
Institutional Repositories in the UK: The JISC Approach

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ABSTRACT

As the uptake of repositories increases, JISC continues to support UK universities in developing their services. This article describes some of the key areas of activity at the institutional and national levels, illustrates the way in which effective networked repositories can support academics, and showcases the contribution of JISC-funded projects to the global growth of repository services.

INTRODUCTION

The intellectual work of academics is the core business of higher education (HE) institutions. Much of this work is documented in research papers, and in materials used for teaching and learning. In an environment where both competition and collaboration are increasing, universities have a significant interest in the management of such assets.

Universities are seen as key resources by nations, commercial companies, and nonprofit organizations operating in an increasingly global economy. Universities support an increasingly information-driven, innovation-oriented economy and society. Universities are also part of these economies and societies; and higher education and research are increasingly globalized themselves. Universities both compete and collaborate internationally. To do so effectively, they need to have both internal management systems and external communications systems that are fit for purpose.¹

Addressing this wider environment, within the United Kingdom (UK), there are external policy drivers emerging from ongoing activities at a European Union (EU) level, such as the Bologna Process (European Commission, 2007) for a European Higher Education Area, and the creation of the European Research Area (European Commission, n.d.). Similarly, there are policy agendas from a national UK level, such as the Research

Assessment Exercise (<http://www.rae.ac.uk/>) and its proposed replacement with the Research Evaluation Framework (HEFCE, 2008), the Transparency Review,² and the government's e-Strategy for education.³ These and other external policy frameworks will give tangible benefits to those institutions that can demonstrate and exploit effective information strategies and systems.

The aim of this paper is to show how work funded by the Joint Information Systems Committee (JISC) (<http://www.jisc.ac.uk/>) in the UK is helping UK institutions configure their information and communications technology (ICT) infrastructure appropriately to face this evolving environment. This has included a major investment in institutional repositories and allied tools and services. Repositories are important for universities and colleges in helping to capture, manage, and exploit institutional assets as a part of their information strategy. A digital repository can hold a wide range of materials for a variety of purposes and users. It can support learning, research, and administrative processes. There are also important preservation opportunities and issues around the use of institutional repositories (see, for example, McGovern and McKay in this issue).

JISC AND THE INFORMATION ENVIRONMENT

JISC supports institutions serving over six million students and staff in post-16 education and research institutions in the UK. JISC does this by providing services such as the academic network (JISC, 2008, January 11b), data centers (JISC, 2008, January 11a; JISC, 2008, January 11c) and through the funding of research and development, as well as by providing the expertise, independent advice, guidance, and resources to promote the effective and innovative use of ICT. More specifically, JISC provides

- access to high quality resources to support learning, teaching, and research;
- advice on the creation and preservation of digital resources;
- Information about the implications of using ICT including legal and organizational issues;
- front-line support for the further education (16–18 years) sector through regional support centers;
- network services and support; and
- innovation programs to bring about original and effective solutions to fully exploit the potential of ICT.

Members of JISC and its committees are senior managers, academics, and technology experts from across the education sector. This provides strong links with the community and ensures JISC remains responsive to the changing needs of further education (FE) and HE.

The aim of JISC's innovation work in the area of digital repositories is to bring together people and practices from across various domains

(research, learning, information services, institutional policy, management and administration, records management, and so on) to ensure the maximum degree of coordination in the development of the repositories' technical and social (including business) aspects. Related work funded by JISC aims to create an interoperable network of repositories for the UK higher education community. Ensuring that these repositories address information management issues within organizations and also access requirements across the UK and beyond is essential to the JISC mission. JISC's work in this area is informed by a number of scoping studies and reports, to which the reader is referred for background.⁴

The information environment (IE) is one of the key JISC strategies. It has at its heart a vision for a distributed but coherent national infrastructure for managing and sharing information resources, based around shared or common services. It was first developed some ten years ago out of community workshops with participants who focused on "strategic planning for achieving a managed environment, together with the technical infrastructure which will provide its basis . . . in order to provide fully integrated end-user services, in place of the current set of stand-alone services" (Russell, 1998). The proposed architecture emerging from these workshops, the Models Information Architecture (MIA) (UKOLN, n.d.), was designed around these objectives, and underpinned much subsequent planning.

