

The International Journal of Digital Curation

Issue 1, Volume 2 | 2007

UK Research Funders' Policies for the Management of Information Outputs

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June 2007

Abstract

A successful research and innovation system depends on the open exchange of ideas, information and knowledge. But both research methods and the scholarly communications system are undergoing fundamental changes which present new opportunities and challenges in communicating the results of research. Funders are at different stages in responding to these changes, and this in turn presents challenges to researchers and research institutions. This paper reports on the findings of a study undertaken in 2006 into the policies, practices and views of a range of the major funders of research in the UK in relation to the management of the information outputs generated with the benefit of their support. It covers the full range of information outputs, including journal articles and monographs, but also other outputs, including data, that are not generally published in traditional form. The article also presents conclusions as to issues that need to be addressed in the development of a coherent and consistent policy framework for the future.

Introduction

Research and development (R&D) activity accounts for £20 billion of annual expenditure in the UK (Office of Science and Innovation, [2004](#)), and information - in the form of both published articles and monographs, and of generally unpublished data - is one of the biggest products of that investment. But funders' policies in relation to the management of those information outputs vary significantly, partly because of the different contexts in which they operate and the different communities they serve. Differences in policy, and in views as to where responsibility lies, both in policy development and in the provision of information services, mean that researchers do not receive from funders a consistent view as to how they should handle the various information outputs they produce.

This paper reports on the findings of a study commissioned by the Research Information Network (RIN) of the policy and practice of UK research funders in managing the information outputs produced with their support. The study was undertaken in 2006 and aimed to provide a comparative overview of how different groups of funders expect the researchers they support to manage and provide access to the information outputs from their research. It also aimed to describe funders' corporate approach to the use of information as part of the overall research process.

To obtain a broad view of the landscape, the study examined the policies and practice of a selection of around 25 of the largest research funders across the public, voluntary, and private sectors in the UK including: the eight Research Councils; seven universities drawn from across the higher education sector, to cover institutions of different sizes and research intensity; and a selection of government departments, of research charities and of industrial bodies that invest significantly in R&D in the UK. A list of the [funders](#) covered by the report is at the end of this paper.

The study sought to:

- describe current policy and practice of major UK research funders with regard to the management of the information outputs produced by researchers whom they support; and
- set out the differences in approaches between funders and explain the reasons behind such differences.

The report (RIN, [2007](#)) presents, of course, only a snapshot of the position as it stood towards the end of 2006, in what is a rapidly developing landscape.

Key Findings

Context

In developing policy and practice in relation to how the information outputs from research are managed and made accessible, funders are seeking to respond to challenges and opportunities set within the broad context of developments in UK Government policy for research and for the higher education (HE) sector more generally (Department for Education and Skills, [2003](#); HM Treasury, [2004](#)). The Ten Year Science & Innovation Framework pages on the DTI website provide an overview

and links to a series of documents on science and innovation policy¹; technological developments; and developments in the publication of research outputs. And all those developments must be set in the wider context of developments internationally.

In research and HE policy, there is increasing emphasis on:

- the contribution that research can make to society and the national economy. (Knowledge transfer - defined as transferring good ideas, research results and skills between universities, other research organisations, business and the wider community to enable innovative new products and services to be developed – is an agenda being increasingly promoted by the Office of Science and Innovation (OSI) and the Research Councils. It features strongly in Research Councils' Delivery Plans.) The DTI website provides a good deal of information about knowledge transfer from the research base²;
- on the need to ensure that the UK sustains a world-class research base; and
- on the need to support that research base with world-class facilities and infrastructure, so that it sustains high productivity at the highest levels of international excellence.

There is a growing recognition – as witnessed, for example, in the Government's *Investment Framework* and in the subsequent work of the E-Infrastructure Working Group established by the Office of Science and Innovation (OSI) (HM Treasury, [2004](#), sections 2.23-2.25; OSI, [2007](#)) – of the important role that the information infrastructure plays in supporting both research and knowledge transfer: world-class research demands world-class information services. But there is also a developing recognition that the UK's infrastructure of information policies and services is widely distributed; and that it has grown haphazardly and less rapidly than the volume of research activity.

Technological developments in the last decade have brought rapid and fundamental change in the handling and dissemination of the published outputs from research, particularly journal articles. Researchers now typically expect to gain access to articles in digital form on their desktop (RIN/CURL, [2007](#)). This has led to increasing demands for immediate access to all published outputs, free at the point of use.

