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## Economics of scholarly communication in transition by Heather Morrison

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### Abstract

Academic library budgets are the primary source of revenue for scholarly journal publishing. There is more than enough money in the budgets of academic libraries to fund a fully open access scholarly journal publishing system. Seeking efficiencies, such as a reasonable average cost per article, will be key to a successful transition. This paper presents macro-level economic data and analysis illustrating the key factors and potential for cost savings.

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### Introduction: Academic library budgets sustain scholarly journal publishing

A key point in understanding the economics of scholarly journal publishing is that academic library budgets sustain scholarly publishing. Universities, and, to a lesser extent, research organizations, have long been the main producers and the main consumers of scholarly journal literature, with revenue flowing through their organizational libraries to publishers. With electronic media, "the contradiction between producers and consumers is not inherent; on the contrary, it has to be artificially reinforced by economic and administrative measures", as Enzensberger pointed out in 1974 [1].

In terms of scholarly publishing, these artificial measures are the academic reward system which artificially props up the entrenched commercial scholarly publishing industry by requiring publication in high impact factor journals, and an inelastic market that keeps commercial interests engaged due to above average profits.

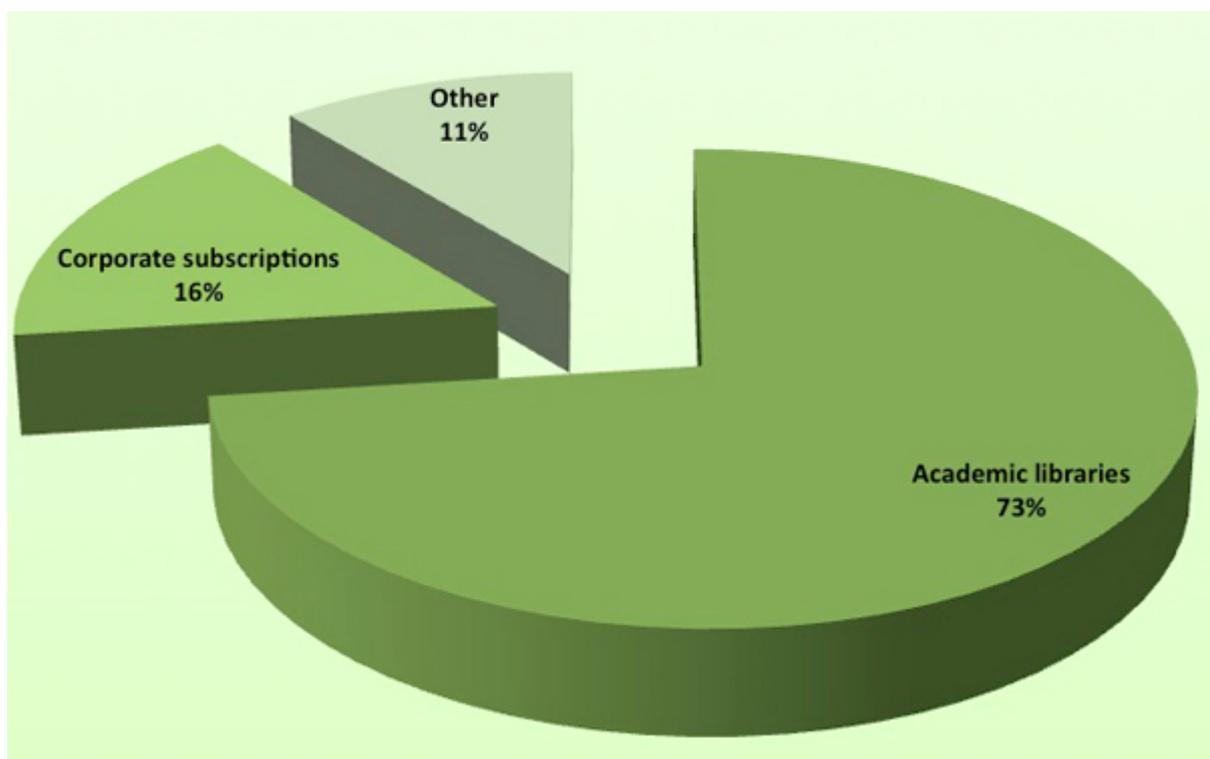
Suber (2008) explains how universities' reliance on the journal impact is a challenge for the development of open access journals. It takes time to establish an impact factor (based on citations which take some time after publication to appear), a factor that favours entrenched journals over new open access journals. Suber discusses the difference between prestige (largely associated with impact factor) and quality, and suggests the existence of a growing gap between journal prestige and quality.

