

## **Digital Repositories at Queensland University of Technology**

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### **Abstract:**

University libraries have traditionally played a central role in the institutional core business of creating and sharing knowledge. With the emergence of new technologies, such as digitisation and the Internet, came new possibilities for storing, disseminating and using information resources created at the university – not all involving the library. By working collaboratively with other sections of the university in the development of these new systems, the university library continues to be a relevant and valued participant in this process. For example, university libraries can be instrumental in the development and maintenance of institutional repositories. At Queensland University of Technology (QUT) in Brisbane, the library has played a key role in the development of a number of digital repositories. These include an E-Print archive (QUT ePrints), the Australian Digital Thesis (ADT) collection, a Course Materials Database (CMD) and FlexiPrint, a student-driven print on-demand service of all compatible CMD and Online Teaching materials. All of these projects involve collaboration between the Library and other University staff, eg academic staff, the QUT Office of Research, Teaching and Learning Support Services (TALSS), individual postgraduate students and even other universities. These repositories have enhanced the information resources available within QUT and have enabled the sharing of QUT-created information resources globally. The collaborative nature of the projects has also strengthened the partnership between the Library, other sections within the Division of Technology, Information and Learning Support and the QUT academic community.

Knowledge production is increasingly trans-disciplinary and collaborative and we may need new systems of information access and dissemination to fully realise the opportunities afforded by these changes. University students and researchers now require a wider range of information sources and access mechanisms that cut across traditional disciplinary 'silos' and are independent of physical location (Houghton, Steele & Henty, 2003). On the other side of the coin, for the results of this research to be applied and built upon, they first need

to be disseminated in ways that facilitate their discovery by all the people who may have use for the information (Robson et al., 2003).

Fortunately, developments in information and communication technologies have provided solutions for these challenges. The digitisation of information resources and the use of the Internet to facilitate dissemination and access are transforming libraries, the process of scholarly communication and the practice of teaching and learning in higher education. The rapid expansion of Library collections to include significant amounts of full text digital resources is providing universities with exciting opportunities to provide students with high quality, flexible learning experiences (Young, McCarthy & Hart, 2003). Also, new modes of research dissemination are providing opportunities for universities to enhance the visibility and accessibility of their research outputs.

The current model of scholarly communication evolved at a time when traditional disciplinary research predominated (Houghton, Steele & Henty, 2003). Until recently, major researchers either knew, or could contact, other major researchers within their narrow fields of interest. Together, the informal and formal (scholarly publishing) methods of scholarly communication generally met the needs of most researchers. This is certainly no longer the case. With trans-disciplinary research, you never know who may be interested in your research. Even within discipline-based fields, traditional scholarly communication processes can no longer deliver the level of dissemination that is required to achieve maximum impact. Constraints include the increasing volume of research, the rising number of journal titles on the market and the rapidly escalating cost of journal subscriptions. Anything that constrains access to research finding is actually constraining the potential impact of the research.

Fortunately, the Internet has enabled us to think about reinventing scholarly communication (Prosser, 2003). In particular, institutional eprint repositories have provided a means for universities to enhance the dissemination of their research

outputs. Researchers continue to submit their research papers to journals for peer-review and publication but also “self-archive” a digital copy of the paper (generally the final corrected manuscript, as accepted for publication) to the institution’s eprint repository. The “Open Access” nature of eprint repositories means that the research can be accessed and read by anyone, free of charge. Institutional eprint repositories enhance their institution’s visibility and prestige by showcasing its intellectual output.

The development of standards (OAI-PMH- Open Archive Initiative Protocol for Metadata Harvesting) means that each individual repository can be part of a global system of distributed interoperable repositories (Day, 2003). Compliance with this international standard enables a repository’s metadata to be systematically harvested by general search engines such as Google and eprint-specific search engines such as OAIster. This significantly increases the visibility and accessibility of the self-archived works. While access is not a sufficient condition for citation, it is a necessary one. Institutional eprint repositories significantly increase the reader base for any published journal article by adding readers who could not access it because their institution did not have a subscription to the journal (Harnad & Brody, 2004). Research indicates that articles that are freely available online are more highly cited (Lawrence, 2001).

### **QUT ePrints**

QUT established its own institutional eprint repository, QUT ePrints, in December 2003. This digital repository showcases the research outputs of QUT academic staff and postgraduate students. QUT researchers can now “self-archive” electronic copies of their research articles, conference papers and other research outputs to the QUT ePrints server and the papers are then widely disseminated to the public via the QUT ePrints website; <http://eprints.qut.edu.au> .

