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ABSTRACT

The costs of scholarly publishing have become unsustainable for both research libraries and university presses. This paper discusses how the transition to electronic journal publishing changes the ways in which these two participants in the scholarly communication process begin to analyze and attempt to control their cost structures in order to remain economically viable. Libraries and their users will be reluctant to abandon a known archival format, and capital investments in the technical infrastructure needed to deliver scholarly information electronically may be made slowly. For publishers, the need to cover first copy costs and to continue serving a market demand for print will create a significant transitional period during which both print and electronic formats must be produced and funded. The transition to fully electronic publication, although likely to reduce operational costs for libraries slightly in the short run and significantly in the long run, creates potential revenue interruptions for presses. Many publishers have proposed pricing models for electronic journals that are based on existing print subscription prices and that include multi-year guarantees of price adjustments to cover both inflation and expansion in the content offered. Libraries are caught in the dilemma posed by many publishers' current pricing structures for electronic journals: the offer of a multi-year reduction in the rate of inflation in high-value commercial journals is attractive when compared to the anticipated inflation in print journals; yet accepting that model would protect a rising share of library collection budgets for high-inflation journals which would then rapidly crowd out other scholarly publications. The short-term measures that the library and press individually might rationally employ to maintain fiscal stability may have far reaching negative implications for the economic viability of the system of scholarly communication as a whole, particularly for the university presses. (Contains 22 references.) (AEF/Author)

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Session #1 Economics of Electronic Publishing: Cost Issues

The Library and the University Press: Two Views of the Costs and Problems of the Current System of Scholarly Publishing

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ABSTRACT:

The costs of scholarly publishing have become unsustainable for both research libraries and university presses. This paper discusses how the transition to electronic journal publishing changes the ways in which these two participants in the scholarly communication process begin to analyze and attempt to control their cost structures in order to remain economically viable. During the near-term future, pressure to maintain both print and electronic dissemination will be great. Libraries and their users will be reluctant to abandon a known archival format, and capital

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investments in the technical infrastructure needed to deliver scholarly information electronically may be made slowly. For publishers, the need to cover first copy costs and to continue serving a market demand for print will create a significant transitional period during which both print and electronic formats must be produced and funded. Moreover, the transition to fully electronic publication, although likely to reduce operational costs for libraries slightly in the short run and significantly in the long run, creates very serious potential revenue interruptions for presses. To ensure fiscal stability during an indeterminate transition phase, many publishers have proposed pricing models for electronic journals that are based on existing print subscription prices and that include multi-year guarantees of price adjustments to cover both inflation and expansion in the content offered. Although the rates of these price adjustments are frequently lower than anticipated for print subscriptions, they are greater than the expected increases to libraries' budgets for collections. Therefore, libraries, whose historical funding models for collections lack adjustments adequate to compensate for actual inflation, are caught in the dilemma posed by many publishers' current pricing structures for electronic journals: the offer of a multi-year reduction in the rate of inflation for high-value commercial journals is attractive when compared to the anticipated inflation in print journals; yet accepting that model would protect a rising share of library collection budgets for high-inflation journals which would then rapidly crowd out other scholarly publications. The short-term measures that the library and press individually might rationally employ to maintain fiscal stability may have far reaching negative implications for the economic viability of the system of scholarly communication as a whole, particularly for university presses.

INTRODUCTION:

The crisis in scholarly communication has been well-known for almost two decades. In a statement that could be written today, Patricia Battin wrote in 1982:

During the decade of the 1970's, librarians faced declining budgets, increasing volume of publication, relentless inflation, space constraints, soaring labor costs, a horrifying recognition of the enormous preservation problems in our stacks, increasing devastation of our collections by both casual and professional theft, and continuing pressure from scholars for rapid access to a growing body of literature. It is ironic that both librarians and publishers introduced computer applications into libraries and publishing houses to save the book, not to replace it. Both were looking for ways to reduce labor costs rather than for visionary attempts to redefine the process of scholarly communication. . . . The former coalition shattered and publishers, scholars and librarians became adversaries in a new and unprecedented struggle to survive in the new environment, each trying in his or her own way to preserve the past and each seeing the other as adversary to that objective.^[1]