For scholarly authors, pressure to publish in high impact journals, often toll access journals, creates an incentive that often works against the best interests of the authors and their work. There is a well documented open access citation impact advantage (Hitchcock, 2013) that illustrates a disconnect between the high impact factor of some well established toll access journals and actual citations which are statistically likely to be higher if the author makes their work openly accessible. When it is important for research results to be available outside of large research university libraries that typically subscribe to high impact journals, publishing in a toll access journal reduces the effectiveness of the research. Elsewhere the author [2] presents a case study of a participatory action research project. The authors conducted a study on body image with young aboriginal women and this research resulted in recommendations for educational programs. However, the authors published in a toll access journal that charges US\$25 to view one article, at one computer, for one day, for anyone without a subscription. This is a model that presents a significant economic barrier for the participants themselves as well as the majority of

people in a position to help them, such as teachers, parents and social workers. For some scholars, participating in this system is in conflict with the author's values. Striphas [3] in an article ironically published in the toll access *Communication and Cultural/Critical Studies* notes that "cultural studies' alienation from the conditions of its production has resulted in the field's growing involvement with interests that are at odds with its political proclivities" (such as the highly profitable multinational corporation informa.plc, owner of Taylor & Francis, publisher of *Communication and Cultural/Critical Studies*).

Many activists for change in scholarly communication have sought solutions to the challenge presented to open access by the impact factor. Recently, a group of high profile researchers and research institutions issued the San Francisco Declaration on Research Assessment (2012) that outlines the problems with journal impact factor as a surrogate for researchers' impact, including skewing of citations within journals, wide variations in impact factor across disciplines, and the ease with which the system can be gamed through editorial decisions, and recommend "Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions".

Returning to the topic of academic library budgets as the primary support for scholarly journals, Michael Mabe (2011), CEO of the International Association of Scientific, Technical and Medical Publishers (STM), recently affirmed that about 80–90 percent of the US\$8 billion in revenue that goes to producers of the world's peer-reviewed scholarly journals comes from library subscriptions, as reported by Ware and Mabe [4]. Ware and Mabe's analysis is based in part on research by the Research Information Network (2008), which found that journals publishing revenues are generated primarily from academic library subscriptions (68–75 percent of the total revenue), followed by corporate subscriptions (15–17 percent), advertising (four percent), membership fees and personal subscriptions (three percent), and various author-side payments (three percent).



**Figure 1:** Where does the US\$8 billion annual revenue for scholarly journals come from? Source: Research Information Network (2008).

Universities are both the primary producers and consumers of scholarly journals. This suggests the possibility of transitioning economic support from the demand (subscriptions) to the supply (publishing services or journal production) side. There are two basic models for accomplishing this transition, with a number of variations. One model involves taking on production services (university/library press model). The other model involves paying for production services, such as

open access article processing fees.

There are significant challenges to making a transition of this nature. Currently, academic library budgets are largely tied up with subscriptions to “must-have” journals, leaving little flexibility to shift support to open access. The vast majority of journals are still sold on a subscriptions basis. A global shift to open access publishing requires publication outlets in sufficient numbers and of sufficient quality to meet the needs of all scholars. A global shift from demand to supply side takes global commitment and participation on the part of libraries, scholars, and publishers alike. Despite the challenges, there are many signs that this transition is already well underway. Laakso, *et al.* (2011) document the growth of global open access publishing and suggest a division into three phases, pioneering (1993–1998), innovation (1999–2004), and consolidation (2005–2009). In 2011, I argued that we may already be beyond consolidation and into a period of competition (Morrison, 2011b). Today, there are more than 9,000 fully open access, scholarly peer-reviewed journals listed in the Directory of Open Access Journals (DOAJ), and the DOAJ’s net growth is a fairly consistent three–four titles per day. There are over 2,000 open access repositories listed in the Directory of Open Access Repositories (OpenDOAR). A cross-search of open access repositories using the Bielefeld Academic Search Engine encompasses over 40 million documents, a number that is growing by the millions every quarter (Morrison, 2005–). One of my central arguments is that a prudent transition of academic library budgets from support for subscriptions journals to support for open access publishing will be key to a successful transition to open access.

Academic library budgets would not be the sole source of revenue in an open access future. As noted in the Research Information Network (2008) report, 15–17 percent of revenue for scholarly journal publishing comes from corporate subscriptions. These corporate subscriptions will include some research organizations, and it makes sense to assume that these will contribute to paying for the production of the results of the research that they conduct. Also, research grant funds can often be used to pay for open access article processing fees. The Wellcome Trust has created a fund especially to pay for such fees. Many research funding agencies have traditionally provided researchers with an option to use funds for dissemination of results. For example, the U.S. National Institutes of Health (2005) calculated that it made available about US\$30 million annually to its grantees for publication and page charges. The Canadian Institutes of Health Research (CIHR) recently instituted a policy that “CIHR-funded researchers will be required to make their peer-reviewed publications accessible at no cost within 12 months of publication — at the latest” (CIHR, 2013). Library and university based publishing outfits can take advantage of local infrastructure such as servers and Internet connectivity. As Edgar and Willinsky (2010) note, there are also substantial sources of subsidy funding available to many scholarly journals.