The Information Environment (IE) Architecture was described and visualized by Andy Powell and Liz Lyon in 2001 (UKOLN, 2008, October 15), the diagram providing a simplified visualization of core technical elements of the IE. This vision has been remarkable in its ability to accommodate more recent developments such as service-oriented approaches. However, it is now being revised more fully to represent a wider scope and participatory, network-level services that characterize the emerging Web environment. A key change in emphasis is from the vision of a "managed" environment to that of a "negotiated" environment, with the implication of peer services within and beyond the UK/JISC world making the arrangements between each other that are necessary to provide useful services to academics, students, and managers. There is a close relationship between this revision and the methods described within the e-Framework for Education and Research (<http://www.e-framework.org/>). For example the methodologies used in the e-Framework will help to identify shared and common services that form part of the information environment and both the IE and the e-Framework support a service-oriented approach.

Various parts of the IE are available as services and policies; the UK Federated Access Management framework (<http://www.ukfederation.org.uk/>), the JANET (UK education network) Acceptable Usage Policy (ja.net, 2008), a variety of sector-wide content licensing arrangements, the Intute Search Service (<http://www.intute.ac.uk/>), and the Jorum repository (<http://www.jorum.ac.uk/>) are just a few examples. JISC has played a

critical strategic role in the development of the IE by channelling strategic investment to establish shared infrastructure where this is more cost effective, and in negotiating boundary agreements regarding external content and services in more effective ways than those available to a single institution.

The notion of the information environment provides the context for the UK's JISC-led work in repositories. It is clear that, in most research fields, scholarly communication is a global activity: knowledge is developed across and between institutional and national boundaries, many academics have a stronger bond to subject peers than to institutional colleagues, and the channels of communication (journals, conferences, associations) are often international. However the financial and organizational infrastructure that supports these activities is largely institutional and national. It is likely that an institutional and national infrastructure provides the most promise of reliable and sustainable development of scholarly open access repositories.

This is not to say that repository activity should remain within institutional and national boundaries: shared standards and protocols, communication and discussion channels, discovery mechanisms, and enhanced services can operate above the layer of institutional repositories. The work JISC is doing, alongside many other bodies, assumes that different types of activity takes place at different levels. In the UK, JISC promotes open standards and a service-oriented approach to managing this layered mix of services, to enable the most efficient and effective integration of services within and beyond the institution. The IE also offers an emerging vocabulary for this mix of services, which is used to structure the next part of this paper:

- Content services, such as repositories
- Use services, such as portals, and visualization tools
- Preservation services, such as format registries
- Shared infrastructure services, such as registries and authority services

The examples given in this list are largely technical but it is important to keep in mind that advisory and support services, and policies, are also key parts of the IE. The next part of the paper gives an overview of the innovation work underway,⁵ before turning to look in more detail at some use cases.

JISC-FUNDED INNOVATION ON REPOSITORIES

England and Australia have accepted that voluntary faculty-initiated and faculty-performed self-archiving is not a viable model for institutional-repository population, and they are beginning to move on. We must do the same. An institutional repository is a useless excrescence unless it is part of a systematic, broad-based, well-supported data-stewardship, scholarly-communication, or digital-preservation program. (Salo, 2007)

Universities and colleges are often managing substantial cultural change when they establish a repository. Institutions via their libraries have traditionally curated material from elsewhere, whereas the emphasis here is on the institutions curating the intellectual outputs from their own activities. As Salo (2007) suggests, this implies that repositories do not work as stand-alone entities, but involve integration of technical systems (with institutional and other systems), policies (with institutional and other policies), and practice across organizational boundaries. This is a challenging and long-term aim. JISC has funded a Repositories Support Project (RSP) (<http://www.rsp.ac.uk/>) to offer guidance and training to repository managers. The lessons learned by JISC-funded projects about IPR, workflows, advocacy, and other issues are shared with the community through the RSP website. JISC has also funded some forty-four “start-up and enhancement” projects, which are institutional and consortial repositories that are developing technical and organizational approaches to setting up and developing repository services and practices. These are funded on a model whereby JISC matches institutional contributions. In this way, it is hoped that institutional commitment to sustaining the repositories is built-in from the start. A list of the themes with which these projects are concerned shows the breadth and depth of their work (JISC, 2008, January 11d).