After investigating the various software options available for creating a digital repository, QUT selected the GNU EPrints open archive software, which is

available, free of charge, from <http://software.eprints.org> . It is running on a PC (Free BSD 4.3 Dual 900Mhz Processors, 1.3Gb System Ram, RAID 5 Array) and utilises Apache and MySQL to serve the pages and power the database backend. The GNU EPrints software can be customised with the institution's "look and feel", it is OAI-PMH compliant and, once it is installed, it is automatically ready to generate metadata in a form which can be harvested by OAIster and Google (the metadata is based on simple Dublin Core). The OAI-PMH compliance enhances resource discovery, which may translate into greater research impact (increased citation rates) for QUT's research outputs. QUT ePrints also contributes to the growing pool of refereed research literature that can be accessed, free of charge, online. Consequently, the service is supporting the needs of business and the wider community as well as supporting the University's research goals.

Establishing an eprint repository is relatively easy compared with the task of getting the institution's researchers to use it. This is probably due to lack of awareness, lack of understanding or even just a lack of time rather than resistance or opposition (Suber, 2004). Consequently, the benefits of self-archiving have to be articulated clearly and frequently in order to gain the support and participation of the institution's researchers.

At QUT, a number of communication and promotion strategies have been adopted to increase the participation rate. These strategies have included a formal launch event and articles published in the University newspaper and the Library's newsletter. Emails were sent to the Heads of Schools and the Assistant Deans, (who chair research committees) requesting space for a presentation on QUT ePrints on forthcoming meeting agendas. Open access-related news snippets and updates are regularly sent to the Liaison Librarians and they are asked to personalise the information and send it out to their constituencies. The "Library News" section of the QUT Library web page has also been used to promote QUT ePrints.

Information alone is not enough to secure researcher participation. There need to be some incentives that actively encourage researcher participation and disincentives need to be removed (if possible). A recent survey by Swan and Brown (2004) found that when authors were asked how they would react if their employer or their funding body *required* them to deposit copies of their published articles in an open access eprint repository, most said that they would willingly do so. At QUT, an eprint repository policy was endorsed by the University Academic Board in 2003 (effective from January 2004). According to the policy;

*“Material which represents the total publicly available research and scholarly output of the University is to be located in the University's digital or "E print" repository... it applies to the corpus of refereed research literature, conference proceedings, and other non-refereed output, as contributed by QUT to the outside world”*

[http://www.qut.edu.au/admin/mopp/F/F\\_01\\_03.html](http://www.qut.edu.au/admin/mopp/F/F_01_03.html)

The intent of the policy is to communicate to the QUT research community that author self-archiving is strongly encouraged and to support individual authors in any negotiations that may be necessary to secure publisher permission.

The need for policies like this has been illustrated by recent events in the United Kingdom. The UK House of Commons Select Committee on Science and Technology recently conducted a lengthy inquiry into scientific publishing. The Committee's report, published in July 2004, recommended the establishment of eprint repositories at all UK Universities and that government-funded researchers should be *mandated* to self-archive, to their institutional repository, copies of any articles which report their research.(Great Britain Parliament & House of Commons Select Committee on Science and Technology, 2004).

The report acknowledged that;

*“the main focus of academics was on the initial publication of their articles in a recognised journal and that subsequent self-archiving was relatively low on their list of priorities. 6:116*

<http://www.publications.parliament.uk/pa/cm200304/cmselect/cmsctech/399/39902.htm>

In the report, it was also suggested that this mandate would accelerate rates of self-archiving by authors by giving them leverage in copyright negotiations with publishers. Currently, over 60% of the publishers of scholarly journals routinely allow authors to self-archive the postprint version of their articles (the peer-reviewed version) (SHERPA, 2004). As a result of this development in the UK, the proportion of publishers that allow self-archiving is likely to increase significantly. Collectively, authors are a valuable commodity and publishers will not want to risk alienating them by refusing to allow self-archiving. Having to negotiate permission with a publisher could prove to be a major disincentive for some researchers. Being able to state that it is a requirement of their employer makes the process a little easier for QUT authors as it provides them with an explanation. Furthermore, once a significant proportion of authors are required to self-archive, it will become standard practice and requesting permissions will become unnecessary, thus totally removing this disincentive.

So far, QUT academics have not expressed any objections to the eprint repository policy. Maybe this is because it is always mentioned in the context of how it can help the academics to achieve their goal of maximum research impact. Having the policy has definitely assisted the eprint project in many ways. For example, requesting space on meeting agendas to discuss the new policy has been more successful than requesting an opportunity to promote a new service.