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## Affordability

A healthy scholarly journal publishing system must be affordable in addition to providing open access. This section will address some of the major elements necessary to ensure that scholarly journal publishing will be affordable into the future.

To calculate the affordability of different options for scholarly journal publishing, one needs to know, at least approximately, how many journals and articles are produced on an annual basis. Björk, *et al.* (2008) calculated that the 23,700 journals listed in *Ulrich’s* as of 2008 published approximately 1,350,000 peer-reviewed journal articles in 2006 [5]. These are the figures and timelines used for the calculations in this chapter, recognizing that both journal article production and revenues have increased since that time.

It takes resources to publish a peer-reviewed scholarly article, such as time spent editing and coordinating peer review, hardware, software, and connectivity for an online journal. The costs in dollar terms vary a great deal. Willinsky (2006) explored the costs per article of scholarly publishing in some depth and found a cost range from zero to US\$20,000 per article. Willinsky [6] quotes Gene Glass, founder of the online-only Education Policy Analysis Archives (EPAA) in 1993 as describing EPAA’s budget as “Zero, nada, no budget, no grad assistant, no secretary.” This is possible in scholarly publishing because of the large percentage of the work that is done on a voluntary basis by scholars paid through university salaries, and in-kind support that is generally available at universities, such as computers, software, and connectivity.

This is a marked contrast with the scholarly journal publishers’ annual collection of about US\$8 billion in revenue. Of this amount, as noted above, about 68–75 percent of the total (US\$5.4–US\$6 billion) comes from academic library budgets. The substantial profits of the large commercial scholarly publishers, typically in the 30–40 percent range, suggests that there is more than enough funding in the current system from the academic libraries alone than is necessary to fund the costs of publishing. I argue that this amount is more than sufficient to fund reasonable

publication costs for all of the world's scholarly peer-reviewed journal articles, but not necessarily the levels of profits that certain publishers are accustomed to collecting.

A key metric to assess efficiency in an open access environment is the average cost per article. From 2004 to 2005, Morrison conducted an *ad hoc* thought experiment called the *Imaginary Journal of High-End Chemistry*, exploring the necessary costs of publication through listserv and blog postings, incorporating feedback from scholarly publishers, librarians, and chemists (Morrison, 2005). The basic argument was that US\$500 per article should be sufficient to cover the necessary costs of online-only, fully open access publishing, even assuming well-paid staff working in a costly environment (Vancouver, British Columbia).

In 2004, the Wellcome Trust published its report, *Costs and business models in scientific research publishing*. After reviewing the literature on costs of scholarly publishing and discussions with senior staff at a range of publishers (including commercial publishers), the Wellcome Trust concluded: "A conservative estimate of the charge per article necessary for author-pays journals lies in the range US\$500–US\$2,500, depending on the level of selectivity used by the journal, plus a contribution to overheads and profits" [7].

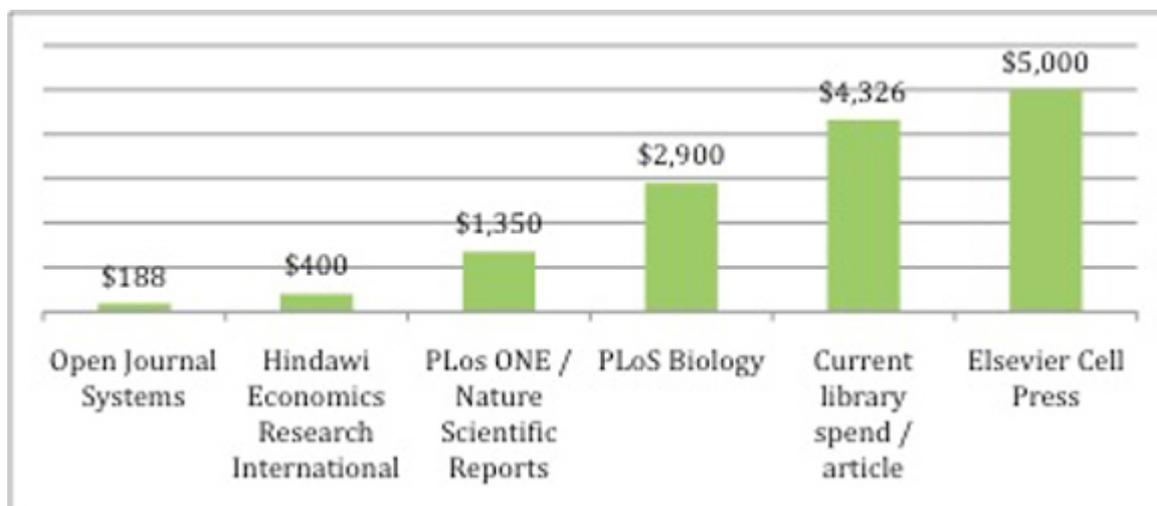
Today's actual article processing fees (APFs) of successful, established fully open access publishers supports these predictions of the Wellcome Trust and from the *Imaginary Journal of High-End Chemistry*. The profitable Hindawi charges fees closer to the low end of the range. For example, the APF for Hindawi's *Economics Research International* is US\$400. BioMedCentral's average APF is US\$1,895, in the middle of the range. PLOS fees range from US\$1,350 for *PLOS ONE* to US\$2,900 for *PLOS Biology*. This is just over the top of the Wellcome Trust range — but then seven years has intervened between the publication of the report and now. It is important to note that the Wellcome Trust cost estimates assume a largely commercial scholarly publishing system. Edgar and Willinsky (2010), surveying a group of journals using Open Journal Systems, mostly published by independent scholars, found an average cost of US\$188 per article. It should be noted that this is the reported expenditures by the journals *per se*, and does not cover the cost of support provided by the institution such as journal hosting and support services.

