

Implementing Open Access: policy case studies.

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Abstract

Implementing open access is a tough job. Legitimate authority, sufficient resources and the right timing are crucial. Pioneers, role models and flagship institutions all have faced considerable challenges in meeting their own aims and achieving a recognized success. Professionals charged with implementing policy typically need several years to accomplish significant progress. Many institutions adopting open access policies probably need to do more, much more, if the commitment to open access is to be meaningful.

A first generation of open access policy development and implementation is coming to a close. It is thus possible to begin evaluation. Evaluating implementation establishes evidence, enables reflection, and may foster the emergence of a second generation of open access policies.

This study is based on a small number of cases, examining the implementation of open access around the world. Some of the pioneer institutions with open access mandates have been included, as well as some newer cases. The emergence of the new stakeholders in publishing is examined, such as digital repositories, research funders and research organisations.

Because this is a groundbreaking study, no claim is made that the results are representative. The emphasis is on variety and on defining a methodological standard. Each case is reconstructed individually on the basis of public documents and background information, and supported by interviews with professionals responsible for open access implementation.

Implementation is typically based on targeting researchers as authors. Indeed, the author is pivotal to any open access solution. This is the 'tertium comparationis' that facilitates an examination of the similarities and differences across instances in an effort to build a broader policy research agenda.

In a final section, open access is placed in the wider context of the evolution of digital scholarship. This clarifies how published research results are destined to become a key component of digital research infrastructures that provide inputs and outputs for research, teaching and learning in real time.

Keywords

Open Access, Open Access mandate, Open Access policy, policy implementation, policy evaluation, digital repository, institutional repositories, research infrastructure, scholarly publishing.

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Institutions covered by the case studies

Arthritis Research UK, Austrian Science Fund (Austria), Centre national de la recherche scientifique (CNRS, France), Conseil Européen pour la Recherche Nucléaire (CERN, Switzerland), Fraunhofer Society (Germany), Institut national de recherche en informatique et automatique (INRIA, France), Health Research Board (Ireland), Medical Research Council (UK), Howard Hughes Medical Institute (HHMI, USA), Queensland University of Technology (Australia), University of Nancy (France), University of Pretoria (South Africa), Wellcome Trust (UK).

Professionals and experts interviewed and consulted (in alphabetical order)

Nina Balter, Martin Borchert, Christoph Bruch, Paula Callan, Patricia Clarke, Geraldine Clement-Stoneham, Christian Fuhrer, Monica Hammes, Robert Kiley, Ulrike Küsters, Jean-Francois Lutz, Salvatore Mele, Alain Monteil, Katja Mruck, Uwe Müller, Elsabe Olivier, Heinz Pampel, Michael Patnick, Nicole Pinhas, Falk Reckling, Laurent Romary, Arthur Sale.

If you would like to commission a study of policy implementation, request a policy evaluation for your institution or ask for advice in policy development, please contact the author: <http://de.linkedin.com/in/chrisarmbruster>

From Proposal to Implementation: studying open access

The registry of open access policies¹ counts ninety-four institutions and forty-six funders that have adopted an open access policy and may be presumed to be in the midst of implementing it (September 2010, earliest policies date from 2003, giving a total of 140 mandates, discounting departmental and thesis mandates). This article is an attempt to investigate open access policy implementation and draw some conclusions about progress so far.

Policy is about achieving a desired outcome. Advocates of open access have identified policy instruments, achieved a measure of coordination and adopted written policies. However, when implementing policy, all manner of things may go wrong. Firstly, a policy may only be ‘lip service’, and the resources and authority necessary for implementation not provided. Secondly, implementation may be delayed (for whatever reason) and, in due course, overtaken by events elsewhere. Thirdly, implementation may engender unforeseen consequences that circumscribe the policy or render it ineffective.

For any organisation, policy implementation is a process of failure, learning and adjustment. Implementation takes time, and one may expect to encounter barriers and challenges, forcing a review of implementation, if not of the policy as such. Where open access policy implementation has been attempted in earnest, it seems to have taken three to four years to achieve results. It is a tough job. It is also a new job that, in less than a decade, has led to the emergence of a professional field. The travails are many, but the following reflections, research and case studies concern implementation that has been effective. Of course, most informants are much less likely to divulge information about failure than about success. Yet, in a new field, it would seem reasonable to begin with some success stories.²

This article is structured as follows: Firstly, I seek to discern and describe the defining characteristics of first-generation open access policy. What kind of policy is it? How does it work? Who are the key stakeholders? Secondly, the particulars of the case study method used here are elaborated. Thirdly, a series of case studies is presented. What is distinctive about the case? What progress has been made? Each case is treated individually, and a headline has been chosen to convey what is distinctive but also exemplary about each case. Fourthly, an attempt is made to infer a broader policy research agenda by comparing similarities and differences of the examined cases. Finally, some suggestions are made for further open access policy development.

¹ Registry of Open Access Repository Material Archiving Policies (ROARMAP) - <http://www.eprints.org/openaccess/policysignup/>

² No attempt is made to review or introduce explicitly the literature on policy analysis, implementation and evaluation. For those interested, let it be noted that the approach covers the micro-, meso- and meta-level (e.g. individual case studies, and processes and stakeholders, and the wider context of digital infrastructures), follows a qualitative methodology (case study), invokes a processual model (that leaves open whether decision-making is rationalist or institutionalist), and assumes a policy cycle. The enquiry is structured by a distinction between ‘intended outcomes’ and ‘unintended effects’, and assumes that a ‘successful outcome’ corresponds to internal goals and is recognized by relevant peer organizations.

First-Generation Open Access: some characteristics of policy development

Open access is an unusually broad area of policy development. It spawns public policy as well as research policy, and has become an issue for a variety of academic institutions, such as research funders, national academies and universities. Policy development may be understood as progressing in stages, from issue identification through an initial policy formulation and stakeholder consultation to the adoption of a specific policy solution, followed by its implementation. An evaluation of failure and success may then lead to a second cycle of policy development and so on. Most stages of open access policy development up to the adoption of specific policies are very well documented.³ For the purpose of describing and evaluating policy implementation, it suffices here to note the following:

- Open access seems driven by the idea that the rise of the Internet opens up unprecedented possibilities to make the published research output universally available and engender wider and new forms of use. The so-called serials crisis, with steeply rising prices for an ever-increasing fleet of journals may explain why libraries invest in open access, but this issue was central neither to the Budapest Open Access Initiative nor the Bethesda Statement on Open Access Publishing nor the Berlin Declaration on Open Access. When open access is defined (Bethesda, Berlin), the focus is on free use of publications and wide-ranging permissions for users, backed up by a stable (implicitly: new) digital infrastructure of open access repositories.
- With open access, new stakeholders have arisen in scholarly communication, such as digital repositories, research funders and research institutions - all with an interest in shaping the digital infrastructures of scholarly communication. The stakeholders are seeking allies among publishers and libraries, while also placing new demands on them. Publishers and libraries may convert to open access, drag their feet, promote their own agenda, or hope that open access fails, but their influence on policy development is indirect only.
- The key players shaping the policy agenda are research institutions that have passed open access mandates (even when it is based on public legislation, as in the case of the National Institute of Health, or comes from a public body with a wide range of functions, as in the case of the European Commission). There is variation among the research institutions (e.g. funders and universities), in their constitution (e.g. public and private) and in how the open access mandate came to pass (e.g. faculty approval, executive decision, public legislation), but it is the institution that drives forward the implementation. Notable are efforts at national and international coordination of policy development, but it must be noted equally that a large number of institutions have signed declarations and petitions without following through by adopting a coherent policy that is suitable for implementation. While it

³ ROARMAP provides many links to institutional websites; any many mandates have been noted and discussed in the SPARC Open Access Newsletter (by Peter Suber) <http://www.earlham.edu/~peters/fos/newsletter/archive.htm>

may be assumed that institutional procrastination occurs, it also seems the case that, to date, many research institutions principally support the idea of open access without being able or willing to work on implementation seriously. Nevertheless, only institutions may drive forward policy implementation.

- Research institutions command respect in the community. Many funders are led by venerated senior researchers. This lends considerable prestige to open access. Moreover, as funders and employers, research institutions have additional leverage over researchers. Typically, therefore, open access policies target the research as author, requiring the deposit of the author's final peer-reviewed manuscript and encouraging open access publishing. However, given the specific characteristics of the profession, with high degrees of personal autonomy and community self-regulation, any implementation is likely to require a sustained effort until such a number of researchers have been won over so as to make open access the new standard. Moreover, since researchers as authors are required to play along, any implementation must be sensitive with respect to the moral and legal rights traditionally associated with authorship. It must also offer genuine and new services to researchers as authors and users.

These observations justify a focus on institutional case studies, and the involvement of authors, be it as grantees, members or employees. Typically, an open access policy has been formulated and published. All policies, whether based on a mandate or not, target researchers as authors. This is the essential 'tertium comparationis' that enables a search for similarities and differences in policy implementation.

Studying cases: sampling, interviews and validation

For the purpose of an initial study of implementation, a selection was required. Theoretical sampling means selecting cases not for being representative (in any way) but as to whether they are likely to increase our understanding of the process of implementation. This implies a consecutive (cumulative) approach to the case studies, whereby the following case study is always also used to modify, control and enlarge previous ideas and results.⁴ Thus the French HAL platform was included as a case to investigate the potential of open access at the national level, even if the infrastructure is not backed by a formal mandate. Moreover, cases of open access policy implementation dating from 2008 or later were included to increase variety, even though evidence and experience may not unambiguously signal success. It must be noted that not all of the organisations approached were willing or able to cooperate. Sometimes the interviews were inconclusive. Yet, the following sample would seem saturated in terms of variety, and the methods utilised define a standard for further study. These are:

⁴ Glaser, Barney & Strauss, Anselm L. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine De Gruyter; Strauss, Anselm L. & Corbin, Juliet (1998). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, 2nd edition. Thousand Oaks: Sage.