One of the key drivers for repositories has been calls for open access to research papers—something JISC supports in principle through the signing of the Berlin Declaration (2006) and in a variety of practical ways. JISC supports The Depot (<http://depot.edina.ac.uk/>), which offers a repository junction to direct users to suitable institutional repositories (via IP recognition), and also acts as a temporary store for researchers who have papers to share but whose institutions do not yet have an open access research repository. The Depot passes details on to the Repository Support Project of institutions without repositories, thus completing the intelligence loop.

Of course, research papers are only one kind of material to be found in repositories. JISC funds Jorum, which is a password-protected national repository for sharing learning materials between UK universities and colleges. The service is developing JorumOpen (<http://www.jorum.ac.uk/>), which will allow the sharing of open content alongside the authenticated repository collections. Institutional repositories will contribute to this national resource. JISC has supported the creation of EThOS (<http://www.ethos.ac.uk/>), which will offer open access to UK theses from this year, based on a network of institutional repositories together with the British Library. In addition, JISC funds work to scope sector needs with respect to the curation of research data (JISC, Information Environment, n.d.). This is a massively more complex problem space than that traditionally addressed by libraries, and will be a considerable challenge to the sector. Addressing these needs will not be successfully addressed without sig-

nificant coordination at an international level, for example with the National Science Foundation Datanet (National Science Foundation, n.d.) projects, the Australian National Data Service (<http://ands.org.au/>), and the Dutch SurfShare (SURFshare, n.d.) program.

Use Services

JISC has invested in the use services area over some time, for example in the portals (JISC, 2008, March 10) and presentation⁶ programs. One key use service is search and discovery. While Google arguably fulfils much of this requirement, JISC has funded the Intute Repositories Search project, to build a discovery mechanism into UK-based open access repository content. Importantly, this project acts as a test bed for enhancing searching (for example via sophisticated text-mining and personalization techniques) and collaborating with other technical projects in this area both in the UK and further afield.⁷

As federated access management is rolled out across the UK, the potential for repositories and associated services to personalize the user experience is increased, although this is not without technical, practical, and legal challenges. Experience from the portal and presentation programs informs JISC's repositories work such as the Intute Repositories Search project). A small group of other similar projects focus on enhancements to enable the search and retrieval of repository content, including metadata issues, presentation methods and interoperability between systems.⁸

Of course, finding and accessing material is only one kind of use service. Another is the placement of items into a repository—"put" (from the user's perspective), "deposit" (from a repository perspective), or "ingest" (from a preservation perspective). It is possible to imagine services making this easier for users, perhaps building from the repository junction functionality noted above, and taking advantage of automatic metadata creation techniques such as those identified by the RepoMMan (JISC, 2008, September 11c) and Metatools (JISC, 2008, November 3b) projects (among many others).

Preservation Services

While users are generally interested in current access and interaction with repository materials, librarians (and other custodians) have an additional interest in the preservation of these materials over time. Repositories have a key role to play in long-term preservation, and JISC funds work looking at roles and responsibilities, models, and technical approaches to effective management of the content life cycle. JISC cofunds the Digital Curation Centre (<http://www.dcc.ac.uk/>), which both offers advice and support on preserving digital material, and acts as a UK partner in what is an international area of work, for example with the Digital Preservation Coalition (<http://www.dpconline.org/>). Other JISC work on preservation has included institutional management support (costing preserva-

tion,⁹ developing risk-based approaches to audit¹⁰), digital preservation assessment tools, and developing institutional repository infrastructure, principally via the PRESERV (<http://preserv.eprints.org/>) and SherpaDP (<http://www.sherpadp.org.uk/>) and Complex Archive Ingest for Repository Objects (CAIRO) projects (JISC, 2008, April 21a).