The importance of cost per article in determining whether an open access scholarly publishing system is feasible from an economic standpoint is implicit in the conclusions of Walters (2007). Walters studied the economic implications of a switch to open access for a range of institutions from small colleges to a large research university with two models, a PLOS model and a model assuming maintaining current revenue streams for scholarly publishers.

Walters found that all institutions would save money with a PLOS model, with an average cost per article of US\$1,500. Walters also found that this model shifts the proportion of costs, so that the large research university pays a higher share of the cost than with the present system. However, the savings from the PLOS model are so substantial (only 15 percent of the revenue that goes into scholarly journal publishing at present, by Walters' calculations), that even the large research university saves about half its journal costs with this model. The other model Walters looked at assumed maintenance of current revenue for publishers; with this model, most institutions would still enjoy savings by Walters' calculations.

The total cost would increase for the large research university library. Mills, *et al.* (2007), using a tetratic network technique and a transaction cost analysis to compare a traditional subscription, print-based medical journal with an open access medical journal, found that total transaction costs were reduced by a factor of between five and 10 for the open access journal. The cost of producing an article in the print/subscription journal was US\$2,500, while an equivalent open access article was US\$500.

My focus is transforming the scholarly publishing system, towards a system that responds to the needs of scholars for information rather than the needs of investors for profits. I will not explore the model which projects current revenue for publishers, but rather focus on the potential for a more affordable future for scholarly journal publishing.



**Figure 2:** Comparison of current costs per article (US\$).

Figure 2 compares current library spend per article with several open access per-article costs. The estimate of US\$4,326 current library spend per article is calculated on the basis of the US\$5.8 billion estimated annual academic library spend per article, divided by the estimated 1,350,000 peer-reviewed articles per year calculated by Björk, *et al.* (2008) for the 23,700 journals listed in *Ulrich's* as of 2008. This amount is contrasted with several current per-article costs for open access journals, as discussed above. The costs on a per-article basis for many fully open access journals are considerably less than the current library spend. Elsevier's Cell Press, a hybrid "open access" choice (technically a "sponsored article" choice, not really full open access), is an outlier with a cost that is higher than the current average library spend.

<b>Table 1: Global costs and library cost savings with transition to open access.</b>				
	<b>Cost per article</b>	<b>Global cost 1.35 million peer-reviewed articles (US\$ millions)</b>	<b>Global library cost savings (US\$ millions)</b>	<b>Global library cost savings (%)</b>
<b>Open Journal Systems</b>	\$188	\$254	\$55,862	96%
<b>Hindawi Economics Research International</b>	\$400	\$540	\$5,300	91%
<b>PLOS ONE/Nature Scientific Reports</b>	\$1,350	\$1,800	\$4,017	69%
<b>PLOS Biology</b>	\$2,900	\$3,915	\$1,925	33%
<b>Current library expenditure/article</b>	\$4,326	\$5,840	0	0
<b>Cell Press</b>	\$5,000	\$6,750	-\$910	-16%

Table 1 illustrates that, given realistic average per-article costs, academic libraries, by working together globally, could fully fund the scholarly peer-reviewed journal system — and save money, too. The columns illustrate the essential point about cost per article being a key metric to assess the affordability of the system, at the Open Journal Systems average cost per article of US\$188, the total cost globally would be US\$253 million. Academic libraries could fund this amount from current budgets and still achieve a global cost savings of US\$5.5 billion annually, or 96 percent less than current spend. This largely scholar-led system would be by far the most cost-effective means of transitioning to open access.

The US\$400 fee of Hindawi's *Economics Research International* shows that highly significant cost savings are compatible with cost-efficient for-profit publishing.