Policy development in the UK has been influenced by international initiatives, and has been dominated over the past two years by moves towards a Research Councils UK (RCUK) position statement, finally published in June 2006, on access to research outputs (RCUK, [2006b](#)). The key policy objective for many funders – although not always clearly articulated - is to enhance the efficiency of the research process and the dissemination of research results by making it easy for anyone interested in research results to gain access to them. The focus within this frame is on access to journal articles and conference proceedings. But there is a growing recognition, especially as the volumes and varieties of data produced by researchers grow at an ever-increasing rate, that there are important issues to address in relation to all kinds of information outputs, especially those that are not formally published.

¹ <http://www.dti.gov.uk/science/science-funding/framework/page9306.html> (All URLs in footnotes retrieved on June 8, 2007.)

² <http://www.dti.gov.uk/science/knowledge-transfer/index.html>

The RCUK position statement has put a basic policy framework in place in relation to journal articles, and the importance of information management is increasingly recognised as an issue to be covered in research management policies and codes. But significant issues remain to be addressed in the development of policies and procedures at local level, in universities in particular, and in developing some key elements of the necessary infrastructure of services.

The General Policy Positions of the Different Groups of Research Funders

Research Councils.

Research Councils have over the past two years focused their attention on publications, particularly journal articles and conference proceedings. The RCUK position statement sets a requirement that Research Council grant-holders should deposit their articles in open access repositories. But important work foreshadowed in the earlier draft statement issued by RCUK in June 2005 (RCUK, [2005](#)) - to ensure that technical standards, metadata and interoperability issues are considered and co-ordinated across the Councils and with other relevant bodies including the British Library, the Joint Information Systems Committee (JISC), the RIN and publishers - has yet to be initiated.

There are many common elements in policy and practice between the Councils, including:

- shared core terms and conditions. All are party to the RCUK position statement;
- agreement that they should not dictate to researchers where they should publish;
- shared agendas in relation to knowledge transfer, communication to society as a whole, and the need to demonstrate effectiveness and value for money;
- the aim of aligning their systems in order to simplify matters for researchers, to allow Councils to share information, and to help Councils to track outputs more effectively; and
- caution as to the utility and sustainability of university-based institutional repositories as a means of facilitating access to research.

There are also significant differences between the Councils. Some employ researchers in their own institutes, as well as providing funding for university-based researchers, and thus have more control over the outputs they produce. And each Council serves different communities who operate differently and produce different kinds of outputs. In the arts and humanities, for instance, monographs and other books retain a central place among research outputs, and creative outputs may be important; while astronomers and particle physicists produce large quantities of data with very different characteristics. As noted in more detail below, Councils differ significantly in the stances they adopt towards unpublished outputs, especially data.

Councils also take account of the needs of audiences beyond the research community who have interests in research outputs. The Economic and Social Research Council (ESRC), for instance, stresses the importance of communicating findings to potential users in business, government and the voluntary sector (see the ESRC

communications policy outlined on the Society Today website³); while the Medical Research Council (MRC) emphasises speed of access to research results for health practitioners (MRC, [2006](#)).

Universities.

The demands of the Research Assessment Exercise (RAE), and ensuring that their academic staff produce the requisite number of high-quality research outputs, remain dominant concerns for most universities. But they are also increasingly seeking to ensure that their research outputs are made widely accessible. The focus of attention is on one type of output - peer-reviewed articles - and the establishment of repositories in which such articles should be deposited. As yet, such repositories are not yet well-established across the higher education sector (as noted below, there are some 80 repositories in the higher education sector in the UK listed in the Directory of Open Access Repositories⁴, but few repositories as yet have significant amounts of content. And in general terms universities have a range of different motivations for establishing repositories and making outputs more readily accessible:

- to disseminate research effectively for the benefit both of researchers and of others who are interested in research results, potentially leading to higher levels of citation;
- to present the range and depth of the university's research to a wider constituency; and
- to enable other researchers to see the university's range of research and to promote relationships with the university's research teams.

Universities vary in the priority they attach to these aims. Codes such as the Russell Group's 2005 code of research governance (Russell Group, [2005](#)) cover such issues as dissemination and monitoring of research outputs, and the recording and archiving of research results and data. But it is not clear that universities have worked out in any thoroughgoing and rigorous way the practical and policy implications of commitments that have been expressed so far in very general terms.

Charities.

The Wellcome Trust has taken a lead in its commitment that communication of research results is an essential part of the research process (Wellcome Trust, [2006](#)). It too has focused on journal articles, and it was the first major UK research funder to require deposit in an open access repository. It now requires deposit within six months of papers arising from Wellcome funding, in the PubMed Central service established by the US National Library of Medicine. The Trust has also led a group of UK research funders in establishing UK PubMed Central, which began operation in January 2007⁵.