- Expert interviews: a series of interviews was conducted with professionals in charge of implementing open access policies. The interviews were qualitative, conducted with the aid of an open set of questions pertinent to each case. Most interviews were conducted by phone. On the assumption that general incentives and parameters may be the essential to open access policy implementation, but success is highly dependent on institutional factors, it becomes essential to interview the professionals charged with implementation. The expert interviews are conducted to elicit the operational know how that is so important for success.⁵
- Qualitative content analysis: The interviews with the experts are subjected to a content analysis by means of a) summation and reduction to the essential elements, b) delineation of the major categories of meaning and interpretation; c) explication of context and any unclear issues; and d) structuration of text.⁶
- Communicative validation: The draft analysis is returned to the interview partners for discussion, comment and approval (internal validation). Moreover, the analysis is discussed with outside experts in the field (external validation).⁷

This type of approach should enable the emergence of second-generation open access policies, which build on a systematic appraisal of earlier success and failure. Indeed, institutions with a history of open access are encouraged to conduct and support more detailed case studies. Possibly, some institutions may be willing to share what barriers they encountered and what the failures were. When designing policy, much may be learned from what did not work, and it saves those coming later from having to repeat unfruitful experiences.

1. Refining green open access policy: Queensland University of Technology (September 2003)

The Queensland University of Technology (Brisbane, Australia) is a notable pioneer of open access policy. The University Academic Board approved a deposit mandate for the institutional repository in September 2003. It was designed to capture primarily the research output published in journals. By 2010, the repository held more than 24000 records, including more than 13000 full-text open access items. QUT is a smaller university by international standards (tenth within Australia), but the institutional repository features

⁵ Hertz, Rosanna & Imber, Jonathan B. (Hrsg.) (1995). Studying elites using qualitative methods. Thousand Oaks, CA: Sage; Meuser, Michael & Nagel, Ulrike (1991). ExpertInneninterviews – vielfach erprobt, wenig bedacht. In: Qualitativ-empirische Sozialforschung: Konzepte, Methoden, Analysen. Eds. D Garz & K Kraimer. Opladen: Westdeutscher Verlag, pp. 441-471.

⁶ Mayring, Philipp (2000). Qualitative Inhaltsanalyse. Grundlagen und Techniken. Weinheim: Deutscher Studien Verlag.

⁷ Seale, Clive (1999) The Quality of Qualitative Research. London: Sage

among the top twenty in the world (Webometrics Ranking of World Repositories, July 2010: No 20 among institutional repositories overall).⁸

QUT is an exemplary case of institutional implementation because the university reviews and refines its policy at regular intervals, every three years. Moreover, QUT seems to have taken on the challenge of maintaining its focus on open access despite the rise of research evaluation and its fixation on the publisher's version of record for the purpose of counting citations. Collaboration and exchange of data with subject repositories is also being explored.

In 2003, the policy stipulated the following (excerpt):

“Material which represents the total publicly available research and scholarly output of the University is to be located in the University's digital or "ePrint" repository, subject to the exclusions noted (...).

The following materials are to be included:

- *refereed research articles and contributions at the post-print stage (subject to any necessary agreement with the publisher);*
- *refereed research literature at the pre-print stage (with corrigenda added subsequently if necessary at the discretion of the author);*
- *un-refereed research literature, conference contributions, chapters in proceedings, etc;*
- *theses (as prepared for the Australian Digital Theses (ADT) process).*

(...)Material to be commercialised, or which contains confidential material, or of which the promulgation would infringe a legal commitment by the University and/or the author, should not be included in the repository.“

A first revision in 2006 clarified two aspects. Firstly, the wording was altered to indicate that authors were not required to deposit both the pre-print and the post-print of an article, and were free to determine the appropriate moment of deposit in accordance with the prevailing disciplinary culture. Secondly, it was clarified that the act of depositing was not subject to agreement with publishers, but that making the item open access could be subject to delays (embargo) or restrictions if the publisher's terms and conditions so demanded. A second revision in 2009 restated the distinction between the deposit mandate for peer-reviewed manuscripts (journals, conferences), and other materials, the list of which was extended to also include, for example, data and books.

Over the past years, the deposit rate has been higher than the annual output of publications, an indicator of the backfilling of the repository. Given the high deposit rate, any measurement or enforcement of compliance has not been a strategic concern. Care has been taken to make deposit easy through a straightforward self-deposit system that is backed by the library, which verifies and corrects data. The repository has been positioned as a service for researchers, as empowering authors in accelerating dissemination, in retaining rights over their publications, in reaching a wider audience, and in improving citation rates.

⁸ Publicly available information from QUT - http://www.mopp.qut.edu.au/F/F_01_03.jsp; Ranking Web of World Repositories (Institutional, July 2010) - http://repositories.webometrics.info/top800_rep_inst.asp (accessed 30 August 2010).

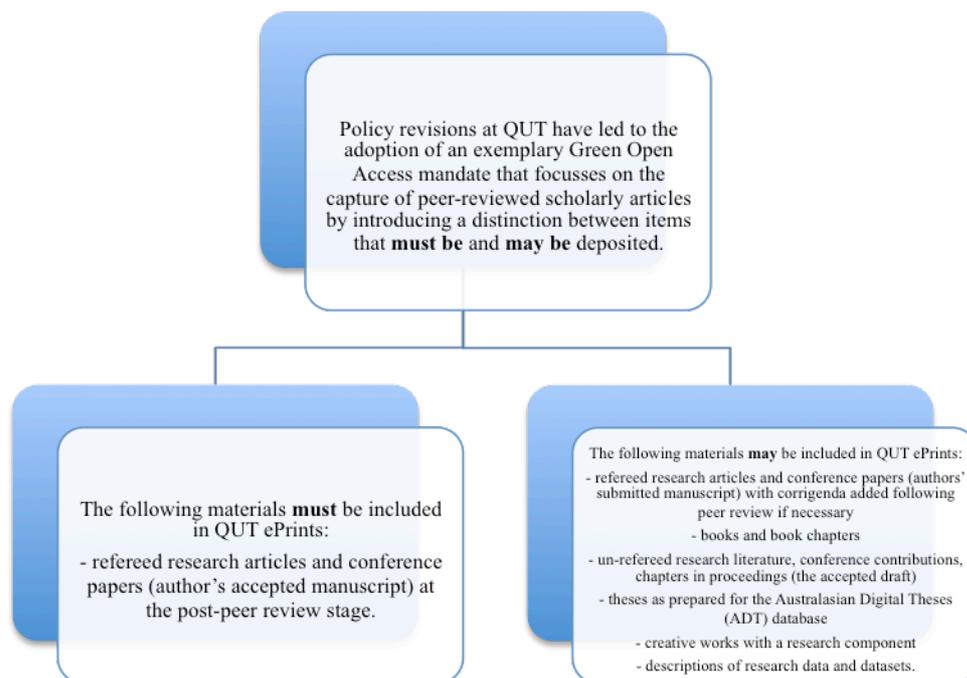


Figure I - Green Open Access: the essential elements and the supplements

The library collects download data from the QUT ePrints service for analysis. Some of the items downloaded most frequently are papers, which are of interest to the local community, a wider lay audience, or of relevance to industry. Also, for some of the more prominent authors, the library has collected correlational data indicating that citation rates increased significantly after authors began making open access copies of their work available via QUT ePrints. For the fifty most downloaded QUT authors it has been possible to collate citation data (obtained from Scopus) for the years before the authors started self-archiving (e.g. 2003 and earlier, if the author was at QUT already in 2004) and for the years in which self-archiving was comprehensive. Science is a growing enterprise and citation counting is improving, but if citation rates for authors more than double within three years of pursuing an open access strategy, then this strategy may be credited at least as having resulted in an early mover advantage. Once most or, at least, many of the prominent universities implement a similar open access strategy, authors at QUT may benefit less, relatively speaking, but in the meantime they do obtain a clear advantage by self-archiving.

Some of the researchers at QUT frequently deposit working papers in existing, global subject-based repositories (e.g. arXiv in Physics, RePEc in economics). For these authors there is an issue of workload, and also of ensuring that the copy existing in different repositories is identical and enables others to cite you correctly. In response, QUT is working on improving the interchange of items with subject-based repositories to ensure that authors must deposit only once (unless they chose to update the deposited version later). This strategy of integration maximizes the visibility of QUT authors in their scholarly community.

QUT is a pioneer open access institution, and the institution and some of its scholars have benefited in terms of extra funding and recognition. This, however, does not explain the success. Rather, regular policy review, well-funded implementation, improved repository service and the demonstration of benefits to authors must be mentioned. As will become clear, other institutions may strive to do as QUT does, but no other university has travelled down the road quite as far as QUT has.

2. Refining policy to foster deposit: University of Zurich (July 2005)

In October 2005, the University of Zurich signalled in ROARMAP that it had adopted an open access policy ‘requiring’ deposit. However, the original wording in German had been ‘erwartet’, i.e. ‘expected’ – which is a weaker term. Moreover, only in October 2006 did the repository ZORA (Zurich Open Repository and Archive) go live. Initial deposit rates remained low. In May 2008, the university enhanced its policy, henceforth requiring researchers to deposit.

Remarkable about the University of Zurich and its open access team is the perseverance in improving implementation and refining policy to increase the deposit and open access rate.⁹ The policy guidelines of May 2008 stipulated three essential elements:

1. The university requires its researchers to deposit a copy of their publications in ZORA with open access unless legal obstacles prevent this;
2. The university encourages its researchers to publish in open access journals whenever possible and contributes towards article processing charges;
3. The annual reports of the university will be based on ZORA, and only publications registered in ZORA will be included. In practice, this refers to metadata only and does not depend on full text deposition in ZORA.

One immediate effect of the change in policy was that the number of publications registered in ZORA increased significantly for 2008 and 2009. Whereas for the years between 2005 and 2007 the number of available items is about one thousand, for 2008 and 2009 the number increased above 7000, essentially capturing the entire output of the university. The main and immediate reason was that researchers wanted their publications to be incorporated into the annual reports and thus deposited records in ZORA. Publication records should not be equated with access to the texts. Taking 2009 as reference year, and excluding books, the university estimates that for about sixty percent of the records a full text is available in ZORA. However, a significant part is permanently inaccessible due to copyright restrictions. Actually available in open access are about forty-two percent of publications. Of these, five out of six are available on ZORA, and the remaining documents may be accessed via a link to the publisher’s website.