At the *PLOS ONE* (or *Nature Scientific Reports*) average cost of US\$1,350, cost savings would be about 70 percent with a global transition, at the *PLOS Biology* rate of US\$2,900 per article, the total cost to academic libraries would be US\$3.9 billion, a cost savings of US\$1.9 billion annually, or 33 percent less than current spend. On the other hand, if the average cost were the Elsevier-Cell Press fee of US\$5,000 per article, this would add close to one billion dollars in library spending, or a 16 percent increase in global library spending on scholarly journals.

This table illustrates the importance of cost per article as a key metric in transitioning to an affordable open access scholarly publishing system. Libraries could support a largely scholar-led journal publishing system at a very small fraction of current spend, as illustrated by the Open Journal Systems average cost of US\$188 per article. Significant cost savings could be achieved at rates currently charged by for-profit Hindawi, or the not-for-profit Public Library of Science. However, average costs in the US\$5,000 range as currently charged by Elsevier's Cell Press would increase the cost of the system as a whole.

In 2008, Greco and Wharton recommended an open access model for university presses, suggesting an approach similar to article processing fees, with a US\$250 submission fee, an additional peer review fee of US\$250 to send books successful at the submission stage out for peer review, and another approximately US\$10,000 or so for final typesetting, copy editing, and so forth, for a total of approximately US\$10,500. Pinter (2011), a publisher with decades of experience and founder of Bloomsbury Academic Press, calls for libraries, publishers and consortia to work together to fund open access monographs, citing a first copy cost of US\$10,000. Pinter's model assumes that publishers would earn additional revenue streams, through sales of print on demand or specially formatted e-books.

If cost savings from a flip to open access at an average rate of US\$1,500 per article were redirected to fund monograph publishing, this would provide up to US\$3.8 billion annually to fund open access monographs. This amount would be enough to pay for the creation of 250,000 open access monographs per year. That would be a quarter of a million more monographs available to everyone, everywhere, added every year. I see libraries as playing an essential role in hosting and preserving these monographs, and ensuring that they are both findable and accessible on a long-term basis. This would be a marked contrast with the current situation where each scholarly monograph sells on average 400 copies.

## Discussion: Issues and challenges with switching to production-based economics

Many of the issues and challenges with respect to journal articles are described by Shieber (2009). Open access journals face an inequitable situation, with the majority of library budgets being committed to subscriptions journals. Hybrid journals are problematic for libraries due to double-dipping, that is, journals charging both article processing fees and for subscriptions. There is a need to establish a suitable cap for open access article processing fees, although Shieber suggests it may be more appropriate to establish caps by author rather than by the article. Beall (2011) has written about the problem of what he calls predatory open access publishers. That is, the article processing fee approach to open access publishing has opened a door for new publishers, including some that appear to be running outright scams, collecting money for article processing fees without actually conducting peer review. In addition, some have been known to use unethical business practices, such as listing people on their editorial boards unbeknownst to the person listed and spamming potential authors and reviewers. Funding agencies are supportive of open access; many have policies requiring open access to the results of research that they fund. Funder generosity in allowing funds to be used to support open access publishing is welcome, however over-generosity could be problematic. For example, if a funder committed to paying open access article processing fees up to US\$3,000, it is likely that many publishers would set their fees accordingly. Corporate publishers would have a duty to their shareholders to adjust fees accordingly, as charging less would result in less than optimal profits to the shareholders. The result could easily be a standard open access article processing fee that would be higher than what is actually necessary for publishing. This would tend to result in a systemic increase in costs, and would impact authors and other funding agencies less able to match the payment. For this reason, I advocate that funding agencies adopt one of the following policies:

Allow grantees to use funds for dissemination of research without specifying how funds are to be used. This gives the grantee an incentive to look for affordable alternatives to keep other funds free for other purposes.

Cap the eligible fee for open access article processing at an affordable amount. For example, *PLOS ONE* has shown that it is possible for a San Francisco-based professional publisher to produce peer-reviewed articles at US\$1,350 per article.

Create funds to subsidize journal publishing along the lines of Canada's Social Sciences and Humanities Research Council's *Aid to Scholarly Journals* program.

Perhaps the biggest opportunity or challenge is the need for collective action. Morrison, *et al.* (2012), in a survey of libraries and university presses that asked about economic models for support for open access publishing, found that the model most likely to be supported (and not opposed by any respondents) was a library consortial approach.

The business models for scholarly communication in print format are very familiar and easy to understand. Scholarly articles are bundled into journals and sold as annual subscriptions. Scholarly monographs are sold by the copy. In both cases, the copy belongs to the purchaser, who is free to keep, lend, sell, or give away the copy. A copy can only be read by one reader at a time. If the library's copy of the book is on loan, the would-be reader either has to wait for the library's copy or find another one. The university library retains copies of both books and journals and assumes responsibility for preservation.