The Leverhulme Trust, by contrast, has no specific policies as to how the researchers it funds should manage, preserve, and allow access to the information outputs they produce. The Trust requires grant-holders to report on the publications that have arisen from work it has supported, and to provide copies of the publications to the Trust, but makes no other stipulation (Leverhulme Trust, [2004](#)). Similarly, the Royal Society has no detailed policies on research information outputs. But drawing in

³ <http://preview.tinyurl.com/2guent>

⁴ <http://www.opendoar.org/>

⁵ <http://ukpmc.ac.uk/>

part on its position as a publisher, the Society has expressed some concerns about the risks that recent developments pose to learned society publishers. The Society's concerns have been set out in a number of documents available on its website⁶.

Government Departments.

Government departments generally expect researchers to publish the results of the research they fund, and they understand the importance of publication in scholarly journals. But departments do not see such publication as an end in itself. They also promote publication in formats that facilitate the widest possible impact among practitioners, and accessibility to lay audiences. Some departments are developing portals to facilitate access to the research they fund: the Department of Health is developing what will be in effect a portal under the National Institute of Health Research banner⁷. But departments have shown as yet little interest in issues relating to the management of unpublished data arising from the research they fund.

Commercial Organisations.

The companies interviewed for the study had little in the way of documented policies on managing and providing access to research outputs. They understand the imperative to publish in learned journals; and though they typically include in their contracts with universities provision to vet and delay publications, they all regard delays or changes as the exception rather than the rule in their funding of basic research. But with consultancy contracts, companies expect to have sole rights to research results. None of the companies stipulate to university researchers where or how they publish; and publication by members of company research teams is seen as contributing to the prestige and standing of the company. Like government departments, they have shown little interest in the management of unpublished research data.

Policies Regarding Different Categories of Published Outputs

Peer-Reviewed Journal Articles.

In the sciences in particular, articles published in academic journals are considered the most important form of published output, and it is not surprising that attention has focused on them. Policy development has focused on facilitating rapid and comprehensive access, which is often perceived as being inhibited by the cost of journal subscriptions. The objective for many funders is to make it easy for anyone interested in journal articles to gain access to them.

Two principal routes have been devised to make journal articles available to readers free of charge at the point of use. The two routes carry with them significantly different implications of policy, practice, and funding. The first, so-called "gold", route is based upon "open access" journals, supported not by the traditional subscriptions, but either by grants and voluntary effort, or by publication fees paid by authors, their funders or employing institutions. But issues have arisen as to the arrangements to meet such fees. Research Councils affirm strongly that researchers themselves should choose where to place their articles; and that it is for researchers' employing institutions to decide whether or not to pay publication fees. Under certain conditions, when publication costs will be incurred during the lifetime of a project grant, Research Councils allow provision for publication fees to be included in grant applications; and

⁶ <http://www.royalsoc.ac.uk/page.asp?id=3967>

⁷ <http://www.nihr.ac.uk>

under the Full Economic Costing regime for funding research projects (introduced in 2005), universities can include in the indirect costs specified in their grant applications provision for meeting such fees even when they will fall due after the project has been completed, as part of the overall cost base of the university's research activity. These new arrangements are as yet not widely understood, however, and there is clearly scope for improving and building upon the guidance provided to researchers and research institutions by the Research Councils and the RIN (ESRC, [2006](#); RIN [2006](#)).

None of the universities interviewed had yet developed a detailed policy on payment of publication fees, and none had modelled the potential cost. But none expressed any objection in principle to paying such fees, so long as the costs could be contained. Among charities, the Wellcome Trust has introduced a scheme to meet publication fees for researchers in some key universities (an outline of the arrangements is available on the Trust's website⁸); but both the Leverhulme Trust and the Royal Society expressed reservations about the model, although the Royal Society has recently launched an open access trial for its own publications. The Government departments interviewed will not pay publication fees; and none of the commercial organisations interviewed had had any discussion with researchers about payment of such fees.

The second, so-called "green", route is through the establishment of repositories for e-prints, which are seen increasingly by Research Councils and universities, along with the Wellcome Trust, as the key route to enhancing access to journal articles. But as noted in more detail below, policies and procedures have still to be worked out, and different funders have significantly different perspectives on the role and value of repositories.

Conference Papers.

Refereed conference papers have similar status to peer-reviewed journal articles in many disciplines. Issues may arise, however, as to permissions and the availability of digital versions to facilitate deposit in repositories. There are differing views among research funders and universities on the value of non-refereed conference papers, and whether or not they should be placed in repositories.

Books and Book Chapters.