⁹ The efforts of the University of Zurich in promoting open access, including also a comprehensive open access website and a video explaining the principles, were honoured by an award: the university won "BioMed Central’s Open Access Institute of the Year" award in mid-2010, together with Harvard University and the Chinese Academy of Science. For more information about the University of Zurich and ZORA: <http://www.oai.uzh.ch/>

A deposit rate of about 60%, after two years, is relatively high. An overall open access rate around 40% is also good (if one compares this to efforts elsewhere and takes into account that the University of Zurich includes disciplines in which open access is far less established, such as social sciences and humanities). Achieving this measure of success is the result of years of dedicated effort. For every item registered in ZORA, the open access team determined whether and what kind of version would be eligible for deposit, and this was communicated to the author whenever possible. Persuading authors that the postprint, i.e. the accepted author's manuscript, is a viable publication form and that it may be deposited in open access, was the most important challenge. Particularly researchers in social sciences and humanities strongly favour the publisher's version. However, publishing contracts usually assign the rights in this version to the publisher only.

Four issues encountered by the Zurich open access team are of wider significance for all institutions contemplating an open access policy based on an institutional repository: a) faculty reluctance in accepting the author's final peer-reviewed manuscript as an authoritative version; b) the substantial effort required to ensure that ZORA at all times was compliant with copyright law and the actual publishing contracts; c) the resources needed to push for deposit, retain editorial control, check copyright and continue developing the policy; d) information technology resources needed to develop ZORA functionalities and make it a natural part of the researchers digital environment.

To win over faculty much advocacy was conducted, particularly in establishing the postprint as an authoritative version that increases the visibility of publications and enhances the circulation of ideas. Besides confusion as to what the postprint is, and how it differs from the publisher's version, there was often little enthusiasm among scholars in the humanities. Many felt partial towards the publishing house, many of which are small and specialist, and were reluctant to engage in any activity that might harm these publishers – or so the perception. The open access team responded by emphasizing that it was seeking deposit only of texts that had passed quality control (peer or editorial review) but that it would only make accessible texts (postprint, publisher pdf) in compliance with the law and publishers policies.

Ensuring lawfulness and adherence to contracts was so important to the university that it commissioned a special report by renowned experts of Swiss and international copyright law. One interesting finding was that Swiss authors, when self-archiving in a Swiss repository, may make available a copy of a scholarly journal publication three months after its original publication – unless they had a written or oral agreement with the publisher that specifies otherwise. While an extensive FAQ aimed at researchers was developed on the basis of the legal opinion, there remains the task of determining the copyright situation for every publication. Databases covering many of the large international publishers may facilitate the task, and the open access team has compiled an additional database (covering more than 1000 journals), but the check needs to be made and the permissible version

obtained from the author or publisher, with preference given to the final published version wherever it may be displayed.¹⁰

Above all, the university devoted resources to make open access happen. For the past years a task force has been assembled to deal with the spike of reporting in ZORA that occurs as the deadline for the annual report approaches. The repository is staffed for editorial control of metadata, peer review status and copyright checks. The open access team performs many more activities: advocacy; courses for ZORA-submitters and students; and coordination of new ideas ranging from an extension of ZORA functionalities to long-term preservation. It also responds to any questions posed by university members. The university continues to accompany open access implementation through the Open Access Council, on which each faculty is represented, and which considers ideas and suggestions for improving implementation.

As ZORA grows in size, and researchers begin to monitor their deposits, the University of Zurich faces the next challenge: the increased demand of researchers for an enhanced functionality of the repository, most importantly enhanced opportunities for the re-use of the metadata and texts. Once researchers begin filling the repository, their expectations increase. For example, they want to export data to their website in multiple ways, use it for reporting purposes, and track usage of their items. It is anticipated that the co-operation between the Main Library— where the open access team is located – and the IT services of the University – who run the ZORA server – needs to be intensified. IT-resources are needed to enhance the functionalities of the ZORA platform and make it an element of the researchers' IT environment that they are eager to use. In return, resources elsewhere will be saved – e.g. when publications in a researcher's website no longer have to be maintained separately but are fed automatically from ZORA; or when the evaluation office of the university can use the quality-controlled metadata from ZORA as a basis for their work.

The University of Zurich is a pioneer of open access in continental Europe that has mastered many of the challenges that institutions in this region may expect, such as introducing the author's final manuscript as a secondary publication, appreciating the closeness of many scholars to smaller publishers in the country and/or discipline. More generally, it emerges that the authors expect to be served as users in two ways: readily tracking their impact as authors, and easily being able to use and re-use their data and deposits.

3. National platform, open collection, decentralized policy: the HAL platform (June-October 2006)

Hyperarticle en Ligne (HAL) is a national platform.¹¹ Because it is a French platform, observers may imagine HAL as centralized system, whereas the remarkable achievement of

¹⁰ See <http://www.oai.uzh.ch/> - buttons for FAQ, Copyright, Journals and Publishers etc., including links to the SHERPA ROMEO list - <http://www.sherpa.ac.uk/romeo/>.

HAL is to be a dynamic platform in a decentralized environment. A shared platform is compatible with a patchwork of local policies, but this means that every institution faces the challenge of conceiving and implementing a feasible open access policy. Usually, the repository is not based on an open access deposit mandate (with the exception of the partial mandate of the Agence Nationale de la Recherche, Humanities and Social Sciences Branch, dating from July 2008), and in many instances there is not even an explicit open access policy.

HAL was conceived as a response to a temporary outage of arXiv. It was first implemented in 2001 by the newly created Centre pour la Communication Scientifique Directe (CCSD) of Centre National de la Recherche Scientifique (CNRS), which has been responsible for the development of the platform ever since. The transformation of HAL into a national platform was incremental, based on a large number of autonomous institutions individually deciding to join, ranging from national research organisation to individual journals, and including universities, research societies and conference organisers. The pivotal moment came in 2006, when agreement was reached among the four largest research organisations, i.e. CNRS, INRIA (Institut national de la recherche en informatique et automatique), INSERM (Institut national de la santé et de la recherche médicale), INRA (Institut national de la recherche agronomique), and further partners such as the association of universities and of the Grandes Ecoles. This established HAL as the national platform, and it has become an easily sustainable solution because many more institutions have adopted HAL. Fifty-nine research institutions, eighty-nine universities and seventy Grandes Ecoles have adopted HAL, and there are many more collections, for example stemming from journals, laboratories and conferences. Moreover, HAL is connected very well to the international subject-based repositories that researchers care about (e.g. arXiv, RePEc, PubMed Central).

In such circumstances, the collection emerging will be diverse, possibly large, but not always coherent. This is reflected in the difficulty of establishing reliably the amount of content available in HAL. In 2010, all French repositories, cumulatively, passed the threshold of two million items (much has been contributed by the digitization of nation journal archives, which often are open access or, at least, open access behind a moving wall). It is estimated that HAL holds about 450000 items, though it is difficult to confirm the exact number because of the double or multiple display of items throughout the HAL system. Also, because of the variety of collection and display policies, it is not possible to estimate with confidence how much content is open access. For example, in September 2010 the homepage of HAL indicated the availability of about one hundred and fifty thousand full texts (of which about 40000 stem from the archive of the Journal de Physique, about 20000 are theses, and about 10000 are publication of the European Geosciences Union). For the years 2006 to 2008 it has been estimated that HAL captured in open access about 7-8% of the French national output, but HAL is not the only

¹¹ The ten partners joining to create HAL as a national platform were: CEMAGREF, CIRAD, CNRS, Conférence des grandes écoles, Conférence des présidents d'université, INRA, INRIA, INSERM, Institut Pasteur & IRD.

repository.¹² Overall, it would seem fair to suggest that the virtue of HAL is that it ties in so many institutions that it allows a whole country to move forwards, but that the overall rate of open access is not yet significant. That does, however, lead to the question what distinguished those institutions that achieve a significantly higher open access rate.

Since HAL has no mandatory deposit policy, the institutions are responsible for organising deposits. Frequently, the local units of national research institutions, or the departments and laboratories of universities, are autonomously responsible for feeding HAL. For example, INRIA is an important contributor to HAL and consolidated numbers exist for the three years from 2007 to 2009, which show the annual publication output, the items logged in the repository and the available full texts. More than one-third open access has been achieved. Among the eight INRIA institutes (located around France), the rate varies from approximately twenty-five to fifty percent open access.

As no uniform collection policy exists, institutions and their sub-units must decide what to include. HAL INRIA collects scholarly output (conference proceedings, journal articles, books), but also technical reports, teaching materials and theses and dissertations. For example, of the 2964 items logged in HAL for 2007, 1288 were conference proceedings, 763 journal articles, 430 technical reports, 142 PhD theses and 34 books (a typical distribution). For repositories overall it is estimated that about one in six deposits is ‘grey’ literature, i.e. non-published materials like a thesis or report.¹³

	2007	2008	2009
Publications in annual report	4977	5153	5868
Items logged in repository	2964	3329	3423
Full text deposit or linked	1820	2023	2154
Open access percentage	36,6%	39,3%	36,7%

Table 1. Open access percentage for INRIA publications

¹² Schöpfel, Joachim & Prost, H elene (2010) D evveloppement et Usage des Archives Ouvertes en France. Rapport. 1e partie: D evveloppement - http://archivesic.ccsd.cnrs.fr/sic_00497389_v1/; Barruch, Pierre (2007) Open Access Developments in France: the HAL Open Archives System. *Learned Publishing* 20(4)267-282. Access to HAL: <http://hal.archives-ouvertes.fr/> & <http://www.ccsd.cnrs.fr/>

¹³ Schöpfel, Joachim & Stock, Christiane (2008) Grey literature in French digital repositories: a survey. http://archivesic.ccsd.cnrs.fr/sic_00379232/en/

For France, the open access rate is estimated at ten percent overall, but all INRIA institutes have significantly higher institutional deposit rates. The reasons would seem to be:

- a) The rapid accumulation of a high number of full texts in a few months (2006) that has increased the value and visibility of the repository, importantly also to the authors that have deposited (HAL INRIA is currently ranked eighth among all repositories and third among the institutional repositories worldwide);
- b) A disciplinary culture highly compatible with self-archiving and a deposit policy that encourages the deposit of a wide variety of items, including conference papers and reports, and also material which, strictly speaking, is not of a scholarly nature, such as texts of popular science tutorials, posters and so on. All of this drives up the value and visibility as outlined above;
- c) A set of service tools for authors (e.g. author identification, publication list export, webpage creation) that provide an incentive to record and archive publications.