Scholarly communications (journals, books, and emerging formats) in the online environment come with a different set of opportunities and challenges. The default "purchase" has changed from sale to leasing or licensing, increasing the danger of information enclosure. Rather than selling subscriptions to individual journal or book titles, it is easy to sell bundles, and many publishers do. One example is the "big deal" of for-profit STM journal publishers that is capturing a disproportionate share of the money available for scholarly communication and is a major factor in the serials crisis. The not-for-profit sector has reacted and created aggregations of its own, such as Project Muse. Aggregations can involve journals of many publishers, and even many different types of publishers, for example the general journal packages sold by companies like EBSCO and ProQuest.

The tendency towards aggregation is happening on the purchasing as well as the sales sides. A library can purchase a site-wide license to a bundle of journals for access by any student, faculty or staff member, whether on or off-site. This can impact the individual subscriptions of a publisher, and even the memberships of a not-for-profit society publisher that has traditionally considered receiving a copy of the publication as a membership benefit. A whole class can download and read an article or book at the same time. A library consortium can purchase a copy of a book, journal, or package, for access by students, faculty and staff at every research library in a country. Library consortia occasionally make purchases at an international level, coordinated by the International Coalition of Library Consortia. While a few publishers have flourished in this environment, others are struggling to figure out the economics for survival. Obviously, selling one copy of an e-book for sharing by the whole world at a price that made sense for a single print copy just won't work. There are many successful models for selling scholarly communication in electronic format, such as differential pricing based on size and/or type of an institution, whether measured by Carnegie classification or student numbers. However, if there are no funds left in library budgets after paying for the big deals of the large STM publishers, other publishers may face cancellations.

These dual tendencies towards aggregation on the sales and purchasing sides suggest an immanent potential of scholarly information in the online environment towards something like ubiquitous or open access. With open access, one copy can be placed online for access to anyone, anywhere with an internet connection. As Sutton (2011) expresses it, free may be inevitable for scholarly communication. It is the process of enclosure that initially takes effort and energy, developing the paradigm of intellectual property and means of enclosure such as digital rights management.

It appears as though the tendency towards aggregation by both publishers and libraries is converging towards open access. If all of the works of a publisher, the "big deal" are available to researchers at every university in a country, this may seem similar to open access, and occasionally people will refer to this as open access.

Elsevier (2011) even has a term for this: universal access. The basic idea is that if everyone who can afford to subscribe or pay-per-view to Elsevier's resources does, and this is supplemented by a little bit of charitable access, then everyone has access. On the surface, this sounds plausible, at many libraries, the online environment has meant greatly expanded access. Many a small library has greatly expanded their journal offerings in the online environment.

The major problem with this is who owns the information. Elsevier is a corporation, an organization with a mission of maximizing profits to shareholders. As long as Elsevier continues a policy of full copyright transfer by authors, Elsevier is free to define the payment terms of its universal access. That is, everyone can have access — provided that they are willing to pay on Elsevier's terms. Or, Elsevier could abandon this approach altogether in favor of another seen as more profitable. If Elsevier is generally selling site wide licenses to libraries rather than pay-per-view, it is much more likely because this is how Elsevier reaps the most financial benefit, not because pay-per-view is less compatible with universal access. In 2010 Elsevier made £724m (US\$1.1 billion) on revenues of £2 billion (as reported repeatedly in the *Economist* [8]). What if a wealthy country or group of countries (or even a group of oligarchs) were to offer Elsevier £3 billion annually to provide them with *exclusive* access to the works owned by Elsevier?

My perspective is that commercial "universal access" is problematic at best, and it seems more consistent with longstanding conceptions of communications in the public interest to build a knowledge commons accessible to all. There may well be a role for the commercial sector here, but the role should not be that of ownership of the scholarly works.

Scholars, libraries, publishers, and consortia are involved in a wide variety of collaborative efforts to transition scholarly communication to a model that emphasizes greater accessibility. Following are just a few examples designed to illustrate the breadth and scope of these initiatives. *RePEC* (2011), *Research Papers in Economics*, describes itself as "a collaborative effort of hundreds of volunteers in 75 countries to enhance the dissemination of research in economics". The *Stanford Encyclopedia of Philosophy (SEP)* is a project led by philosophy scholars, who created their own high-quality subject encyclopedia, with entries invited by subject experts and kept up to date. *SEP* has been working towards creating an endowment to fund ongoing open access, assisted by the International Coalition of Library Consortia (2005), among others.