Books are vital in some disciplines, in the arts and humanities and the social sciences in particular. The Arts and Humanities Research Council (AHRC) and ESRC are thus concerned that policies should take full account of the needs of researchers for whom books remain of critical importance as outputs from and inputs to their research. More complex issues arise, however, in making books, as distinct from journal articles, more widely and freely available over the internet. Universities generally wish to include book content in their repositories, but coverage is very limited at present. In practical terms, depositing book content raises difficulties because books require individual copyright clearance (there are no blanket arrangements as there are for journal articles); and because there is often no readily available electronic version of the content as published.

⁸ <http://www.wellcome.ac.uk/doc%5Fwtx036803.html>

Policies Regarding Outputs That Are Not Formally Published

While the focus of attention has been on published outputs, positions on handling non-published outputs are less assured and more variable.

Theses and Dissertations.

Access to theses is now being addressed at national level by the EThoS Project, which aims to provide a UK online electronic theses service, and to create a central hub to find all UK theses (see project website⁹ for a description of the project). Following its completion and an independent evaluation of the project, in January 2007 over 70 higher education institutions expressed an intention to join EthOS. EThOSnet is now working with the British Library and the higher education community to create access to e-theses that is both technically and organisationally sustainable. Although all Research Councils, and some charities and commercial organisations, fund postgraduate research, it is universities that are responsible for the regulations relating to submission and examination of theses and dissertations, and the award of degrees. Funders other than universities thus have no specific policies in relation to managing theses as information outputs and making them more widely available. It is notable that some universities exclude theses from their repositories on the grounds that the repository should contain only peer-reviewed content.

Data.

Data are increasingly recognised as essential products and by-products of research, and the foundation for many other outputs, in the form of journal articles and other publications. Increasing volumes and varieties of data are being produced by researchers in the course of their research, and data creation may indeed be a funded research activity in itself. Access to and re-use of data are thus becoming increasingly important in the research process. While they are typically not “published” formally themselves, data are an essential part of the evidence necessary to reconstruct and evaluate research results, and the events and processes leading to those results. It is perhaps significant that while many publishers are hesitant about open access to published text, researchers are more hesitant about open access to data. But there are concerns among some research funders that the lack of co-ordinated policies for collecting and managing important datasets puts them at risk.

Differences in the nature and origins of data bring with them differences in value, and implications for policy and practice. And there are major differences in the degree to which funders see it as their responsibility to make data accessible and act as long-term guardians.

Some **Research Councils** such as AHRC¹⁰, the Council for the Central Laboratories of the Research Councils (CCLRC)¹¹, ESRC and the Natural Environment Research Council (NERC) have a reasonably well-developed infrastructure and associated policies for data curation, preservation and access. The

⁹ <http://www.ethos.ac.uk/>

¹⁰ The work reported on in this paper was completed before the AHRC announced in March 2007 its decision to cease funding, from the end of March 2008, the Arts and Humanities Data Service. The full implications of that decision are not yet clear.

¹¹ The interviews for this study took place before the decisions to merge the Particle Physics and Astronomy Research Council (PPARC), the Council of the Central Laboratory of the Research Councils (CCLRC) and the nuclear physics work of the Engineering and Physical Sciences Research Council (EPSRC).

NERC, for example, has a series of data centres covering each of its main areas of activity, and its data policy (currently under review) requires that award holders offer a copy of any dataset resulting from NERC-funded activities to one of those centres (NERC, [2002](#)). Other Councils have in practice passed data management responsibilities on to bodies other than themselves. There are issues for all the Councils as to the proportion of their budgets they are prepared to devote to such services. Some are now seeking to learn from each others' experiences, for example, in joint MRC/Biotechnology and Biological Sciences Research Council (BBSRC) discussions; and in MRC/ESRC joint work on issues arising from population datasets. Following the completion of the study reported on in this paper, BBSRC launched a data sharing policy in April 2007 (BBSRC, [2007](#)); and in May 2007 the MRC set out a series of principles on access to, and use of, MRC-funded research data (MRC, [2007](#)). Some Councils are also considering how to reward researchers for the creation of valuable datasets that may not lead to a conventional scholarly publication.

Universities tend to leave the management of datasets produced by their researchers largely to the researchers themselves and their departments. Such policies as there are relate largely to the need to meet funders' requirements. Although a few universities – five of those listed in the Directory of Open Access Repositories¹² – appear to be seeking to gather datasets together in their repositories, the universities interviewed for this study believe that data curation is a specialist task, to which they themselves are not well suited. Thus they do not require or encourage the deposit of data in institutional repositories, instead acknowledging that a subject-based approach to data archiving is likely to remain predominant for the foreseeable future. It is notable, however, that a recent RIN study shows that academic librarians are keen to take on the role of managing and curating research datasets (RIN/CURL, [2007](#)).

Among **charities**, the Wellcome Trust is seeking to support easier access to data through UK PubMed Central and other initiatives. It recognises, however, that systematic storing and access to data will happen more slowly than access to journal articles.