That formal open access policy development is not easy in France becomes evident if one considers that many research laboratories are so-called Unité Mixte de Recherche (UMR), supported by a variety of institutions (e.g. one or more universities plus one or more national research organizations). Each laboratory could adopt an open access policy, but often it would cover only a small number of researchers. If institutions adopt specific deposit mandates or collection policies, this would require national coordination lest the policies are not complementary or even contradictory. Some UMR have nevertheless accumulated a significant number of deposits over deposits over the past years.

	Participating institutions	Deposits in HAL (June 2010, cumulative)	Open access percentage (2007-09, estimate)
UMR 7039 Centre de Recherche en Automatique de Nancy (CRAN)	Université Henri Poincare, Institut National Polytechnique de Lorraine, CNRS	778	39%
UMR 7118 Analyse et Traitement Informatique de la Langue Française (ATILF)	Université Nancy 2, CNRS	200	29%
UMR 7502 Institut Élie Cartan Nancy (IECN)	Université Henri Poincare, Université Nancy 2, Institut National Polytechnique de Lorraine, CNRS, INRIA	718	to be confirmed

Table 2. UMR located in Nancy and their open access percentage

A case in point are three UMR located in Nancy, in the area of computer science, mathematics and linguistics. Deposit in HAL seems to have been supported by the following factors:

- a) Institutional diffusion: all UMR have had strong institutional and/or personal links with the INRIA institute located in Nancy, which has achieved more than forty percent open access in HAL;
- b) HAL as a reporting tool: one UMR has explicitly adopted HAL as a reporting tool for publications, while a second UMR uses HAL extensively for logging preprints;
- c) Inhouse publication management: two of the UMR have personnel and resources for publication management, including deposit to HAL.

To date, the HAL infrastructure may be utilized to achieve open access deposit rates that are similar to those of funders and institutions that have a deposit mandate and/or fund article processing charges. On the other hand, the overall rate of open access facilitated by HAL is not higher than ten to fifteen percent. However, HAL provides a ‘smart’ infrastructure that enables a division of labour with some centralized development, many local instances, shared evolution of services, and a sense of joint responsibility. It keeps cooperation and transaction costs low. By allowing all kinds of institutions, laboratories and journals with varying policies to connect, all are enabled to move forward. Yet, the opportunities and benefits associated with this national but decentralized approach could be realized much quicker and more effectively if more stringent local policies were developed to foster deposit.

4. Maximising a funder’s impact: The Wellcome Trust (October 2006)

The Wellcome Trust open access policy came into effect in October 2006.¹⁴ It requires authors to make freely available a copy of their journal article through UK PMC. Two routes are open to grantees, either to publish in an open access journal or, else, to publish in a journal that permits self-archiving. The Wellcome Trust policy is significant in two ways. Firstly, among research funders, the Wellcome Trust was the first mover and made a substantial effort to monitor policy implementation. Secondly, the research funder supports a specific research field (here: the life sciences) and has implemented a coherent solution that centres on a subject-based repository service (see below).

The Wellcome Trust supports and monitors policy implementation in four ways.

- a) It is expected that within six months of publication a copy will be deposited in UK PMC. Compliance may be checked by observing the rate of deposit for the last six month. As a first benchmark, after three years, the Wellcome Trust has achieved a deposit rate of about forty-five percent, with four out of five manuscripts submitted by publishers (green or gold), and the rest coming through the author submission system.

¹⁴ The Wellcome Trust OA policy and further information - <http://www.wellcome.ac.uk/About-us/Policy/Spotlight-issues/Open-access/index.htm>

- b) The Wellcome Trust has asked grantees to report, at the end of any grant, what results have been published and whether all manuscripts have been deposited in UK PMC. This second check enables the Wellcome Trust to request a deposit one more time, though this may mean that it occurs later than initially requested (i.e. outside the six months).
- c) Block funding is provided to the home universities of grantees to cover open access publication charges. The Wellcome Trust has identified at which universities most of their grantees reside. At thirty universities, grantees may draw on these funds beyond the lifetime of their grant to pay for any open access publication charges - another chance to increase the number of manuscripts becoming available in UK PMC.
- d) The overall cost of open access may be monitored. In the financial year 2009/10 expenditure for open access was GBP2.9m – for an open access rate approaching fifty percent. Given the Wellcome Trust’s total research spend of about GBP650m, the Wellcome Trust expects that full open access would amount to the envisaged one percent of the research budget.

The Wellcome Trust:

- Expects authors of research papers to maximise the opportunities to make their results available for free,
- Requires electronic copies of any research papers that have been accepted for publication in a peer-reviewed journal, and are supported in whole or in part by Wellcome Trust funding, to be made available through PubMed Central (PMC) and UK PubMed Central (UK PMC) as soon as possible and in any event within six months of the journal publisher's official date of final publication,
- Will provide grantholders with additional funding, through their institutions, to cover open access charges, where appropriate, in order to meet the Trust's requirements,
- Encourages - and where it pays an open access fee, requires - authors and publishers to license research papers such that they may be freely copied and re-used (for example for text and data-mining purposes), provided that such uses are fully attributed,
- Affirms the principle that it is the intrinsic merit of the work, and not the title of the journal in which an author's work is published that should be considered in making funding decisions.

Figure II – A funder’s open access policy (excerpt)

The effort at monitoring enables some further reflections on open access policy implementation by research funders. Funders adopting such a policy wish to maximize the impact and re-use of research results – automatically and immediately. Open access publishing delivers both, whereas self-archiving necessarily includes a delay due to the embargo that must be respected. Moreover, there is uncertainty whether all authors will comply. A remedy may be that publishers deposit manuscripts on behalf of the author

(though this is a somewhat paradoxical situation, i.e. author self-archiving becomes a publisher service). However, if publishers deposit, they are in a position to withhold or limit re-use rights, and to charge for the service.

Overall, funders are able to anticipate publication charges as part of research costs and may budget reliably. This indicates that research funders are likely to prefer open access publishing and are crucial to its success.

5. Implementing open access as a digital infrastructure: UK PMC (January 2007)

UK PMC was set up in January 2007, backed by eight research institutions with an open access policy, mainly public and private research funders in biomedicine and health, but including some research performing organisations.¹⁵ The British Library has delivered the repository, with several more partners contributing to service improvements.¹⁶ Moreover, international funders have joined UK PMC in an effort to create a Europe PMC.¹⁷

In 2009, UK PMC registered about 750000 downloads a month (and PMC in the US presumably registers many more, as UK PMC registers about 250000 unique sessions a month, but PMC many millions). Download at UK PMC compare well to other subject-based repositories, e.g. RePEc also had around 750000 downloads a month in that year. UK PMC operates a helpdesk for manuscript submission and access queries. Frequency and content of queries indicates that the service is running smoothly. Given that UK PMC is backed by research organisations and thus one of the better-funded, large and reliable repositories, its functionality and service is among the best. Notable have been the deployment of a single search interface (<http://ukpmc.ac.uk/>); the ingestion of content types other than journal articles, such as clinical guidelines and doctoral theses; the development of software to enable citation counting and surfing; and steps towards enabling text mining of the full corpus.

UK PMC shows how the emergence of funders and research organisations as major players in digital publishing leads to a shift in focus. Published outputs are no longer primarily a product (to be purchased by libraries, to be read by researchers) but input for information infrastructures. Information infrastructures for digital scholarship are subject-specific and global, because science is universal but disciplinary. UK PMC is a national add-on to an existing infrastructure, first built in the United States by the National Institute of Health. PMC Canada and Europe PMC follow the same logic, and the various national (e.g. US, UK, Canada) or international (Europe) portals now constitute entry-points that

¹⁵ <http://ukpmc.ac.uk/About> - Arthritis Research UK, Biotechnology and Biological Sciences Research Council, British Heart Foundation, Cancer Research UK, Chief Scientist Office, National Institute for Health Research, Medical Research Council, and the Wellcome Trust – some of which fund research externally as well as supporting inhouse research units.

¹⁶ European Bioinformatics Institute, MIMAS (Manchester, a national data centre), and the National Centre for Text Mining.

¹⁷ Austrian Science Fund (FWF), Health Research Board (Ireland), Science Foundation Ireland, Telethon (Italy).

offer differing, partly overlapping, partly competitive, services on the basis of a globally shared infrastructure.

The notion that a publication is mainly an input to future research is captured well by the Medical Research Council:¹⁸

“If an open access fee has been paid MRC requires authors and publishers to licence research papers such that they may be freely copied and re-used for purposes such as text and data mining, provided that such uses are fully attributed. This is also encouraged where no fee had been paid.”

The open access policies of the backers of UK PMC are similar in intent and outline. All policies mandate deposit and grant a maximum embargo period of six months after publication. There is a clear preference for the retention of copyright by authors. If an article processing charge has been paid, all funders require a re-use license. Publication in journals that are not compliant with the stated policy and UK PMC is strongly discouraged.

However, the manuscript submission rate still represents a challenge. Initially, only about ten percent of mandated manuscripts found their way into UK PMC. The Wellcome Trust, with a concerted effort (see above), over three years raised that rate to about half of all mandated manuscripts, while other UK PMC sponsors with a mandatory deposit policy report lower rates. It may be observed that funders are typically removed from their grantees, which are employed elsewhere, and any research contract is of limited duration. Hence, funders may be interested in

- a) Asking applicants (and their institution) to include future open access publishing costs already in their grant request (e.g. MRC),
- b) Reimbursing authors (and their institutions) for publication charges beyond the lifetime of the contract (e.g. Wellcome Trust),
- c) Asking publishers to automatically deposit eligible articles, even if additional charges are levied (e.g. Arthritis Research UK).