Libraries have formed a Compact on Open-Access Publishing Equity (2011), as a means of beginning to address the problem of supporting open access while library budgets are still tied up in subscriptions. The Synergies Project (2011) has brought together libraries and university presses across Canada to develop a common platform and support for online hosting of Canadian academic journals, particularly in the humanities and social sciences. In addition, a group of open access publishers has formed an association called the Open Access Scholarly Publishers Association (OASPA). BioOne and Project Euclid are cooperative societies whose publisher members benefit from the economies of scale made possible by working together, as described by Crow (2006). Both BioOne and Project Euclid feature a mix of fully open access journals and publishers, subscription-based journals, and in-between models such as journals that make back issues freely available.

arXiv.org, developed and much used by researchers in physics, mathematics, and other disciplines, is hosted by Cornell University Library, has 18 mirror sites around the world. It is presently in the process of finessing a sustainability strategy, arXiv Sustainability Initiative, involving support by those institutions that are its heaviest users. As of October 2011, 129 institutions from 16 countries had pledged support of US\$382,000 in contributions for 2011 (arXiv, 2011). arXiv hopes to eventually receive support from the 200 institutions around the world that are the heaviest users of the service.

SCOAP<sup>3</sup>, the Sponsoring Consortium for Open Access Publishing in Particle Physics, is a global collaboration designed to transition library subscriptions in high energy physics to open access. As of December 2011, SCOAP<sup>3</sup> has obtained sufficient library commitments for this task, and is in a tendering process with publishers.

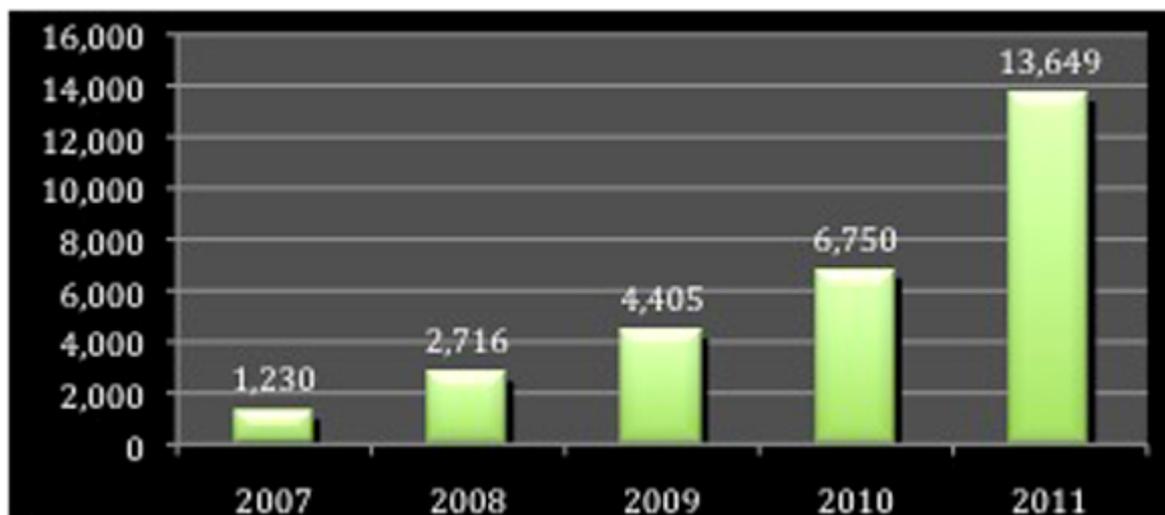
OAPEN (2011) describes itself as a collaborative initiative to develop and implement a sustainable open access publication model for academic books in the humanities and social sciences. The OAPEN Library aims to improve the visibility and usability of high-quality academic research by aggregating peer-reviewed open access publications from across Europe. OAPEN is only one of a number of European Union-wide cooperative open access initiatives.

Houghton and colleagues have conducted major macroeconomic analysis of the potential for transition from subscriptions to open access at the country level, first in the U.K. (Houghton, *et al.*, 2009a), and more recently in the Netherlands (Houghton, *et al.*, 2009b), and Denmark (Christoffersen, 2009), indicating significant cost savings from a transition to open access in all countries studied. These studies included a broad range of factors involved in scholarly communication, including unpaid activities such as reading and reviewing. The significance of these studies is that they illustrate the financial advantage of even a unilateral move by one country to open access, including countries such as the U.K. where a favorable balance of trade is enjoyed due to high profits of local publishers. The amount of savings varied with the method of providing open access, with the gold approach or open access publishing providing the smallest savings, green or self-archiving greater savings, and the greatest savings were anticipated with a

more radical transition of the whole scholarly publishing system to one involving publishing through institutional repositories with a peer-review overlay.

