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## THE CHANGING ECONOMIC MODEL OF SCHOLARLY PUBLISHING: UNCERTAINTY, COMPLEXITY, AND MULTIMEDIA SERIALS

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### INTRODUCTION

Scholarly publishing is undergoing a transformation that affects every participant in the information chain. Serials used to be a relatively uncomplicated activity, driven by the need of scholars and researchers to publish. Since the early 1980s, both journal price inflation and the growth in the number of journals and the numbers of papers published have outstripped the ability of even the most lavishly funded library to purchase what faculty and students demand. At the same time, modern technology has offered us the opportunity to develop new ways of distributing scholarly literature that offer the researcher facilities and qualities that cannot be undertaken in the print medium.

There is a great deal of data to demonstrate that the number of papers has increased at roughly the same rate as expenditures on research and development in western economies [1]. The number of papers published per scholar has remained level over the past 20 years; it is the number of scholars that has doubled. In the U.S. in 1975, 2.64 million scientists are estimated to have published 312,200 articles; in 1995, there were 5.74 million scientists and 577,100 published articles [2]. Meanwhile, library expenditures have increased by less than half that rate. The broad funding outlook remains gloomy; for example, in the U.K., student numbers have increased by 15% in the three years up to 1996, but funding per student decreased by 30%.

The geographical distribution of subscriptions has also changed. For many years after World War II, the major research libraries in the U.S. maintained complete collections of all the literature published in the field; they were a dependable and significant body of subscribers. In the mid-1970s, this started to change. For most publishers, the U.S. has declined as a proportion of the total world market. While southeast Asia and western Europe have, until recently, been expanding markets, the decline in U.S. library spending has removed a stable growth factor. Most publishers now expect volatility: more cancellations or non-renewals, and more new subscription orders.

Suddenly our simple model has become more complex and uncertain. Change is relentless. The

development of resource sharing means a single subscription where once there were many. The growth of consortia—there are over 200 in the U.S. alone—and the demand for institutional, system-wide or even state-wide licensing implies a clear demand for more for less. Document delivery now provides a “pay by the drink” model that potentially and fundamentally changes the pattern of income a publisher receives. Nevertheless, the number of papers seeking publication continues to rise relentlessly, causing information overload in even the most specialized areas of interest.

What has happened to the underlying costs of producing a journal? It is worth noting at the outset that paper, printing and distribution account for a small portion of the total subscription price. Between 60 and 70% of the cost of publishing a journal is incurred in processes that are inescapable, regardless of the medium of output. Tenopir and King, in an excellent article in the *Journal of Scholarly Publishing* [2], analyze the factors that characterize our economic model:

- The average fixed cost of producing the first copy of an article is about \$4,000, covering direct costs such as review and refereeing, editorial work, preparing illustrations and making the master copy (i.e., printing plates), and indirect costs such as subscription maintenance, marketing and author administration. Naturally, costs vary from one journal to another, depending on the subject and the complexity of the text.
- While price increases typically will result in reduced subscription numbers, a greater influence will be the size of the market served, being the readers interested in the information conveyed by specific journals.
- Publishers are, on average, publishing more articles and more issues per journal, and more pages per article. The average number of issues increased from 6.5 in 1975 to 8.3 in 1995, and total pages from 820 to 1723 in the same period.
- In the 1980s, there was a distinct shift from individual subscriptions to library-provided materials. Thus subscription numbers dropped, and the high fixed costs had to be spread over fewer, mainly library, subscriptions, thus increasing institutional prices at a rate greater than inflation and size increases alone explain.

To Tenopir and King’s list, I would add the following:

- Editors’ expenses are much higher than they were 20 years ago. Editors now need a personal computer, fax, e-mail facilities and an answering machine, where a simple typewriter was once sufficient.
- Institutions that were once prepared to carry the cost of the editorial office and the secretarial assistance required are no longer so willing. Many require the publisher to pay the full cost of such facilities.
- Journal editors are increasingly unwilling to work for the love of it. They require payment in the form of editorial fees or, in some cases, a royalty on sales.
- Both commercial and non-profit publishers are under pressure to produce profits or surpluses for the journal owner, be it a learned society, a university, or the company’s shareholders. Many learned journals have in the past been published at a loss; support for such loss makers is increasingly difficult to find.
- New journals are launched only in response to the emergence of new areas of academic research. But they have to be financed from existing resources, i.e., from the revenues earned from existing titles. The risk for the publisher is considerable, with the accumulated loss on a new STM title reaching \$150,000–200,000 by the end of the third year; it will not cover its accumulated investment until volume 6 [3]. In the humanities and social sciences, the

break-even may be achieved sooner, but still requires the original decision to invest for the future.