Shared Infrastructure Services

User and preservation services often need to call background services, such as registries and authority services. These background or shared infrastructure services provide core information in a consistent and authoritative way that enables interoperability and coherence across a distributed information environment or network of repositories. JISC funds a variety of such services in the UK (JISC, 2008, September 19). For example, the Intute Repositories Search calls on the OpenDOAR (<http://www.opendoar.org/>) directory of open access repositories to identify the base URLs and policies of the repositories it harvests and searches. Similarly, the Depot's repository junction tool calls the OpenDOAR and (soon) the 'Where Are You From' WAYF service that is a part of the UK Access Management Federation, to enable an effective redirect for potential depositors. The Depot itself calls SHERPA RoMEO (SHERPA RoMEO, n.d.) to check whether papers can be deposited there. Similarly, preservation services often rely on shared infrastructure, such as file format registries (such as PRONOM [National Archives, n.d.]) and representation information registries (Representation Information, n.d.).

Authority services, such as name authority files, are important to repositories not only for ensuring that names are correctly and consistently recorded. As repositories are increasingly used to support internal and external management reporting, it becomes essential that the material held therein can be trusted to be attributed to the right person. JISC is funding a pilot name authority service (JISC, 2008, September 18c), which should build on work already underway elsewhere such as the OCLC Virtual International Authority File (<http://viaf.org/>) and the Dutch Digital Author Identifier (SURFfoundation, n.d.) approach.

Of course, many such shared infrastructure services would work best at a global level. An international Global Registries Initiative is underway, which includes the Australian ORCA registry (Australian Partnership for Sustainable Repositories, n.d.) of repository collections, the U.S. OCKHAM registry (<http://www.ockham.org/>) of the National Science Digital Library, and the UK JISC Information Environment Service Registry (<http://iesr.ac.uk/>) of collection descriptions and services that provide access to them. The Global Registries Initiative is intended to plot a way forward, and held its second meeting in March 2008 (Service Registries Blog, 2008).

REPOSITORIES IN PRACTICE

This section explores how repository activity takes place, and how it can be best supported by shared services, standards and processes, within the context of the Information Environment. Because it is not possible to be exhaustive about the myriad of practices that take place around scholarly communication, we posit simplified and idealized workflows for two stakeholders interacting with repositories: a science researcher and a teaching academic. Although the workflows are simplified, JISC-funded projects have produced or are working to produce outputs that will help to realize these workflows. We should note that librarians and information managers are clearly also key users of repositories. This paper does not explore their requirements, although they are a very important aspect of the work JISC is funding.

Scenario One: Science Researcher

Use Case (fig. 1):

- Organize and document experiment in a “virtual research environment”¹¹ > deposit data in repository > preservation
- Write paper > locate suitable repository > deposit in repository > metadata automatically generated > link to data > publish in overlay journal > preservation

A virtual research environment (VRE) helps researchers in all disciplines manage the increasingly complex range of tasks involved in carrying out research. A VRE should be linked to the repository that is going to store the data created in the course of experimentation. The CTREP (JISC, 2008, September 18a) project is looking at improving the interoperability between the VRE and repository at Cambridge University and University of the Highlands and Islands Millennium Institute. Deposit of data into a repository may not take the self-archiving approach; the ROAD (JISC, n.d.) project is investigating the deposit of data from robot-controlled experiments directly into a repository, following the results of a similar project Repository for the Laboratory (R4L) (JISC, 2008, September 11d).

Once data has been deposited in the repository, curation is a high-profile and complex challenge. The eCrystals Federation (JISC, 2008, May 6) project, building also on R4L, is developing an international network of data repositories for crystallography. The project will address issues of curation and preservation of data in an active federation of repositories and will be a test bed for the DRAMBORA toolkit (<http://www.repositoryaudit.eu/download/>). DRAMBORA is designed to assess the readiness of a repository for providing preservation services. Similarly, the DISC-UK DataShare (JISC, 2007, December 7) project is exploring and developing

