIMS (Monash), CertMusStud (ECU), Cert IV Frontline Management (TAFE).

Michelle is currently University Archivist at Curtin University, working within CITS Information Management, where she is directing the inactive records program and part of the team working to develop and implement *flow*, an open source content management system across the University. Michelle is committed to the ongoing identification and preservation of the documentary history of Curtin. Michelle has worked as the archivist/records manager for the Sisters of Mercy, Perth and West Perth, and has worked as a knowledge assistant for Corrs Chambers Westgarth Lawyers, Perth Knowledge Centre.

Michelle can be contacted at m.lillico@curtin.edu.au