Although **government departments** have legal obligations in relation to their own records, they generally cede responsibility for data generated as a result of funded research projects to the relevant research institution.

Most of the **commercial organisations** interviewed had no specific policies or views on preserving and providing access to data or digital assets. Since they lack the necessary expertise to deal with such issues, they generally cede responsibility for data generated as a result of funded research projects to the relevant research institution.

Performances and Related Outputs.

In areas, particularly in the arts and humanities, where performances and portfolios of creative work can constitute significant outputs of research, the Arts and Humanities Data Service (AHDS) plays a useful role in collecting, preserving and promoting the re-use of electronic resources which result from research.

¹² <http://www.openoar.org/>

Grey Literature.

Grey literature in the form of reports produced and published by research institutions and funders can form a significant output of many research projects; and the internet has made publishing grey literature relatively simple. But there are differences of perception as to its value. For funders such as ESRC – as well as government departments which place emphasis on the impact of research in influencing policy-makers and practitioners – making sure reports, summaries and other grey literature are available is very important. Universities are typically more concerned to present material of proven quality. Even those that include grey literature in repositories put it in a category or location separate from the peer-reviewed journal articles that are their primary focus of attention.

The Development and Role of Repositories

There are currently over eighty institutional and subject-based repositories in the UK identified by the Directory of Open Access Repositories. Most still have relatively small amounts of content, but they are growing. Detailed policies and procedures have still to be worked out in many cases, however, and different funders and universities have significantly different perspectives on their role and value.

Six of the eight **Research Councils** now require the deposit of journal articles in “an appropriate repository”, but many Councils express caution about the utility of *institutional* repositories. Their concerns focus on sustainability, and the difficulties in creating a coherent and consistent system across a large number of universities, issues that the Joint Information Systems Committee (JISC) is seeking to address through its repositories programme¹³. Several Councils see subject-based repositories as a more effective way forward; and this has led the BBSRC and the MRC, for example, to support the development of UK PubMed Central. Other Councils, such as CCLRC and NERC, have established their own repositories for the publications of the research staff they directly employ; while ESRC is seeking to develop its Society Today service¹⁴ to provide access to the outputs produced by the researchers it funds.

Many **universities** are now developing repositories, stimulated by the RCUK position statement and commitment from librarians, and by funding from JISC. Universities see repositories as a way of providing a showcase for the university and its research, and of improving the efficiency of research and scholarly communications. These two motivations are interlinked, but variation in the emphasis given to each of them carries implications for policy and practice. Key issues of policy remain to be settled, including:

- the scope of repository content, and whether that should be restricted to peer-reviewed journal articles or expanded to cover pre-prints, reports and working papers, books, theses, and recordings of performances and audiovisual works
- whether researchers should be required, or simply encouraged, to deposit their outputs. Universities have been reluctant to act themselves, rather leaving it to Research Councils and other funders
- the role of university libraries in managing repositories and providing training and advice for the deposit of material within them

¹³ http://www.jisc.ac.uk/whatwedo/programmes/programme_rep_pres.aspx

¹⁴ <http://www.esrc.ac.uk/ESRCInfoCentre/index.aspx>

- the mechanisms for deposit and the creation of metadata, and whether this should be handled by authors, or by repository managers
- the relationships between institutional and subject-based repositories, including how to avoid researchers' having to deposit their outputs in more than one repository
- linkages between the contents of institutional repositories and other related services and content, including research information systems and grants databases
- the costs of running repositories and the linkages between them, and how they should be met in the long term

In many universities, development of a repository is being accompanied by a review of the university website, and in particular the availability of journal articles and other outputs on departments' and individuals' sub-sites. More central oversight of websites is a goal for many universities.

All funders are aware that deposit of significant numbers of articles in repositories could lead to loss of subscriptions to established journals, and the danger this may pose to learned societies in particular. Some publishers now allow access through open access repositories after an embargo period following publication. It is not clear how publishers may change their policies if significantly more authors begin to provide access to their articles through a repository. Concerns about the impact of repositories continue to be expressed by publishers, most recently in a position paper (STM, AAP/PSP, & ALPSP, 2007) issued in May 2007 by the International Association of Scientific, Technical and Medical Publishers (STM), the Association of American Publishers Professional and Scholarly Publishing division (AAP/PSP), and the Association of Learned and Professional Society Publishers (ALPSP). RCUK plans to address this issue through a study to be initiated in 2007.