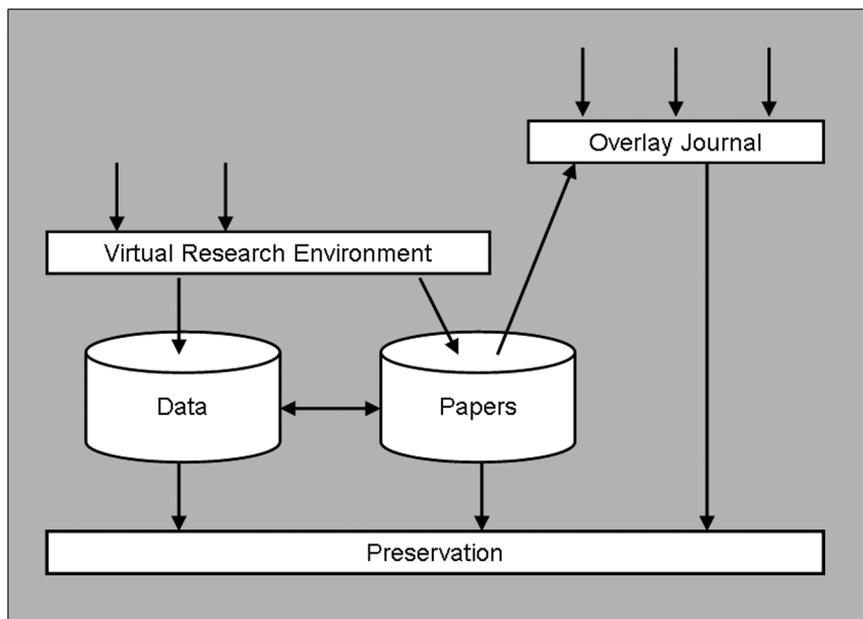


Figure 1: Scenario One: Science Researcher use case

ways in which collaborations of institutional repositories can curate and share research data. The DExT (JISC, 2008, April 21b) project is addressing different facets of preservation, such as how to deal with preserving proprietary file formats. The project, focused on social science data, aims to provide a suite of tools that allow researchers to migrate their data between different file formats and prepare the data for long-term curation. The Data Audit Framework (JISC, 2008, March 31) and recently developed preservation costing methodology will enable those charged with curating research data to plan and manage that work effectively. A study of the necessary careers and skills should help the UK and others develop strategies for what is undoubtedly an area of skill shortage at present.

In the second part of this scenario, the researcher drafts a research paper based on the data and information collated from a variety of sources. The academic often has far more information coming in than she could ever process. One tool which may help with this problem is Feedforward (JISC, 2008, November 3a), which is a desktop information management tool that can be personalized. It can manage RSS feeds (from repositories and elsewhere) as well as desktop files and links to services such as del.icio.us (<http://del.icio.us/>). These sources of information can be filtered by use of a mixer, which is operated in the same way as an audio graphic equalizer, but the importance of various subjects is adjusted, rather than

the tone of the sound. The software also helps you design your own contexts for information so that you can categorize the various pieces of information in a way that makes sense to the way you work. Another tool working in the same area is Gold Dust (JISC, 2008, April 12), which is producing and testing the delivery of highly relevant, personalised current awareness content to academics, from within various presentation services (including Feedforward). Researchers also increasingly want to work collaboratively, on the Web 2.0 network level. The Social Networking Extensions for Eprints (SNEEP) (JISC, 2008, February 6) project is developing plug-ins for the Eprints repository platform to add bookmarking, commenting, and tagging to the interface.

Once the paper is written and published the researcher then wishes both to share the research paper and to ensure that it is preserved. When and how they are able to do this is a key question in the development of repositories and varies based upon institutions and subject disciplines. There are a number of different approaches to embedding the collection of research outputs in the workflows of researchers. For researchers with no repository yet to use, JISC has funded The Depot (JISC, 2008, September 18b). As of mid-2008 over twenty JISC-funded projects are running to develop new or existing repositories to deal with research outputs. The outputs of these varied projects are also made available via the Repositories Support Project (<http://www.rsp.ac.uk/>).

One of the frequent objections to depositing in a repository by sceptical users is that the completion of the metadata fields is time consuming. The Metatools project is examining the metadata generation tools available, evaluating their usefulness and ultimately, making the best tools available as Web services. The recently completed RepoMMan project looked at automatically generating contextual metadata as part of developing a tool to embed the repository in the user's natural workflow. Shared infrastructure services such as a name authority service (JISC, 2008, September 18c), SherpaRoMEO, and OpenDOAR can also simplify the deposit process and improve the metadata quality.