Indeed, the main difference is in what way and how far open access publication charges are sponsored and reimbursed. The more funds are available and the easier it is to obtain them, the higher the rate of open access publishing and of automated deposit to UK PMC.

Relations with publishers are characterised by cooperation and conflict. Some publishers have agreed to archive on behalf of the authors, directly depositing into UKPMC as the embargo expires. Other publishers seek to inhibit archiving at UKPMC, demanding extra payment for every article, this being either a relatively high publication charge or an extra charge for a green open access deposit.

¹⁸ See <http://www.mrc.ac.uk/Ourresearch/Ethicsresearchguidance/Openaccesspublishing/index.htm>

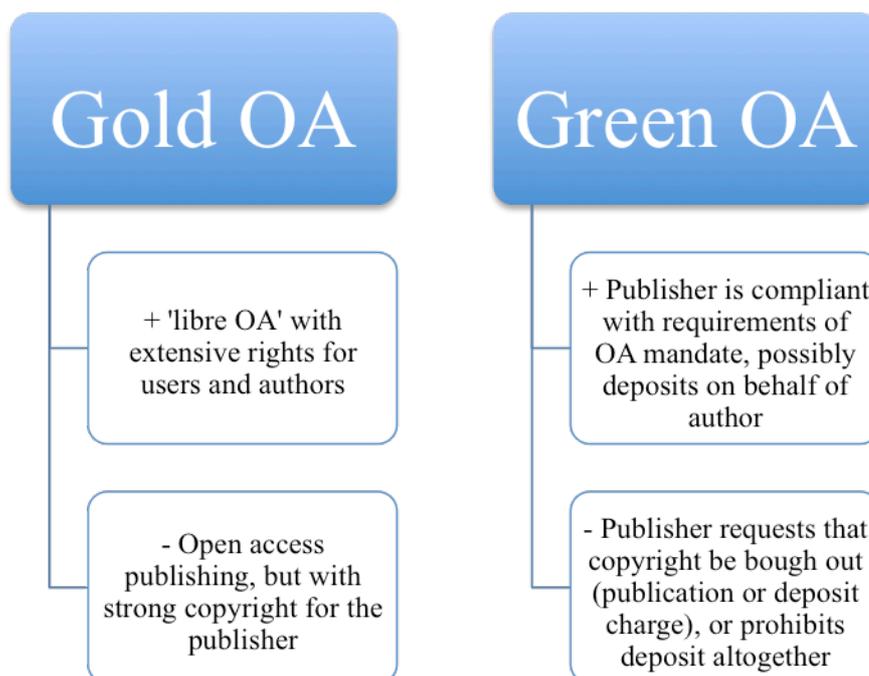


Figure III - Funders and Publishers: cooperation & conflict

The motivation and outlook of the backers of UK PMC may be explored further. For example, the Medical Research Council (MRC, UK) introduced its policy with effect from October 2006, following discussion with the other Research Councils in the UK. The MRC was interested in a solution corresponding to its national community of grantees, including the thirty research units and institutes it directly sponsors. PubMed and PubMed Central, as national infrastructures for the United States, were considered as a model. In preparing implementation of the policy, the MRC had worked since early 2005 with the Wellcome Trust, and other UK funders, on the development of a corresponding UK infrastructure, effectively leading to the emergence of an international infrastructure (PMC International). In this manner, the MRC pro-actively shaped the infrastructure and worked to ensure its sustainability.

For the MRC, UK PMC is an essential element of its policy because

- a) It makes MRC funded research outputs more visible, also as a collection of outputs (and in due course a complete collection of primary publications);
- b) Nationally, it brings all the relevant disciplinary research funders to the table, facilitating collaboration, which, in turn, makes any investment in UK PMC more efficient;
- c) The repository provides a distinct interface and added value to the MRC and its community of intramural researchers and grantholders, for example, through the mining and re-use of research results.

Arthritis Research UK also joined UK PMC at the beginning.¹⁹ The main motivations were ensuring the unrestricted availability of published research results; placing these results in a wider, subject-based context; and collaborating with other biomedical research funders in exploring the future of digital scholarship. As currently the smallest specialist funder, the relationship with grantees is particularly important for Arthritis Research UK, hence there is a strong emphasis is on persuading rather than policing grantees to deposit their papers in UK PMC.

Consequently, Arthritis Research UK is particularly keen on improving the functionality and service of UK PMC because

- a) The improved interface and additional features enable promotion of the service with grantees,
- b) A growing corpus of content on UK PMC will support public access and open learning on the issue of arthritis,
- c) Publications as ‘pure outputs’ of research will gradually become more embedded in a wider digital research and learning infrastructure.

The Health Research Board (HRB, Ireland) joined UK PMC in January 2010.²⁰ This enabled HRB to implement a mandatory open access policy, requesting grantees to deposit in UK PMC a copy of all papers, which have been accepted in a peer-reviewed journal. Adopting UK PMC as preferred infrastructure followed a review of a HRB open access position, which had been adopted two years previously.

Ireland has significant funder mandates, but repository development typically has been university-led. HRB, however, also has grantees outside academic institutions. In this situation, UK PMC offered a funder-led infrastructure, which matches the portfolio of HRB. Notably, the Science Foundation Ireland, which funds across the academic disciplines, simultaneously decided to join UK PMC.

For HRB, the decision to join UK PMC, and to participate in the possible extension of the project as Europe PMC, made sense institutionally for the following reasons:

- a) A funder-led, subject-based repository is most effective, because it enables direct and monitored implementation, and also most efficient, because all content is ingested and made available at a single site;
- b) Research outputs funded by HRB become visible internationally alongside other subject-specific outputs in a single repository with varying access portals, increasing usage and the possible uses of published outputs;
- c) HRB is enabled to become a player in the further development of subject-specific digital infrastructures, in partnership with other funders;
- d) A joint project of funders enhances their bargaining power in the relationship with publishers when it comes to securing Green open access, buying out copyright to foster re-use, and developing open access publishing solutions.

¹⁹ See http://www.arthritisresearchuk.org/research/our_research_policies/open_access_policy.aspx

²⁰ See <http://www.hrb.ie/research-strategy-funding/policies-and-guidelines/policies/open-access/>

Both the UK and Ireland have a well-developed repository infrastructure centred on universities. As of 2010, in Ireland only one university has an open access mandate (Dublin Technology Institute), whereas in the UK seventeen institutional mandates are recorded. Nevertheless, the UK repositories and the universities have not been able to make a comprehensive offer to research funders to organise the deposit of research outputs, and thus support the policy implementation of research funders. Yet, as the number of institutional mandates grows, some co-ordination between funders and universities would seem necessary to ensure that the authors are not burdened with multiple deposit requests.

6. Learning from global research infrastructure: SCOAP3 (April 2007)

The Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP3) is remarkable because it revives the old dream that open access will enable (public) research institutions to cap the cost of scholarly publishing (ending the serial crises) while promising to deliver a publishing system that may be integrated seamlessly into the new digital research infrastructures.²¹ In this sense, SCOAP3 complements the Large Hadron Collider at CERN and the digital data infrastructure associated with it. It originates from the same culture of global collaboration that serves to tackle large-scale scientific and technological challenges – challenges too large even for a nation state.

SCOAP3 is the first and, to date, most important trial run for the global conversion of journals to open access. It is a global enterprise because it requires collaboration on all continents to collect the EUR10m budget envelope, an inclusive international decision-making process when tendering journal publishing, and will result in open access publishing as a universal standard for a research field (High-Energy Physics - HEP). Green open access is already the standard in HEP, with more than 95% of HEP articles freely available since the late 1990s. For the HEP community, the leading journals are easy to identify. Four out of five articles are published in six leading journals owned by four publishers, and more than 60% of the articles appear in journals owned by not-for-profit (society) publishers.²² SCOAP3 seeks commitment from library and funding agencies who are today purchasing subscriptions, to flip publishing in HEP, by tendering for peer-review services in established journals, who would make their content open access in a manner that connects the price to quality and volume (introducing tendering as a new element to open access publishing).

The main implementation challenge is the collection of pledges from countries and institutions (mainly libraries, but also their funding agencies in a more global sense) to fund SCOAP3 - and in this the project differs from collaborative open data projects, which are funded simply by the researching institutions, not the 'reading' institutions. Shares initially

²¹ See <http://scoap3.org/>

²² Mele, Salvatore et al (2006) Quantitative Analysis of the Publishing Landscape in High-Energy Physics. JHEP 12 S01; Mele, Salvatore (2009) SCOAP3: where libraries, scientists and publishers meet repositories, peer-reviewed journals and Open Access. *Serials Review* 35(4); Gentil-Beccot, Anne; Mele, Salvatore & Brooks, Travis C. (2009) Citing and Reading Behaviour in High-Energy Physics. How a community stopped worrying about journals and learned to love repositories. - <http://arxiv.org/abs/0906.5418>

are allocated by country and to be based on 'peer review usage'. For example, the United States is expected to contribute 24.3%, Germany 9.1%, China 5.6% and Brazil 2.7%. Early on, implementation in the US presented a formidable challenge as pledges had to be collected from a large number of libraries and their consortia, who today purchase access to HEP titles by subscription. By September 2010, however, nearly the whole projected budget of USD3.5m had been pledged by almost two hundred institutions, showing that open access may be mandated not only centrally (e.g. NIH mandate legislated by Congress), but also built across the country. In this process, SCOAP3 managed to reach and persuade several hundreds of decision makers.

Overall, by September 2010, SCOAP3 has collected pledges amounting to more than 70% of its yearly budget envelope across Europe and North America, in the Middle East and Australia. The challenge that remains is to extend SCOAP3 beyond these regions. The necessary contributions from Japan (7.1%), China (5.6%), Russia (3.4%), India (2.7%) and Brazil (2.7%) are missing so far. While SCOAP3 is confident that support in these countries will materialize, the project is equally adamant that SCOAP3 will only move ahead if pledges from these outstanding countries have been made (amounting to 21,5% of the budget). The message is that open access will happen globally, or it risks failing. International consensus on open access and its principles must be translated into action that is backed by financial commitment. In all countries those stakeholders with decision-making capacity are eventually to face up to their responsibility that if they can make a pledge, they must do so, or else the SCOAP3 opportunity might be lost.