Metadata and Interoperability

There is growing awareness that development and adoption of improved standards for metadata, and effective exposure so that information can be indexed and searched, are critical to effective management of research outputs of all kinds. But funders have not prescribed formats for the metadata that should be attached to research outputs of different kinds, or the standards that repositories should apply if they are to be recognised by funders as appropriate locations for outputs arising from the research they fund. Most repositories in practice use the Dublin Core metadata set¹⁵ which provides a simple standardised set of conventions for describing materials online. Dublin Core is a mandatory format for the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)¹⁶, a widely adopted protocol designed to collect the metadata descriptions of the information objects in repositories so that services can be built using metadata from many repositories.

The Research Councils which have specialised data archives and data centres – AHRC, CCLRC, ESRC and NERC – have issued the most detailed guidance on metadata. NERC is also actively involved in the development of discipline-specific metadata standards. It is widely accepted that researchers themselves should be

¹⁵ <http://dublincore.org/documents/2006/12/18/dces/>

¹⁶ <http://www.openarchives.org/OAI/openarchivesprotocol.html>

actively involved in providing metadata, as they are the experts in the outputs they produce. But data centres find that many researchers lack the time, skill or motivation to give high priority to this, and that much of the metadata they receive is of poor quality. More generally, there is little sign as yet of a proactive and consistent approach across funders to developing and implementing the tools and standards to ensure interoperability for the benefit of researchers in finding, accessing and using research outputs.

Curation and Preservation

The policies and practice of the Research Councils in relation to curation and preservation have tended to focus – in contrast to their stance on access to research outputs – on data as distinct from publications or other outputs. The AHRC¹⁷, CCLRC, ESRC and NERC see the data centres and archives they support as an essential part of the infrastructure to support high-quality research. Other Councils rely on other agencies to provide the necessary services. Only the CCLRC has taken an active interest in the curation and preservation of published research outputs.

Universities have traditionally, through their libraries, played a critical role in curating and preserving published research outputs in print. But they have tended to look to other bodies, including the British Library as well as Research Council data centres, to meet the challenges of digital curation and preservation, for both published and unpublished outputs.

There are as yet no clear and consistent views as to the role that institutional repositories should play in long-term preservation. For published outputs, alongside the development of repositories, some universities are participating in a pilot programme using the Lots of Copies Keeps Stuff Safe (LOCKSS)¹⁸ tool to ensure that several copies of the entire contents of journals are maintained. The preservation role of an institutional repository, on the other hand, can cover only the published outputs of that institution's staff. For data and other non-published outputs, the role of repositories in long-term preservation also remains unclear, even for the small minority of institutions that are currently intending to collect such material in their repositories. The number of such institutions may grow, but there is an urgent need for clarification of the roles of universities and their repositories on the one hand, and the subject-based data centres on the other, in handling the complex issues of long-term preservation.

Government departments and commercial organisations tend to see curation and preservation of research outputs as a responsibility of the research organisations to which they provide funding.

Intellectual Property

Research funders generally expect that organizations in receipt of funding should exploit the intellectual property (IP) arising from research wherever possible. Most funders' stance on IP issues is set firmly in the context of promoting and facilitating knowledge transfer. There is clearly potential for tension between the aims of widespread and rapid dissemination of research results on the one hand, and of

¹⁷ Here again it should be noted that the implications of the AHRC's decision, taken in March 2007, to cease funding the AHDS, are likely to have a significant impact on its overall stance in relation to the preservation and curation of data.

¹⁸ <http://www.lockss.org/lockss/Home>

protecting and exploiting IP on the other. Most funders recognise that it may be necessary to delay publication in order to secure ownership of IP; but the general view, perhaps surprisingly, is that managing IP does not often conflict with providing access to research information outputs.

Research Councils make no claim to the IP arising from the research they fund in universities and other institutions outside their direct control; but they do require assurance that suitable arrangements are in place. Councils with their own institutes manage their IP more actively, with CCLRC and MRC having their own technology transfer companies. (MRC's company, MRC Technology (MRCT), has been established to commercialise intellectual property arising from its research.¹⁹) Since it directly employs researchers at its own institutes, MRC claims ownership of intellectual property arising from their research. In the case of joint research centres with universities, intellectual property ownership rests with 'the employer of the staff concerned'. Jointly-owned intellectual property rights are the subject of a revenue-sharing agreement. It is notable, however, that none of the Councils raised IP as a major issue in the interviews for this study. And in its evidence to the Gowers Review – an independent review established by the UK Government into the UK intellectual property framework – RCUK did not indicate that IP protection is a significant issue in the management of information outputs from research (Gowers Review of Intellectual Property, 2006; RCUK, 2006a).