Under the scenario presented above there are at least two artifacts from the research process stored in repositories, the data and the article. It is important that the data and the article are linked. The StORe (JISC, 2008, September 11e) and CLADDIER (JISC, 2008, September 11a) projects investigated this linkage and the outputs of both projects will be built on by the Storelink (JISC, 2008, February 7) project. In addition, the middleware developed by StORe has been released this year by the national social science UK Data Archive (<http://www.data-archive.ac.uk/>) as a sustained service. Improving the link between data and publications would benefit researchers as it would make it simple to view the data that other publications have used, and to see how their data is being used in publications.

The OJIMS (JISC, 2007, November 13) and RIOJA (JISC, 2008, May 12a) projects are investigating how repositories might support publication of content via an overlay journal, that is, a journal that selects candidate papers from open access repositories. Both of these projects are examining the mechanics, business models, and peer review tools necessary to support the publication of repository content using an overlay journal model.

As with research data, the next step in the workflow is preservation. JISC-funded projects are approaching preservation issues from a number of angles. The Remap (JISC, 2008, September 10a) project is looking at embedding preservation into the existing workflows of a repository. SOAPI (JISC, 2008, September 10b) is developing a toolkit to create a manageable workflow for repository managers to deal with preservation. CAIRO (JISC, 2008, April 21a) is developing a tool for ingesting born digital items into a specialized repository. Sherpa DP2 (JISC, 2008, September 10c) is developing a collaborative, shared approach to preservation for the institutions in the Sherpa consortium.

Scenario Two: Teacher

Use Case (fig. 2.)

- Create learning object > put in virtual learning environment (VLE) > automated deposit into repository > establish intellectual property rights (IPR) for the learning object > share with peers > make available as Open Content

The first two steps in the workflow are common practice in nearly all higher education institutions in the UK and it is becoming more common for institutions to store learning objects in a shared file store such as a module of a virtual learning environment (VLE). However, it is far from common that the objects are deposited automatically into a repository from the VLE. A number of JISC projects are addressing this issue. The MR-CUTE (JISC, 2008, August 29) project is creating a tool for Moodle that will enable content stored in Moodle (<http://moodle.org/>) courses to be uploaded to the Moodle repository and provide a search function for this content. A more generalized approach has been made possible by the SWORD (Simple Web Service Offering Repository Deposit, 2008) project, which has developed a Web service that can be used to deposit items into a repository or repositories from another application. A related project is SOURCE (JISC, 2008, November 3c), which is using the SWORD Web service to create bulk migration tools that will allow learning objects to be moved between different repositories.

Sharing of learning objects, like most other repository content types, is a complex area. Not all teachers and not all institutions are keen on sharing the resources they have created. A summary of the barriers and incentives