SCOAP3 demonstrates that reaching international consensus is the main challenge in establishing open access publishing as a standard. And the High-Energy Physics community seems to be a good work-bench to explore this idea, with decades of collaborative approach and a truly globalised research infrastructure. Will libraries move to the same level of international co-operation to solve their long-standing issues?

It is not that the mechanisms of the tender are unclear. The tender for the journals will link price with quality and volume. Assuming a capped budget envelope, this requires a ranking of journals by quality (e.g. based on bibliometrics) in combination with the suggested price per article. Based on the proposed journal volume, SCOAP3 would then award contracts until it has reached its limit. It is also not that the major conditions of the tender are unclear. If publishing will underpin digital research infrastructures in new ways, then all articles must be irreversibly available in open access with wide-ranging use and re-use rights, for the general public, researchers, and the machines they'll build in the e-Science era. Publishing must be integrated with the global research infrastructure, e.g. by pushing all articles into repositories.

It is remarkable that all publishers in the field are already experimenting, while waiting for SCOAP3 to happen, with Open Access along the lines proposed by this initiative, e.g. for the publication of the first experimental results of the CERN LHC collider. Publishers will be an integral part of the tendering and will be free to tender their journals for conversion, or continue running them on the traditional model. Publishers may also launch new journals. That said, in the past two decades, new journals aimed at the HEP

community have not attracted submissions in significant numbers. This gives the existing HEP publishers a stake in making SCOAP3 happen.

The open access movement may have been making good progress in the United States and across the North Atlantic. Yet, it needs to face the challenge of building international consensus. Conversely, stakeholders elsewhere in the world need to face their responsibility in contributing to global open access solutions, which are presumed to benefit particularly through capped expenses with immediate and simultaneous open access to published research results.

7. Linking public access to open data: Howard Hughes Medical Institute (January 2008)

In the United States, open access is also called public access, because the focus has been on gaining on-line access to the results of publicly funded research and this has required extensive lobbying of Congress. ‘Public access’ or ‘access for taxpayers’ seems a politically more compelling notion, particularly when elected representatives must decide, as in the case of the National Institute of Health (NIH). The Howard Hughes Medical Institute, however, is private and, although also a funder of biomedical research like the NIH, follows a different model and its investigators conduct research in Hughes laboratories at universities and other host institutions. Nevertheless, the HHMI policy follows this trend and is entitled ‘Public Access to Publications’.²³ It stipulates that:

“An Institute laboratory head is responsible for ensuring that each original, peer-reviewed research publication on which he or she is a major author is freely available and downloadable on-line within six months of publication. “Major author” normally includes both the first and last authors: if a middle author is designated in the paper as the corresponding author, then that author is also considered to be a major author.”

HHMI is a very noteworthy pioneer of open access. In April 2003, the Bethesda statement on Open Access Publishing was agreed upon at the HHMI headquarters (Maryland). Moreover, the HHMI policy is that it builds on an earlier research policy on “sharing of publication-related materials, data and software”, effective since May 2003. In the May 2007 HHMI Bulletin, then President Tom Cech²⁴ explicitly connected these two policies by stating that the envisaged public access to publication should be seen as a logical extension of the policy principally requiring laboratory heads to share materials within sixty days of any request (after publication). The rationale for this (unique) policy was that the HHMI mission to biomedical science forward was best served if the materials, databases and software integral to scientific advances was made available for verification or extension by other researchers.

²³ See <http://www.hhmi.org/about/research/policies.html>

²⁴ See <http://www.hhmi.org/bulletin/may2007/cech/>. Of course, the research policy on „Sharing of Publication-Related Materials, Data and Software“ (SC-300) was appropriately hedged with reference to the requirements of law, national security and a list of responsibilities for those requesting materials.

The HHMI policy covers ‘laboratory heads’, which means all the principal investigators at HHMI’s Janelia Farm Research Campus and at the universities. Thus the vast majority of the approximately four hundred employees are covered. However, a number of grantees in the United States and abroad are not formally subject to the policy.

The consultative process before adopting the public access policy took time. Researchers at HHMI often are also editors, for example of small journals or society journals. Also, an infrastructure for manuscript submission into PubMed Central had to be established, and this included negotiations with publishers. Four main routes exist (which are the same for the NIH manuscript submission system):

- a) From journals that directly deposit final published articles in PMC (e.g. from an open access publisher);
- b) Publisher depositing the final published article or accepted manuscript version in PMC on behalf of the author (e.g. from a hybrid OA journal);
- c) Self-archiving of the final or accepted version peer-reviewed manuscript in PMC via the NIH manuscript submission system;
- d) Verification and completion of a submission process for a final peer reviewed manuscript that the publisher has deposited.²⁵

The last route of deposit is a variation on green open access, based on publisher deposit. In the case of the HHMI, open access is to be achieved within six months (the life sciences typically build rapidly on published results). However, for many journals the publishers demand longer embargoes. Hence, the HHMI was to strike deals with the publishers to achieve a reduction of the embargo. For example, for articles from Cell Press (imprint of Elsevier) \$1000 are paid to secure deposit and access within six months, whereas Elsevier and Wiley demand \$1500.

HHMI has transferred a list of its principal investigators to these publishers, and these notify the HHMI author upon acceptance of the transfer of the final manuscript as so-called ‘stage two version’ to PMC. The author confirms that it is her or his manuscript, and then PMC prepares the manuscript for final release (after the embargo of up to six months) and the author approves this final version.

More generally, deals have been made with journals to achieve green open access either immediately or, else, at least within six months. Typically, publishers demand extra payment for this, though some transfer to PMC not the author’s final manuscript, but the published version.

²⁵ Verification often is part of the process for route b) and c) as well.

	HHMI	Wellcome Trust
Elsevier journals	<p>Charged \$1500</p> <p>Author manuscript version – after peer review – deposited by Elsevier in PMC</p> <p>Paper available in PMC/UKPMC six months after publication</p> <p>No re-use licence</p>	<p>Charged \$3000</p> <p>Final version of paper deposited in PMC by Elsevier</p> <p>Paper available in UKPMC/PMC at time of publication</p> <p>Full re-use licence</p>
Cell Press (imprint of Elsevier)	<p>Charged \$1000</p> <p>Author manuscript version – after peer review – deposited by Elsevier in PMC</p> <p>Paper available in PMC/UKPMC six months after publication</p> <p>No re-use licence</p>	<p>Charged \$5000</p> <p>Final version of paper deposited in PMC by Elsevier</p> <p>Paper available in UKPMC/PMC at time of publication</p> <p>Full re-use licence</p>

Table 3. Comparison of contracts between a research funder and publishers

HHMI also facilitates open access publishing. Here too, some deals have been agreed centrally with publishers such as BioMed Central. For individual agreements that HHMI may make with publishers, HHMI will fund article-processing charges up to \$2000.

A high rate of open access has been achieved for the first two years. In 2008 and 2009, more than 3500 articles were indexed cumulatively in PubMed, and for more than 2500 of these the full-text version may be found in PubMed Central (an open access rate of more than 70%).

HHMI has rapidly achieved this high open access rate because it demands public access within six months and because it pays publishers extra. The principal investigators at HHMI support public access and bear the additional workload with good humour. The workload mainly results from the fact that conditions for gold or green open access vary across journals, publishers vary embargoes, and HHMI is obliged to keep track of complex and changing terms through a database. The main challenge for HHMI as a pioneer institution is that the transition costs are probably higher because publishers' bargaining power is stronger as long as there are few comparably stringent open access policies.

8. Open access to all publications, internationally: Austrian Science Fund (FWF, March 2008)

The Austrian Science Fund (FWF) is the research funder with the most comprehensive open access publishing policy.²⁶ Not only does it support open access to articles and books, but it also does so in an international framework. Moreover, the policy encompasses research data.

Open access advocates argue that science is a public good and hence its results should be publicly available ('free to read'). However, the FWF also recognizes open access as a fundamental shift in scholarly communication, which is leading to new modes of presentation, reading and use of research results. Transition costs are anticipated, and hence the FWF is keen on incentives for researchers and publishers, ready to bear additional costs, and willing to undertake the required shepherding to guide researchers and other key stakeholders through the challenges of the transition period.

The main benefit anticipated is that open science will engender advances in the mode of knowledge production (including e.g. increased speed, improved peer review, broader impact, interlinkage of text and data) resulting in new breakthroughs. Additional benefits are a strengthened relation between scholars and the public (through public access) and a reinvigoration of the market for scientific publishing.

In all FWF programs, grants covering the costs of scholarly publications in refereed specialist journals can be requested up to three years after the end of the project. In the case of journal articles, the FWF provides funding for open access as well as page charges, submission fees and colour illustrations. In the case of monographs, proceedings and collections, the costs can only be reimbursed if the publishing house ensures open access. In the case of independent publications supported by the FWF, an open access subsidy can be requested in addition to printing and translation costs.

Figure IV - The FWF policy on covering publication charges (excerpt)

The open access policy of the FWF reaffirms the principle of free access, which is to be achieved either through open access publishing or by self-archiving copies of the publication. In line with the aim of aiding system change, the FWF stipulates in detail that

- a) Open access publishing charges may covered from FWF grants;
- b) Additional support for publication charges may be requested up to three years after the end of any project;
- c) Monographs, proceedings and collections are also covered by the policy;
- d) In the life sciences the preferred solution is for all papers to be made available through UK PMC, whether published in open access, deposited by publishers or self-archived;

²⁶ See http://www.fwf.ac.at/de/public_relations/oai/index.html

- e) Research data is also to be made available via repositories within two years after the end of any project.