We are beginning to see signs of a more radical transition, away from the format of print. Odlyzko (1994) predicted the demise of the journal long ago, but while the trend away from print is strong, things have not progressed as rapidly as predicted. In the history of communications technologies it is often the case that a new technical trend does not always completely eliminate the communication made possible by the previous technology. The 8-track tape was made obsolete by the smaller audio cassette, which in turn was made obsolete by the compact disc, which is now pushed toward obsolescence by iPods and online delivery of music. However, the analog vinyl record is making something of a comeback in music circles. Similarly, while the trend is clearly away from print in academic publishing it is very possible that print publications of some type or other will continue to find a niche in the world of scholarly research.

One striking shift in scholarly publishing of particular importance to the economics of scholarly publishing is the rise of the megajournal. PLOS pioneered this approach with *PLOS ONE* in 2006. Rather than filtering articles for scope or interest to readers, a practice that makes sense when journals are issued in print and so must be bundled into issues of a predictable size, *PLOS ONE* accepts all sound science, articles that pass peer review, in any discipline. This approach introduces important efficiencies into scholarly publication. Generally, the practice has been for authors to submit a paper to first one journal, then another if rejected by the first journal, sometimes for several rounds. Each rejection is costly for the rejecting journal, and adds overall to the time of scholarly editors and reviewers, as many articles end up being reviewed more than once. It is likely the efficiencies of *PLOS ONE* that have made the US\$1,350 article processing fee (in contrast with the *PLOS Biology* fee of US\$2,900) a possibility. In 2010, *PLOS ONE* became the world's largest journal, publishing close to 7,000 articles that year (Morrison, 2011a). In 2011, *PLOS ONE* doubled its output, publishing close to 14,000 articles. One of every 60 articles indexed in PubMed is now a *PLOS ONE* article. *PLOS ONE* also appears to have inspired a number of new megajournals. Size is only one of the innovations of *PLOS ONE*, which also features post-publication peer review and article-level metrics.



**Figure 3:** Number of articles published in *PLOS ONE* per year, 2006–2011. Source: Morrison, 2005–, "The dramatic growth of open access".

Authors in the developing world are expected to publish in the top international journals; from an economics perspective, this is not optimal for the developing world, as discussed by Merrett (2006). Local publishing would be more affordable, as it would allow scholars and universities to take advantage of a lower cost of living. Local publishing would also provide academic leadership and business opportunities for the developing countries. Local journals would also be more receptive to research on topics of local interest, such as illnesses that are common in the developing world but rare in the developed world. For those developing world authors who do wish to publish in international journals, the International Network for the Availability of Scientific Publications (INASP) has created a program called AuthorAID, which helps developing country writers with their writing.



## Conclusion

There is more than enough revenue if library acquisition budgets were redeployed to fund an open access scholarly publishing system. Transitioning the major source of support for scholarly journal publishing, library journal subscriptions, will be key to a successful transition. A prudent transition seeking affordable scholarly journal publishing has the potential to provide academic libraries with significant savings, which could fund redistribution of economic support for scholarly publishing, particularly to reinvest in scholarly monograph publishing. A key metric in understanding affordability in scholarly publishing in an open access environment is the cost per article or cost per book. Cooperative solutions have been emerging in scholarly publishing for some time, and will be important in the transition to full open access. The most cost-effective approach to the transition will involve a more radical transition away from the print format. Further research to identify in more detail the costs of scholarly journal publishing in the electronic environment would be useful. For example, case studies of scholar-led journals to detail the full costs including costs of institutional hosting and support services would be useful, and it would be helpful to identify the types and costs of support enjoyed by such journals with an established track record of success.



## About the author

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## Notes

1. Enzensberger, 1974, p. 106.
2. Morrison, 2012, chapter 2.
3. Striphas, 2010, p. 3.
4. Ware and Mabe, 2009, p. 16.
5. As of 2011, by my calculations *Ulrich's* lists approximately 26,000 active, academic/scholarly journals, approximately a 10 percent increase over 2006. Assuming that there is no difference in the average number of articles published per journal, an estimate of just under 1.5 million peer reviewed articles published per year seems reasonable. *Ulrich's* list contains predominantly English-language titles, and may reflect a Western bias. For example, Chinese academic journals are likely underrepresented in *Ulrich's*. According to Jie (2010): "China has almost 9,500 academic publications that generate about 2.5 million papers per year, according to Shen's figures. But there are 30 million teachers, lecturers, students, technicians and researchers seeking publication". It is assumed that this is of limited relevance to the present exercise, as any bias in *Ulrich's* coverage is likely matched by a bias in purchasing. That is, this analysis is predominantly a Western-based, developed world analysis.
6. Willinsky, 2006, p. 69.
7. Wellcome Trust, 2004, p. 2.
8. "Scientific publishing: The price of information," *Economist* (4 February 2012), at <http://www.economist.com/node/21545974>, accessed 23 May 2013; "Of goats and headaches: One of the best media businesses is also one of the most resented," *Economist* (26 May 2011), at <http://www.economist.com/node/18744177/>, accessed 25 September 2011.

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