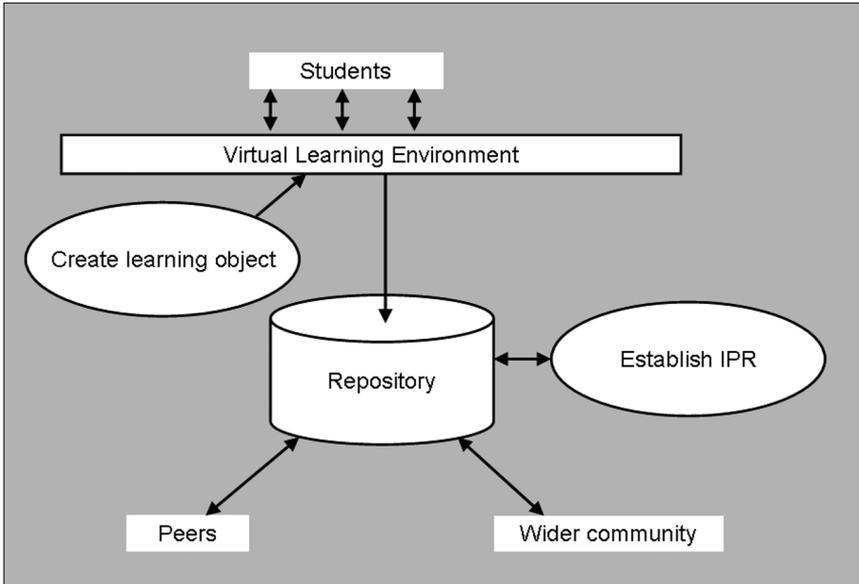


Figure 2: Scenario Two: Teacher use case

to sharing has been brought together in a synthesis report (Charlesworth, Ferguson, Schmoller, Smith, & Tice, 2007) covering the lessons learned by over thirty recent JISC projects. It suggests that, while technical challenges remain, perhaps the most pressing work is concerned with organizational, cultural, and legal (or, at least, perceived legal) barriers to sharing. The Trust DR project (JISC, 2008, September 11f) has produced a toolkit (Casey, Proven, & Dripps, 2007) that universities and colleges can use to establish the IPR for their learning materials. The “Rights and Rewards” study documented the incentives that are likely to encourage tutors to share material, and the rights they would therefore have to retain in order to do so. For the repository manager, the “Community Dimensions of Learning Object Repositories” project produced structured guidelines (Douglas, Margaryan, & Milligan, 2007) to help those setting up learning object repositories, particularly those designed to support specific communities.

Using a standard repository (a vanilla implementation of available repository software) may not be the easiest way for teachers working in the same subject area to share learning objects. Such a community may have specific ways of working, or trust relationships, that are not well reflected in out-of-the-box repositories. The Faroes (JISC, 2007, December 6a) project is now addressing this issue practically by developing a lightweight repository of learning objects that makes sharing objects extremely simple.

The Open University has developed an innovative platform, called OpenLearn (<http://openlearn.open.ac.uk/>), which makes the learning objects produced by the university available to all for free. This may not be a suitable way of working for all institutions—the Open University has a very distinctive mission and practice based on distance learning supported by commissioned course materials—but the JISC Pocket (JISC, 2008, May 13) project is applying the Open University's model at three other universities therefore increasing the content available from OpenLearn. The lessons learned from this should develop understanding of how collaborative open content can operate within UK HE repositories.

The Jorum (<https://www.jorum.ac.uk>) national learning materials repository is continuing to develop UK expertise in this field. The Jorum Development Bay will bring together resources and ideas for content creators and repository developers. JorumOpen will be an open access service, enabling the sharing of UK-created learning materials worldwide using Creative Commons licences (or CC derivatives). The service will also use federated access management to support sharing between staff in UK further and higher education.

CONCLUSIONS

The JISC investment in repositories continues to evolve. In the work described above it is clear that the investment is supporting universities and colleges to reconfigure their ICT systems to better support their core businesses of teaching and research. This is comparable to activities and investments by other national and international organizations and will enable such systems to operate and cooperate effectively on a global level. The JISC Information Environment, and the repositories investments supporting it, will continue to innovate so that universities and colleges can play their part in the global knowledge economy and be equipped to respond to new models of learning and research.

Technology moves forward fairly rapidly and therefore opportunities continue to emerge that can lead to improved research and learning. However in order to take advantage of this, new ways of working and new approaches to ICT service provision are required. Supporting this change is part of the rationale for the innovation work that JISC funds.

Lorcan Dempsey (2007) raises an important challenge:

Increasingly, we want to represent resources in a variety of [other] workflows. These might be the personal digital environments that we are creating around RSS aggregators, toolbars and so on. Or the prefabricated institutional environments such as the course management system or the campus portal. Or emerging service composition environments like Facebook or iGoogle. As well as in network level discovery environments like Google or Amazon that are so much a part of people's behaviors. Libraries need to focus more attention on reconfiguring library services for network environments.