The policy of the FWF already provides a response to some of the notable challenges facing research funders when implementing open access. Since 2004, the FWF has been supporting open access journal publication charges. A first deposit request was issued in 2005. However, the consolidated policy, as emerging by 2010, addressed the following issues. Firstly, research papers often are completed only after the lifetime of a funded research project, but the FWF has an extended deadline for funding publication charges. In 2010, the FWF expects to fund about 350 open access publication charges at a total cost of approximately EUR400k. Secondly, generic research funders support disciplines that publish a lot of books, but FWF supports open access to books with up to EUR6000 for immediate open access and EUR4000 if embargoed for no more than twelve months (between 30 and 40 books are funded in 2010 at a cost of approximately EUR150k). Thirdly, in Europe national research funders have been seeking to collaborate internationally, and the FWF is willing to support international solutions like UK PMC (with several hundred articles ingested from in 2010). Internationalisation is backed by the FWF policy of soliciting international peer review for project applications as well as the review of books submitted for an open access subsidy.

Compliance is monitored by FWF through project reports, in which grantees have to provide justification if any research results is not made available in open access. In 2009, the FWF spent about EUR350k on open access from a budget of EUR150m, but expenditure is expected to rise due to cooperation with UKPMC and the funding of book publication charges to EUR550k in 2010 – about 0.3% of the total FWF budget.

9. One policy, sixty publication strategies: Fraunhofer-Gesellschaft (July 2008)

The Fraunhofer-Gesellschaft is Europe's largest application-oriented research organization. Its sixty thematically diverse institutes have a high degree of autonomy concerning research and publication strategies as well as infrastructure. Some institutes have shared infrastructure concepts, others have highly customized information technology infrastructures or specialized research libraries. Also, the close cooperation with industry partners sometimes calls for careful publication planning with respect to confidentiality or patent registrations. Hence the particular challenge for the Fraunhofer-Gesellschaft is that its open access policy needs to be adapted for each of the sixty institutes and their publication strategies.

Fraunhofer's board of directors adopted an open access policy in July 2008, requiring all publications to be made available, either by open access publishing or, else, by self-archiving a copy of the author's manuscript in the institutional repository. In the latter case an embargo period up to one year is acceptable. The aim is, principally, to make available all publications, including monographs and conference papers, and to enable not only their free reading and printing, but also copying, mining and re-use.

On the issue of implementation the policy states:

“The Fraunhofer-Gesellschaft is committed to providing the necessary financial, organizational and non-material support that will allow the concept of open access to be implemented under optimum conditions.”

For this purpose, Fraunhofer-Publica (<http://publica.fraunhofer.de>) has been supplemented by a server providing open access to full texts (<http://eprints.fraunhofer.de>). Publica notes all publications resulting from research. Since its inception in 1988, it has collected 130000 bibliographic records (September 2010). It is to be transformed into an open access platform.

Implementation requires relaying policy outwards and downwards. Senior researchers are requested to support colleagues. Authors are encouraged to retain the rights to their publications. A service infrastructure is offered to support authors in publishing and depositing. Fraunhofer explicitly stated that it would provide the necessary financial and organizational resources to implement the policy.

When implementing this policy, given the high autonomy of researchers and their institutes, the first challenge is building a system of incentives and rewards that foster adoption, particularly by the leading researchers. Moreover, an effort was made to collect and deposit backfiles, to demonstrate the viability and impact of the repository as open access collection. Open access advocacy, institute-by-institute, complemented this strategy.

It has emerged that the users from industry are interested mainly in direct access to the full text. Hence Publica now includes links to relevant external content, for example, 6800 URLs (Uniform Resource Locator) point to patents granted to the Fraunhofer-Gesellschaft, the details of which are accessible through the database of the European Patent Office. Furthermore, 17000 DOIs (Digital Object Identifiers) point to free downloads for documents that, for example, have been provided through national or campus licenses.

Since the year 2000, researchers at Fraunhofer have published about 18000 journal articles and 23500 conference papers (September 2010). Available as full text are about 5300. However, Fraunhofer estimates that if green open access was pursued vigorously, with due respect for copyright and publishers' contracts, the amount available in open access could at least be tripled (this would roughly correspond to the 40% open access achieved at the University of Zurich). Furthermore, it could be explored what value could be added by systematically making available the so-called 'grey' literature of working papers, presentations and posters.

Hence, the open access team has been communicating green open access as the easier route, initiating the call 'Give us more!' to persuade researchers to post a copy of present and past publications to the repository. The libraries of the institutes were provided with extensive lists that enumerated all publications eligible for a green deposit. Moreover, additional information was made available on how to communicate with authors and double check, for any publication, the publisher's copyright and open access policy. The first aim of the initiative was to demonstrate the ease with which green open access may be provided, reduce the inhibition of authors and decrease the insecurity surrounding any 'secondary' publication. The principal aim was practicing and habitualizing green deposit.

In June 2010, 134 lists were sent to the sixty institutes, enumerating a total of 3100 publications that were older than 12 months, eligible for green deposit on the publisher's terms, and thus suitable for being made accessible immediately. This yielded an additional one hundred full texts from ten institutes. While this is not a lot, the number of texts that were submitted to the repository immediately upon acceptance for publication did increase in this period by about 25% if one compares the numbers for 2010 to 2009.

A lesson learned by Fraunhofer's central publication support is that from a researcher's perspective the notion of open access is encountered somewhere towards the end of the publication process. Increased efforts are needed to help authors consider open access as part of their publication strategy. The idea is, for each institute, to introduce management routines that establish open access as a natural part of the publishing process.

The Fraunhofer Society is an instructive case for research performing organisations, particularly when the organisation is decentralised. Extra credit the Fraunhofer Society deserves for bringing open access to applied and industrial research, such as microelectronics, material science, production science as well as optics and photonics. Moreover, Fraunhofer is the only German signatory to have followed through after signing the Berlin Declaration in explicitly adopting and implementing an open access policy.

10. Open Access complements the Research Information System: The University of Pretoria (May 2009)

The University of Pretoria is remarkable for an open access policy that couples the archiving of research papers with the production of annual research reports for the South African government. These reports co-determine the amount of funding the university receives annually.

The University of Pretoria belongs to a second wave of universities, at which open access advocates had the chance to draft policy by comparing those of other universities. In a second step, the draft policy was rewritten repeatedly to convey the right message in local circumstances, i.e. a leading research university in a middle-income country experiencing the unique post-apartheid transition. The mandatory policy covers published journal articles and conference papers only, which are to be submitted immediately upon acceptance to the repository UPSpace.

Also, the university benefited from an earlier mandate for electronic thesis and dissertations (ETD). Submissions of ETDs commenced in 2000 and a mandate was accepted in the year 2004. This paved the way for an open access policy.²⁷ To date, the University of Pretoria has operated two repositories, and the earlier one for ETDs, UPeTD

²⁷ See <http://www.ais.up.ac.za/openup/index.htm>; for how the ETD mandate played a role in the establishment of the OA mandate see <http://www.library.up.ac.za/openup/docs/UPmandateAfrica.pdf>; Olivier, Elsabe (2009) Open Scholarship and Research Reporting in tandem: creating more value for the University of Pretoria - <http://repository.up.ac.za/upspace/handle/2263/10109>

is ranked 65th (out of 800) among the institutional repositories worldwide.²⁸ The plan is to merge UpeTD with UPSPACE.

In effect, the University of Pretoria has enacted two mandates :

- Mandated submission of theses and dissertations (2004);
- Mandated submission for research papers/articles and conference proceedings (2009).

As the University of Pretoria benefited from experience and advice elsewhere, it was observed that an effective institutional open access policy would seem more likely to result if:

- A series of experiments result in demonstrators, which convey the impact of the repository while minimizing any extra work for the scholars;
- Extensive advocacy on the benefits to the institution and for the scholars is matched by a readiness to listen to concerns and misgivings about the method and process (e.g. deposit process, copyright addenda);
- A mandatory policy is only instituted once the necessary authority and resources for implementation are secured.

Since 1997, South African research institutions must submit annual research reports that detail publications in recognized national and international databases (mainly: a list of South African journals, or indexed by Web of Science and the International Bibliography for the Social Sciences). For recognized publications, the institution receives (extra) funding from the Department of Education, most of which is transferred to the relevant departments. Hence, universities have invested in their Research Information Systems. At the University of Pretoria, each faculty has a RIS coordinator, charged with capturing the annual research outputs, ensuring the completeness and correctness of the data. The Open Scholarship Office realized the similarities in shared goals of research capturing and offered support and additional services in the exchange of research article outputs. Repository staff was able to trace published items that had been missed earlier and to add a Uniform Resource Identifier to many publications, thus enhancing their visibility. The effort to improve the position of the university (i.e. more funding) came before the move to mandate deposit and also preceded any claims that increased visibility of research outputs might lead to higher citation rates. The Open Scholarship Office and the repository staff thus simultaneously seek to serve the scholars and the institution.

The situation at the University of Pretoria would seem prescient for any institution seeking to launch a green open access policy in an environment in which research assessment and publication evaluation is already important, e.g. there is a correlation with the funding the institution or research group receives. Since May 2009, the University of Pretoria has been enlarging the content available via the repository. Moreover, much effort has been made to raise awareness first with the deans of the faculty, then the RIS

²⁸ Ranking Web of World Repositories (Institutional, July 2010) - http://repositories.webometrics.info/top800_rep_inst.asp

coordinators, and finally also with the faculty. However, the Open Scholarship Office (who manages the Open access mandate) and the faculty librarians have been encountering the following challenges:

- Faculty members have queries and reservations about the post-print: as publications are part of an assessment system, the publisher's version seems all-important. This focus frequently leads authors to think first that the post-print is the publisher's version (.pdf), and, when the difference has been clarified (i.e. the author's final peer-reviewed manuscript is required), to voice reluctance as the 'green version' is not identical with what they perceive to be the authoritative version;
- Faculty members tend to focus on the extra work, not the extra benefits of green open access: as evaluation is important in the national system, the production of the green version of a paper is perceived as extra work and therefore rejected, making any conversation about the (potential) benefits of green open access difficult, be it in the ideational dimension (e.g. benefits to scholarship, South Africa, developing countries) or in a more pragmatic sense (e.g. receiving more citations). Notoriously, faculty members will post the publisher's pdf on a personal website to foster circulation of their work, but be reluctant to provide a green version to the repository, even if the later offers superior possibilities for discovery.
- Librarians and the Open Scholarship Office increasingly assume responsibility for submissions: in the interest of building an open access collection and maintaining momentum, it then becomes necessary for the Open Scholarship staff and the librarians to archive on behalf of the authors. Thus at the University of Pretoria, for 2010, self-archiving hovers below five percent, meaning that more than 95% of the papers are deposited in a system best described as library assisted deposit or mediated deposit.