Publishers have compensated for the underlying cost increases they face, in an under-funded market, in various ways:

- They have tried to develop links with learned societies to sell more copies to individual society members at discounted prices, thus covering a portion of the fixed costs that have to be recovered.
- They have developed non-subscription revenues such as advertising, supplements and special editions sold to industrial or special interest groups, and license revenue from document delivery services and CD-ROM publishers who reach markets that are unlikely to subscribe to the journal.
- Publishers have been putting more words on the page, by increasing the size of the page, reducing type sizes, using double column setting and narrower margins.
- Most important, the production systems used have been transformed by technology. Computerized typesetting and page layout software is commonplace. Journal articles are frequently submitted on disk; publishers apply their skills in quality management, presentation and layout to material already in machine-readable form. The printed product may look traditional, but it has been output from a system that our forebears would find unrecognizable.

Nevertheless, journal prices have increased dramatically in the last three decades. Journals in the humanities and social science now average \$185, in medicine, \$506, and in science and technology, \$902 [4]. Overall, journals are 30 times more expensive in 1997 than they were in 1970. This represents an average annual increase of over 13 percent. Clearly, this cannot go on for ever.

Publishers have started to output their journals in electronic form, in response to vocal demands from librarians, many of whom clearly believe that technology holds the solution to the economic problems they face. When one examines the benefits and disadvantages of the electronic and printed media, the future is much less clear. From the financial point of view, electronic publishing eliminates paper, printing, binding, storage and transportation costs. Nevertheless, it is just as costly to employ highly skilled editorial and technical staff to prepare data for electronic publication as it is for paper-based publishing. The savings on marketing are not obvious at present, as users still have to be identified and reached with information about the product; the next few years may see changes in this perception as we use the Internet more as a medium for information distribution. Nevertheless, the technology will continue to require heavy capital investment in computer equipment that needs to be renewed every eighteen months or two years in order to keep pace with software developments. That universities are able to replace their equipment only every three years—or longer—creates further problems of matching product delivery to the recipient's capability.

There is still a marked ambivalence about electronic publishing in the academic community, that goes beyond a reluctance to learn how to use new technology. Many academic readers are not yet using many electronic journals, whether they are free or on subscription, though most use the Web frequently. The power and rigor of searching secondary databases to identify literature to read is universally appreciated. When it comes to primary research literature, many academics are openly skeptical. They want to publish in print. Their reading will generally be done at home, using the printed word. Many social scientists go further, and decry the loss of authority and status that they believe is inherent in electronic publication. This has been described as the “cartooning” effect: such material is not worthy of serious study because it comes in the same format as “The

Simpsons” or “Beavis and Butthead” and is, therefore, to be treated with the same level of seriousness and attention. That publishers are reluctant to abandon print and embrace the new technologies wholeheartedly is a reflection of the concerns of their authors and editorial boards. On the other hand, publishers will support electronic modes of publishing wholeheartedly when it is clear that a corpus of academics do.

So we publishers proceed with caution. Nevertheless, publishing printed and online editions of journals in parallel represents the start of a process of developing truly multimedia scholarly publishing, where the electronic edition of a journal paper may display features like video, sound, moving graphics and models, as well as interactive features, that the paper edition, by definition, lacks. However, we have still paid too little attention to what features of the electronic edition really add value for the reader. And we still need to develop the protocols necessary for effective peer review and quality control of those features. It has to be emphasized that the paper edition has the authenticity and permanence that the electronic version still appears to lack.

Electronic journals create the opportunity to provide a range of features of real value to working scholars. We, like many publishers, have asked them what they want, and they tell us their list comprises:

- full reference retrieval;
- linked footnotes;
- complex figures converted into moving pictures;
- embedded links that are continually updated both forwards as well as backwards;
- direct access to the data on which the paper is based; and
- concept, or thesaurus-like, searches, which will require major developments in artificial intelligence.