Dempsey is concerned that the library and other institutional systems where appropriate, orient themselves and exploit the network level infrastructure that is increasingly in place on the Web. This is a path that JISC is pursuing through its investments. As one small example, JISC funded Fedorazon (JISC, 2007, December 6b), which “looks to remove the ‘hardware’ barriers involved in launching and maintaining a repository. It will accomplish this initially by enabling the use of Fedora Commons repository software on-top-of Amazon’s virtual servers (EC2 & S3).” It is likely, and probably essential, that such local-network collaborations will become more common in order for libraries to remain relevant in the current Web environment. This is particularly true for repositories, which have struggled to find an appropriate place in the workflows of higher education.

A key finding from recent JISC investments is the cost of interoperability, in this case underpinning local and network collaborations involving repositories. Projects such as PERX (JISC, 2008, September 11b), ASK (JISC, 2008, September 1), and Intute Repository Search (JISC, 2007, November 1) have demonstrated that what McDonough (2008) has termed the “Social Limitation of Interoperability” is more limiting than had previously been assumed. Where there are compelling use cases for detailed and precise metadata, then some means must be found to plan for the cost of this, either in human terms or, better where possible, in terms of developing tools and automated services. It may be that this cost and, where possible, the effort are best borne by the use services that rely on that metadata, leaving repositories as a minimal networked content store whose main job is to make content effectively available to other services, for preservation, network discovery, or whatever. Certainly, imposing heavy metadata requirements on depositors has done nothing to encourage deposit.

The repository work described above is very much concerned with both local workflow and networked discovery and access, although these have been perhaps not sufficiently brought together so far. Two years ago the JISC commissioned a “digital repositories roadmap” (Heery and Powell, 2006), a revision of which is due for release imminently. The 2006 roadmap noted that “while the current technical infrastructure in the UK is in need of some development, it is primarily in the areas of policy (both national and institutional), culture and working practices that changes need to be made.” It is unlikely that much has changed in the last two years, except perhaps that the participatory Web (“Web 2.0”) has shown how tools and services can themselves be used as change agents. JISC will continue to support positive change, for example via the development of a network of repositories and related services that aims to support information management and curation; dissemination and sharing; research and learning processes as well as the interaction of local and network level services.

NOTES

1. This is widely discussed and advocated; among many other examples, see Charles Vest's presentation "Globalization and Higher Education: Competition and Cooperation," available from the MIT site at: <http://mitworld.mit.edu/video/433/>
2. See http://hefce.ac.uk/Pubs/Circlets/2000/cl17_00.htm for Transparency Review reporting requirements.
3. See <http://www.dfes.gov.uk/publications/e-strategy/> for the UK government's e-Strategy report, "Harnessing Technology: Transforming Learning and Children's Services."
4. The reports, with a commentary, are available from http://www.jisc.ac.uk/whatwedo/programmes/programme_rep_pres/rep_pres_keydocs.aspx
5. Much of this is described or linked from the webpage for the current innovation program, at <http://www.jisc.ac.uk/reppres>
6. See JISC Presentation Programme at http://www.jisc.ac.uk/whatwedo/programmes/programme_presentation.aspx. A key recent project is "Developing Personalisation in the Information Environment," accessed at <http://www.jisc.ac.uk/whatwedo/programmes/resourcediscovery/Personalisation.aspx>
7. Examples include the OAIster service and the DRIVER project.
8. Projects include those within the "Tools and Innovation" strand of the current program found at http://www.jisc.ac.uk/whatwedo/programmes/programme_rep_pres/tools.aspx. Also, see projects such as "Rich tags: Supporting better exploration of digital repositories with semantic social tagging," accessed at http://www.jisc.ac.uk/whatwedo/programmes/programme_rep_pres/rich_tags.aspx
9. See, for example, the LIFE projects at <http://www.life.ac.uk/> and the report on costing the preservation of research data at <http://www.jisc.ac.uk/publications/publications/keepingresearchdatasafe.aspx>.
10. Relevant audit tools developed include DRAMBORA at <http://www.repositoryaudit.eu/>. And, soon, the Data Audit Framework found at <http://www.jisc.ac.uk/whatwedo/programmes/digitalrepositories2007/dataauditframework.aspx>.
11. For more detail on virtual research environments, see JISC's Virtual Research Environment program at <http://www.jisc.ac.uk/whatwedo/programmes/vre2.aspx>.

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