Unless there are specific agreements to the contrary, IP created by researchers in universities during the course of their employment belongs to the university. Many universities have, however, as a matter of policy, determined that specific categories of IP should be vested in the staff who produce them; and in practice they make no claim to any income from academic publications (see, for example, the Leeds University policy on intellectual property rights²⁰). Universities do seek to exploit the potential returns from their IP; but many of those interviewed for this study indicated that IP protection arose only infrequently as a requirement in managing information outputs, and that they preferred the benefits that publication and exposure would bring, rather than the relatively small income stream that exploitation of IP might generate.

Government departments have in recent years, following the publication of the Baker Report in 1999 (HM Treasury, 1999), sought more actively to manage the IP arising from their research, with arrangements for joint exploitation of IP created by funded researchers in universities and other institutions. The impact of these measures on access to research outputs is not yet clear.

All the **commercial organisations** interviewed are operating in fast-moving marketplaces and this influences their attitude to publication and IP protection. They want access to research results first, before their competition; but they see their competitive advantage in the ability to embody research rapidly in innovative products and services, rather than in ownership of IP *per se*. Hence they expressed little interest in restricting their university partners' publishing activity in order to protect IP. Rather, they believed in rapid publication of results, in order to avoid the risk of patenting by others that would inhibit their own activities. Some companies expressed concern that universities are themselves seeking unrealistic returns on their IP, and that this is

¹⁹ <http://www.mrctechnology.org/>

²⁰ <http://www.leeds.ac.uk/research/hbook/ipr3.htm>

restricting the value of outputs from collaborative research and inhibiting knowledge transfer. It should be noted, however, that model agreements on who is to own, and have the right to exploit, the intellectual property in the results or outcome of collaborative projects between universities and commercial organisations were developed in 2004 following recommendations of the Lambert *Review of Business-University Collaboration* (HM Treasury, 2003) published the previous year. The five model agreements are available on the DTI website²¹.

Conclusions

A successful research and innovation system depends on the open exchange of ideas, information and knowledge. In order to produce high-quality research, researchers must have easy and rapid access to as wide a range as possible of the data and information produced by other researchers. Similarly, successful dissemination and exploitation of research depends on effective flows of information between researchers and other individuals and organisations with an interest in its results. Technological developments have brought, and will continue to bring, fundamental changes in how those ends are achieved.

Some research funders are taking a lead in engaging with these changes and their implications, many are still at the early stages of seeking to find the most effective responses, while yet others have hardly begun their engagement. But there is a growing realisation that the full value of the wide variety of information outputs from research will be realised only if research policies, practices and support systems develop appropriately. Effective stewardship of information outputs is becoming a more urgent matter as increasing volumes and varieties of outputs are being produced, in forms which demand that stewardship and curation issues are addressed from an early stage in the research process. The different groups of research funders covered in the RIN study are in a strong position to address these issues and facilitate the adoption of good practice, by developing appropriate policies and procedures.

Precise requirements will vary according to the nature of the research, the institutional and funding context, and the broader policy imperatives of funders and research institutions. Nevertheless, there is a strong case for a collaborative approach, with funders working as appropriate through their representative bodies, and in co-operation with key stakeholders and centres of expertise, including:

- representatives of the research community;
- the British Library and other major research libraries;
- the Joint Information Systems Committee (JISC);
- major data centres and services; and
- representatives of the publishing industry.

In the broader context of the development of codes of research governance, the aim should be to establish transparent, equitable and consistent systems for the effective management of information outputs. In developing such systems, no single funder or other agency can act effectively in isolation, nor will it be possible to address all the issues at once. But there is an urgent need to build on the policy framework that has begun to be established through the RCUK Position Statement and related initiatives, so that through pilots and early implementation in specific areas we can

²¹ <http://www.innovation.gov.uk/lambertagreements/>

begin to establish common systems of good practice. Key areas that need to be addressed include:

- *Roles and responsibilities.* There is currently a lack of clarity as to the roles and responsibilities of the key players involved in research and the management of research information outputs, including researchers themselves, funders, research institutions, libraries, and specialist data centres and services. Some are very actively involved in initiatives and the provision of services to manage information outputs, while some rely essentially on provision and policy development by others. It is not to be expected, of course, that all funders should operate in precisely the same way. But in a complex landscape it is important that there should be dialogue between funders and other relevant agencies, and that mechanisms should be established to avoid the dangers of needless inconsistency, of wasteful duplication, and of damaging gaps in policy and provision of services.
- *The different kinds of both published and unpublished information outputs.* Different kinds of output raise different issues and requirements. Much of the attention of funders has focused to date on journal articles and conference proceedings, but it is important also to develop policies and procedures in relation to:
 1. *Books*, which are an important output for some disciplines, especially in the humanities and social sciences; and which cannot be treated in the same way as journals;
 2. *Theses*, where there is a need for universities in particular, building on the EThoS Project, to clarify the extent to which they wish to make theses and dissertations more widely available in digital form; and whether or not theses should be treated as peer-reviewed;
 3. *Grey Literature*, which constitutes an output of central importance to funders such as the ESRC and Government Departments, but is viewed with great caution by many others, including universities; and
 4. *Data*, increasing volumes and varieties of which are now being created and collected in the course of research, and which is of growing importance in the dissemination of research results.
- *Costs and Funding.* There is remarkably little information available about the current overall costs of managing the information outputs of research in the UK and providing access to them. Similarly, little work has been done on the likely costs of current and new developments, and of how they might best be met in a sustainable way. The developments outlined in this study have brought with them challenges to traditional assumptions about the role of libraries and their budgets, but also as to the location of funding responsibility for the information infrastructure, and the proportion of their budgets that research funders are prepared to devote to developing and sustaining that infrastructure. More work is required on the short and the long-term costs of developments such as repositories and data centres.
- *Benefits.* A focus on costs should not exclude evaluation of the benefits from investment in provision for managing information outputs effectively, in improving the efficiency of research, and in enhancing its impact. Failure to invest in putting effective arrangements in place will