An important difference between QUT and UP would seem to be that QUT had its OA repository in place before a national research evaluation scheme came into effect. Also, in Australia the evaluation scheme includes a citation count, whereas in South Africa just the locus of publication counts. Open access advocates might be tempted to query the efforts of colleagues at UP, but the challenge they face is better described as a logical difficulty (that is also relevant to Australia, and indeed any situation in which evaluation schemes based on publications are important): Firstly, any evaluation that is connected to the distribution of life chances (e.g. funding, tenure) must be based on authoritative documents and the system must be seen to be fair. Currently, only the published version is seen as authoritative (no comparable green open access version has yet been identified and standardized) and only the systems offered by large commercial firms (e.g. Thomson Reuters Journal Citation Report or Elsevier's Scopus) are large and old enough to be trusted. Secondly, any distribution of life chances by systemic evaluation results in much negative news (e.g. rejection letters, less funding than competitors), which means that participants may comply, but often comply unwillingly, and this may make the production of the green version seem like an additional chore that one seeks to avoid.

In these circumstances, UP has come up with a creative (interim) solution. A direct line of communication has been established to the many (smaller) journal publishers in South Africa, particularly those who are listed by the Department of Education as eligible journals (a publication resulting in extra funding for the institution). Deals have been struck that enable repository archiving for articles produced at UP. During the negotiations some publishers chose to provide a 'green version' for archiving, but the overwhelming majority opted to allow the archiving of their version (publisher's pdf), subject typically to an embargo of six months.

Towards a research agenda: comparing open access policy implementation

All case studies demonstrate that considerable energy needs to be exerted to move open access policy implementation forward. However, the sample is not yet large enough to offer general conclusions. The diversity of policies and their differing emphasis indicate that policy development is still very much fluid. Nevertheless, some preliminary insights on institutional policy implementation may be derived, such as:

- Institutions have found that implementation requires that one or more digital repositories must be specified for collection, regardless of whether contributions are 'green' or 'gold';
- Research funders seem to find that their open access policy is only effective if they also invest in a digital infrastructure to support it;
- An effort to take away the burden from the author is observable, particularly among research funders and in collaborative ventures.

To consolidate the evaluation of policy implementation and foster the emergence of second-generation policy development, interested stakeholders should consider commissioning more case studies.

As the author is pivotal to open access implementation, and author participation was introduced as a 'tertium comparationis' for this study, further and more general research questions may be developed. These are of relevance to all open access stakeholders and should be investigated as soon as possible. The five most important issues emerging from this study are:

- a) Publishing and deposit policies and their embedded expectations as to what authors are supposed to do. Some institutions seem to have persuaded many authors to comply with the open access policy, but overall the results are mixed. Since many 'mandatory' policies are based on 'voluntary' compliance, often for good reasons and also for the foreseeable future, stakeholders might consider finding out what authors actually experience when following an open access policy and what the most significant challenges and barriers might be.
- b) Variations of author deposit, such as self-, assisted, mediated or third party deposit. Even if some consider self-archiving the most desirable solution, it is notable that efforts at open access implementation often lead to variations on author deposit. Investigating the experiences of authors will help to understand why deposit routes need to be amended or switched. Furthermore it would

- independently be worthwhile to understand the characteristics, benefits and cost of different deposit routes. These might be different for the institution and the author.
- c) Relevant and reliable measurement of the degree of open access achieved and its benefits for authors. Only some institutions are able to provide reliable measures as to which amount of the total (eligible) corpus is actually available in open access (per year). Even fewer institutions have made an effort to measure what the benefit (impact), if any, has been for the authors. There may be quite a few studies demonstrating or refuting a general open access citation advantage, but it is not enough to point institutions or authors to these. Rather, an effort needs to be made to track impact (e.g. access, usage and citation) in a manner that is readily comprehensible for authors following a specific open access policy.
 - d) Overlap and interaction between funders and institutions when asking authors to provide open access. There is some evidence that funders and institutions are beginning to collaborate when asking authors to comply with open access policies. Principally, however, the interests and methods of funders and institutions are not necessarily compatible. For example, the Compact for Open Access Publishing Equity, sponsored by institutions, is highly critical of supporting hybrid open access journals, which many funders allow and support as compatible with their mission of providing OA to the funded outputs.²⁹ Funders and institutions should explore differences in their open access policy and mission with mutual respect and seek common ground – else they risk confusing and, ultimately, alienating the authors.
 - e) Collection policies and usage rights for the corpus, particularly in considering authors as users. Much of the effort in open access implementation goes towards securing the deposit - understandably so, as this is the first big hurdle. In some instances, consideration is being given to the users experience in accessing open access collections. Yet, a more systematic point needs to be made. All authors of research publications are always also heavy users of digital research infrastructures. It is urgent to understand how depositing authors experience accessing collections on their ‘own’ and other repositories, and to work towards improving that experience.

The road ahead: some suggestions for developing open access policy

The case studies undertaken, and the research agenda derived, were incremental. But it is also possible to step aside and consider open access in the context of the wider changes associated with the rise of digital scholarship. Besides digital publishing, the main other element is the new cyber-infrastructure and the emergence of data-driven science.³⁰ A certain homology may be observed between the emergence of digital research

²⁹ See <http://www.oacompact.org/compact/>; Shieber Stuart M (2009) Equity for Open-Access Journal Publishing. PLoS Biol 7(8): e1000165.

³⁰ Hey, Tony; Tansley, Stewart & Tolle, Kristin (2009) *The Fourth Paradigm: Data-Intensive Scientific Discovery*. Seattle: Microsoft Research

infrastructures and the call for open access to published results. It is a homology implicitly assumed in the Bethesda statement and the Berlin Declaration, based on a fundamental compatibility between the norms and economics of cyberscience, open access and the knowledge economy.³¹ This leads me to the concluding suggestion that open access advocates might centre their vision on integrating open access with a new type of digital and global infrastructure that includes all research results in real time. Publishing research results then becomes a service whose rationale is to feed that infrastructure with valid and reliable results that may be used, as they emerge, in research, teaching and learning.

In most world regions, and many countries, major digital infrastructure initiatives are under way. Scholarly communities recognize their importance. Funds are being mobilized. Digital infrastructures are dependent on institutions, not scholarly societies, and also not on publishers or libraries. Research institutions and national governments are the major players. Therefore, the question that policy makers should be asking is how to articulate open access as an essential part of the new infrastructure that merits institutional investment (in repositories, publication charges etc.). Should it be difficult initially to articulate compelling positive reasons, a starting point might be to imagine what it would mean if it were not possible to feed published research results into digital infrastructures?

Suggesting that open access becomes more viable if embedded in research infrastructures, not least because it will have clear and direct benefits for researchers, is also to hold the opinion that the ‘access problem’ (serial prices, restricted access, very limited access in developing countries etc.) will not be the issue that galvanizes researchers to make open access the new standard. To be sure, researchers support unrestricted access and will back their library if battling with unreasonable price demands from publishers. However, asking researchers (as authors *and* users) to forego access to journals while libraries are battling with publishers, comes rather close to asking them not to eat and drink. Hence, open access advocates would seem well advised not to think primarily of leading researchers into battle, be it against publishers or for public access, but, first, to articulate a compelling vision of what benefits will accrue to researchers once open access becomes the new standards. If these benefits are clear and accepted, then that which now seem to be major battles are likely to become minor skirmishes only, incidents along the way, as the new infrastructure is being built.

Finally, from these observations four suggestions result:

- a) If open access is articulated as an essential and founding element of digital research infrastructures, the issue of ‘embargoed’ open access will go away. Digital infrastructures, by definition, operate in real time and therefore any sort of delayed access will become unacceptable, most of all to researchers. Of course, this has consequences for open access policy, particularly for green open access policy, and policy makers will reflect the implications;

³¹ Armbruster, Chris (2008) Cyberscience and the Knowledge-based Economy, Open Access and Trade Publishing: From Contradiction to Compatibility with Nonexclusive Copyright Licensing.. *International Journal of Communications Law and Policy*, Issue 12, 2008 (available at: <http://ssrn.com/abstract=938119>).

- b) As published research results become an essential element of digital infrastructures, the balance of bargaining power shifts considerably. Rather than having to try converting publishers and journals to open access (or invest time and money to start new ones), research institutions and national governments would be in a strong position because publishers and journals would be required to seek access to these new infrastructures, or face becoming irrelevant;
- c) With a focus on scholarly communities, it may be suggested where research institutions and open access policy makers might concentrate their efforts. Open access publishing, and its integration into everyday research integration, is most advanced in the life sciences (cf. PubMed, PMC International, PLoS, BMC and other publishers and databases), in economics (cf. RePEc, SSRN, NEEQ, 143 journals listed in DOAJ), in physics (particularly high-energy physics, cf. ArXiv, SCOAP3, CERN Document Server), and in computer science (cf. CiteSeerX, OA support from computer science departments). In any or all of these areas demonstrator projects could be envisaged, integrating published research results into community-specific infrastructures;
- d) With a focus on infrastructures, it is possible to envisage contracts, not just for open access publishing, but also for licensed content, which would tie these outputs to emerging research infrastructures. This would be particularly interesting if data and publications could be tied into the same infrastructure. Of course, there is a strong element of continuity in scholarly communication, which is based on communities. However, these communities, and their scholarly societies, are not capable of building and maintaining the new digital infrastructures. Research institutions and national governments will be organizing funding and governance. Hence, policy makers would need to understand if and how real time open access to the scholarly literature could be integrated into the emerging national and international research infrastructures.