The problem for publishers, librarians and academics is that the technology does not yet exist to enable publishers to produce, and universities and research establishments to use, all these features systematically. Moreover, the use of high technology effectively disenfranchises many countries who do not have the infrastructure, unreliable though it is, that blesses us in the developed world. So both publishers and librarians are locked in to a multiple medium environment for the foreseeable future. The paper-based journal will survive, but electronic products, particularly material delivered over the Internet, will become more important, when and where the unique features of the medium become important in relation to the research to be reported. The problem is that publishers cannot see how they can publish the electronic version at a level that will cover the cost of peer review and of the multimedia and interactive features that will be needed to complement the article text and to exploit the unique capacity of the medium.

So where do we, as a community serving scholarship, go from here? In the U.S., the Association of American Universities and the Association of Research Libraries published a report [5] which broke down scholarly information transfer into three models:

- the traditional “classic” print-based model;
- the “modernized” parallel publishing model; and
- the “emergent” model that bypasses print and uses computing and telecommunications technology exclusively to create what is referred to as knowledge management systems called “collaboratories.”

The AAU/ARL concluded that 50% of scientific literature would still be in print by 2015, and that there would be no single dominant model for the foreseeable future. Nothing has really become

clearer since the publication of that report. Print is a feature of our landscape for the foreseeable future.

The principal issue facing publishers is how to maintain the viability of their activities, and the role they play in scholarly publishing. That role is especially important in relation to managing and certifying the quality of published output through the peer review process. To forego that certification process is to reduce the value of the formally published paper from the authentic scholarly work to just another piece of noise on the Net. The principal issue facing librarians, it seems to me as a sympathetic publisher observer, is how do they meet faculty and student requirements for information in multiple formats that may involve significant support costs out of budgets that do not even keep pace with the cost of information in the traditional medium.

The environment is clearly ready for new business models. Some tentative steps have already been taken to develop new pricing and purchasing models, on two fronts:

- Publishers have begun to develop licensing schemes that provide extended access to their journal material, whether in print or electronic form, on terms that are intended to meet the teaching and research needs of the licensed institution, including copying for the reserve collection, use in course packs, etc. Academic Press's APPEAL scheme is the best known. This provides extended access to the entire list electronically, and discounted rates for new or additional print subscriptions. For the publisher, it stabilizes revenue. As these schemes tend to be priced with reference to current subscription rates, questions remain to be answered in relation to future prices, the cancellation of titles no longer needed, and the incorporation of newly launched journals.
- Resource sharing has been developed into formal purchasing consortia, either on a membership basis like the Southern Universities Purchasing Consortium in the U.K., or on a regional, state or even national basis.

Development of these new models is at an early stage, but they do offer the prospect for both publishers and libraries to break out of the straitjacket of the individual journal subscription price. Publishers need to be more flexible in meeting the legitimate demand for information they publish, especially if it involves broadening the circulation. Librarians need to concede that effective negotiation requires a centralized, well-briefed office with authority to negotiate on behalf of all the members of the institution or consortium. Both parties need to recognize and articulate the legitimate concerns of the other in a way that implies a partnering rather than an adversarial relationship.

There is also an important role for intermediaries or aggregators in this scenario. No library wants to provide access to electronic data using more than one common system or front end. There is a constant demand for standardization. The problem with standardization is that it assumes mature technology and clear and settled demand. Neither exists in our world at present. To standardize on present technology is to stifle competition and inhibit the introduction of new, better, software. The alternative to standardization is the intermediary who supplies a standard interface and stands between the library and the many information providers and publishers and their myriad systems. Suffice it to say that subscription agents have always provided an invaluable role in rationalizing journal subscription ordering; the launch of products like Blackwell's Navigator, SwetsNet, Dawson's Information Quest and EBSCO Online simply represents an enhancement of the vendor's traditional role. Other players have developed similar services, like OCLC. Many of the consortia are based on established services that provide a common interface. And other organizations are aggregating content into collections available online or on CD-ROM, like Ovid, UMI, EBSCO Publishing and Information Access. It is entirely reasonable to assume that they will

develop this activity by providing a single access point to electronic information from many publishers competing with different systems. The future is likely to involve more collegial methods of working together. How we do this will be a matter of controversy as well as innovation for many years to come.

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