- have damaging consequences.
- *Knowledge Transfer*. Knowledge transfer (KT) is an increasingly important policy imperative, but there is little consistency across funders as to their policies in relation to the kinds of information outputs arising from research that are required to support and facilitate KT, or how they should be disseminated and promoted. Similarly, there is little consistency in funders' approaches to how research results should be made accessible and comprehensible to lay audiences and the public at large.
 - *Intellectual Property*. There is evidence of some inconsistency of approach among funders in seeking to resolve the tension between the aims of widespread and rapid dissemination of research results on the one hand, and protection and exploitation of IP on the other. There may be inevitable variations as between different funders' positions on IP; but where research is funded as a public good, it is important that priority should be given to making results accessible as widely and rapidly as possible.
 - *Repositories*. With one or two exceptions, repositories are not yet well-established, but their development is likely to have a major impact in this country and overseas. There is as yet, however, lack of clarity as to the roles of subject-based as distinct from institutional repositories. And for universities in particular there is a need for greater clarity as to the key purposes that repositories are designed to fulfil, the scope of their content, whether researchers should be required to deposit certain kinds of outputs, and the mechanisms for deposit and the creation of metadata.
 - *Open Access Journals*. If the open access journals that rely on publication fees as a key part of their business model are to be sustainable in the long term, research institutes and other funders must establish mechanisms for the payment of such fees. The Research Councils and the Wellcome Trust have begun to establish procedures, but other funders are cautious or hostile. Researchers and research institutes need greater clarity and consistency of approach.
 - *Metadata and Interoperability*. High-quality metadata are essential to ensuring that information outputs are effectively managed and made accessible to others; but most researchers at present show little awareness of the importance of their role in providing such metadata. Both funders and research institutions have a vital role to perform in providing guidance and establishing procedures to support researchers in providing high-quality metadata. Similarly, it is important that – as foreshadowed in the RCUK *Position Statement* of 2005 – research funders should join together with other relevant bodies including JISC, the British Library, the RIN and publishers – to develop a proactive and consistent approach to developing the tools and standards to ensure that we maximise the opportunities for exchange and re-use of information outputs.
 - *Curation and Preservation*. Most of the information outputs that researchers now produce are in digital form. In order to ensure that valuable outputs are not damaged or lost, active measures are required to collect, curate and preserve them; and it is essential that decisions should be part of an organisational process, rather than being made on an ad hoc basis. Data and information policies are central to this, and need to be co-ordinated across funders, research institutions, and specialist agencies.

Research Funders Covered by the Study

Research Councils

Arts and Humanities Research Council (AHRC)
Biotechnology and Biological Sciences Research Council (BBSRC)
Engineering and Physical Sciences Research Council (EPSRC)
Economic and Social Science Research Council (ESRC)
Medical Research Council (MRC)
Natural Environment Research Council (NERC)
Particle Physics and Astronomy Research Council (PPARC)
Council for the Central Laboratory of the Research Councils (CCLRC)
In April 2007, PPARC and CCLRC were merged into a single Science and Technology Facilities Council (STFC).

Universities

University of Glasgow
Nottingham Trent University
University of Oxford
University of Portsmouth
University of Sheffield
University of Surrey
University of York

Government Departments

Chief Scientist Office (CSO) of the Scottish Executive
Department for Environment Food and Rural Affairs (Defra)
Department of Health (DH)
Department for International Development (DFID)

Research Charities

Leverhulme Trust
Wellcome Trust
Royal Society

Industry Bodies

BAe Systems
BP Exploration and Production
British Telecom
GlaxoSmithKline (GSK)
QinetiQ
Vodafone

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