Some researchers feel challenged by the web-based deposit process and, even if sufficiently motivated, are unlikely to deposit papers unless support is available. At QUT, this is being addressed in a number of ways. In collaboration with the relevant Liaison Librarian, hands-on workshops are run for groups of staff and postgraduate students from a specific School or Research Centre. Workshop participants are encouraged to bring an electronic copy of one of their papers so they can deposit it during the session. The administrative staff from the School are also invited to the workshops and given a paper to upload. The aim is to

create a local pool of expertise that academics can call upon for help with the deposit process. Some Research Centres send a research assistant who will later be depositing papers on behalf of authors from the Centre. Generic workshops, open to all staff and postgraduate students, are offered regularly on each campus (but tend to be poorly attended at this stage). QUT Liaison Librarians are all very familiar with the deposit process but are careful to limit their role to that of providing advice or arranging workshops and presentations with the QUT ePrints administrator. An FAQ (Frequently-Asked-Questions), a step-by-step deposit guide, a copyright advice guide and a link to a website that lists publisher policies can all be accessed via the QUT ePrints web page. These features are all designed to provide point-of-need assistance to depositors.

In the first six months following the launch of QUT ePrints, only fifty papers were deposited. However, in the next three months, the total number of papers deposited grew to over two hundred and fifty and the deposit rate is continuing to gain pace. Hopefully, this is an indication that QUT researchers are embracing the concept and that self-archiving will eventually become part of normal research practice at QUT.

### **The Australian Digital Theses Collection (ADT)**

The Australian Digital Theses program (ADT) was initially developed by a group of seven Australian universities, and is based on the work of the Networked Digital Library of Theses and Dissertations (NDLTD) and the Virginia Polytechnic Institute. Theses are made available to the world in Portable Document Format (PDF) via the National ADT Database. There are now over 100 QUT theses available on ADT. Like QUT ePrints, the objective is to promote and increase access to the research output of QUT higher degree research students.

QUT Masters by Research and PhD students are now required to provide both a print and a digital copy of their thesis, for the Library, at the conclusion of their study program. This became mandatory at QUT at the beginning of 2003. Both

copies are actually submitted to the Research Student Centre and then forwarded to the Library. QUT academic staff members who have completed higher degree studies at institutions outside of Australia may, if they wish, deposit a copy of their thesis or dissertation in QUT ePrints.

### **The Course Materials Database**

Libraries now emphasise the information to which they can provide access and this goes way beyond their physical collections of books and journals.

Innovations in technology and the rapid expansion of Library collections to include significant full text electronic resources are providing universities with exciting opportunities to provide students with high quality and flexible learning experiences,

The Course Materials Database (CMD) is a database of recommended readings selected by QUT lecturers for students enrolled in their subject offerings (units). The digitised copyright material (book chapters, journal articles, conference papers, legislation, cases, whole works, standards, reports, etc) placed on the CMD can then be accessed via each unit's Online Teaching (OLT) webpage. It can also be accessed via a link on the QUT Library webpage and via each student's personalised portal on the QUT Intranet (QUT Virtual).

The CMD provides students with convenient 24 hours per day, 7 days per week, access to high use information resources from any PC on campus, and from off-campus. The materials are available equitably to all students when they need them as they cannot be out on loan to another student, lost or stolen. A survey of student need for online services at QUT had indicated that students wanted a single, convenient online place to access their course materials; eg "I would like to 'suck down' everything for my subjects in one hit" (Young &Stokker, 2001).

The system is also very popular with QUT Lecturers as they no longer need to provide the Library with a photocopy of the copyright materials. They simply

complete a web-based request form, and the Library locates and processes the materials. If the item is available via a fulltext database, a link is created. If the item is only available in hardcopy, it is scanned. If the material is not held in QUT Library then Library staff place an urgent document delivery request or obtain a personal copy from the lecturer. At the end of each semester, the CMD materials are automatically “deactivated” rather than removed from the database.

A “Notes to Students” field allows lecturers to provide a message to students eg. “Essential reading for the mid semester exam”. This field forms part of the display in the CMD. Lecturers can nominate whole semesters or just specific dates during which the materials will be available to students, they can check what has been added to the CMD for any particular unit and can advise the Library if any materials need to be reactivated for a subsequent semester. An enhancement to the CMD form 2005 will enable lecturers to independently reactivate readings where copyright allows. This offers lecturers greater flexibility and control over access periods and avoids unnecessary duplication of effort (by them and by Library staff) when materials are re-used in subsequent teaching periods.

Importantly, using the CMD to manage the digitisation of copyright material in support of courses ensures the University's compliance with legislation. To meet legal requirements, any material where the copyright does not belong to QUT needs to be placed onto the CMD. The technology needed to provide online access to recommended readings has existed for many years but, until recently, Australian libraries were unable to proceed along this path because of an uncertainty as to what was permitted under the Australian Copyright Act (Lean &Young, 2002). Fortunately, in 2001, the Copyright Amendment (Digital Agenda) Bill made it clear that universities, and other educational institutions, could provide online access to copyright materials and many universities, including QUT, began creating electronic reserve collections. The Amendment provided the legal certainty that had previously been missing but it included a number of conditions which required careful administration (Lean &Young, 2002).

The CMD facilitates both compliance and the necessary administration. A description of these conditions and advice to QUT academics on compliance can be found at <http://www.dias.qut.edu.au/copyright/CMDcompliance.html>

These days, many university students are time-poor due to the need to juggle their studies with paid employment. Consequently, they really appreciate the convenience afforded by the CMD. QUT Library spends over seven million dollars on print and digital resources each year. By facilitating discovery and access to many of these resources via the CMD, the Library is maximising the value gained from this expenditure. The CMD has also afforded new opportunities for QUT Liaison Librarians to work collaboratively with their academics to identify resources that should be included in the database. Helping academics to learn the process of requesting and reactivating CMD resources can also help strengthen the liaison relationship.

Successful implementation of the CMD required the collaboration of different areas of QUT. Within the Division of Technology, Information and Learning Services collaborating staff come from the Library, the Teaching and Learning Support Services department who created the Online Teaching pages, Information Technology Services who were responsible for the development of QUT Virtual, QUT Printing Services and the QUT copyright officer. Beyond the Division, collaborators include the Publications and Printery department and the academics of each faculty.

The CMD project was commenced in November 2000 with the creation of the database. Unfortunately, due to the late release of funding, a pilot project planned for semester one 2001 could not be done in time. Consequently, the CMD went live in semester two, 2001 without a preliminary test run, and succeeded! By August 2004, the CMD database contained over 25,000 documents. Usage, as measured by the number of PDF documents requested from the CMD server, has been extremely high with 2.67 million hits in 2003.

While this figure represented a 10% increase on the 2002 statistics (2.41 million hits), the year to date figures for 2004 appear to suggest that the usage rate may be levelling off now.

A survey of students and academic staff was conducted in late 2003 to gather feedback. The response was very satisfying with over 83% of students reporting that they used CMD to access required readings. When rating the importance of the service, 35% of students said "they couldn't live without it" while a further 54% indicated that it was "very useful" to them. Ninety three percent of staff who indicated that they use the CMD rated the service as good or excellent.

The anticipated benefits of the CMD project have been realised:

- Improved service to students.
  - Convenient 24/7 access to high demand course materials
  - Material cannot go missing
  - Text documents are searchable
  - System is easy to use
- Documents can be digitised once, re-used (reactivated) many times
- Accurate records of our use of copyright materials under the CAL licence can be kept

While the CMD has been very successful in providing fast convenient online access to high use information resources, the majority of students still want their own printed copies of the materials. As the number of resources in the CMD increased, the queues at the on-campus networked printers increased. The situation was exacerbated by the fact that most lecturers now place weekly lecture notes (in MS PowerPoint) on the Online Teaching (OLT) pages and students generally print these too. Students with internet access from home can avoid the printer queue by printing at home, but downloading and printing a large number of PowerPoint files and PDF documents is still very time-consuming, especially for those with dial-up modem access rather than broadband. On-

campus printing also proved to be slightly more expensive for students than purchasing printery-produced “course packs” (which contained lecture notes and recommended reading) from the University Bookshop. The number of lecturers who create course packs has reduced significantly. Consequently, a faster, cheaper option for printing CMD and OLT resources was needed.

### **Flexiprint**

After a brief pilot project, the Flexiprint service was introduced across the University in July 2004. Flexiprint is a web based user driven “Print on Demand” system which enables students to select printable material from either the CMD or their OLT page and compile their own “Print Pack”. Students are given options to pay on-line (via their credit card) or at a QUT Printing Services counter on campus. They can also choose a location and time to pick up the printed material, or have the items sent to their home address. The cost per page depends on how long the student is prepared to wait. The range is currently between 7c per page for collection in 48 hours to 9c per page for collection in 30 minutes. Home delivery takes 3 days and incurs an additional charge for postage. On-campus student lab printing and off-campus printing (at home) is still available. As this is a web-based service, Flexiprint is available to students and staff from any computer, on or off-campus, that has internet access.

There is a Flexiprint link on each CMD page so all compatible CMD documents can be printed via Flexiprint. Lecturers do not need to request this service for CMD materials. However, if they wish to make their lecture notes, tutorial notes or other (non-copyright) materials available via Flexiprint, they need to use a simple upload process accessed via the admin interface for their OLT page. The uploaded files are converted to pdf “on the fly” as Flexiprint deals, exclusively, with pdf documents. An interface that will enable students to upload their own documents is currently under development.

QUT ePrints, ADT , CMD and Flexiprint are all examples of utilising information and communication technologies effectively in the support of the University's research goals. The CMD provides QUT students with dynamic and innovative access to a wide range of information resources. The Flexiprint service provides students with a range of options for managing the printing of these information resources that are responsive to their individual needs. QUT ePrints and ADT are increasing the accessibility and visibility of QUT research outputs, thus significantly increasing its potential impact. These services are also supporting QUT researchers by providing access to high quality research information from internal and external sources.

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