LIBRARY COSTS

Library Materials:

Print:

The results of the economic crisis in the system of scholarly publishing were documented

statistically for the first time in University Libraries and Scholarly Communication.^[2] Some of the principal findings included the facts that although materials and binding expenditures remained a relatively constant percentage of total library expenses, there had been a hidden, but significant, change in the ratio of books and serials expenses; and that although materials expenditures had steadily risen, the average annual numbers of volumes added to library collections continued to decline. Not only were libraries spending more and receiving fewer items in absolute terms, libraries were also collecting an ever smaller percentage of the world's annual output of scholarly publications; from 1974, even increases in university press outputs outstripped library acquisition rate increases.

Moreover, the study documented that certain fields experiencing some of the greatest increases in their share of the total output were precisely those with the highest average per-volume hardcover prices: business, law, medicine, and technology. According to the report, science had the highest average prices and remained at a more or less constant and significant market share of about 9.5 percent; titles in arts and humanities, social sciences, and business experienced price increase rates closer to the GNP deflator (p.xix).

Another finding was that serials prices consistently increased faster than inflation, experiencing an overall annual inflation rate of more than 11 percent from 1986 to 1990. Prices of scientific and technical journals rose at the highest rates (13.5 percent per year, on average from 1970 to 1990), and the most expensive serials experienced the largest relative price increases. In contrast, book prices inflated at 7.2 percent per year, while average general annual inflation was approximately 6.1 percent. The report suggests that in certain institutions, science journals could comprise only 29 percent of the total number of journal subscriptions yet consume as much as 65 percent of the serials budget. According to the report, "three European commercial publishers (Elsevier, Pergamon, and Springer . . .) accounted for 43 percent of the increase in serials expenditures at one university between 1986 and 1987" (p.xxi). The report does not introduce the question of the extent to which these inflation rates in the prices of scientific journals reflect increasing costs of production, expansion in content, the market value of the information itself -- a value that might extend well beyond the university, or price gouging.

In 1996, Brian Hawkins updated the study and found the following:

In the 15-year period from 1981 to 1995, the library acquisition budgets of 89 of the nation's finest schools nearly tripled, and in real dollars increased by an average of 82 % when corrected for inflation, using the Consumer Price Index (CPI) . . . the average library in this elite group of libraries lost 38% of its buying power during this period . . . In those 15 years, the inflation rate for acquisitions was consistently in the mid teens. Although the costs of . . . monographs did not rise quite as fast, the cost of some serials -- especially those in the sciences -- increased over 20% a year. If these trends continue, by the year 2030 the acquisitions budgets of our finest libraries will have only 20% of the buying power they had just 50 years earlier . . . As dire as these projections may be, it should be recognized that they are based on the precarious assumption that library acquisitions will increase an average of 8% compounded per year as they have for the past 15 years. This amount is nearly three times inflation, and nearly twice the amount of total increases in the cost of higher education.^[3]

However, Hawkins notes that the trend line for average increases in Library acquisition budgets is downward. While average acquisition budget increases were 9.67 percent during 1981-85, the increases were only 5.4 percent during 1991-95,. Hawkins extrapolates from these figures to

conclude that if inflation in the price of scholarly information were to remain steady and library acquisitions budgets to increase at a rate similar to that of 1991-95, then libraries would have only 20 percent of their 1981 purchasing power by 2007.

Other analyses lead to similar conclusions.

Harrassowitz regularly alerts libraries to subscription pricing information so that its customers can plan in advance to adjust purchasing patterns to stay within budget. In November 1996, Harrassowitz provided firm 1997/98 subscription pricing for six publishers publishing the majority of the STM journals.^[4] The announced price increases ranged from 1.2 percent to 22 percent, averaging 11.15 percent. A weighted average based on the numbers of titles published by the publishers yields an average of 11.82 percent. Harrassowitz further provided an analysis of the impact of announced price increases on particular types of libraries. According to Harrassowitz, those libraries categorized as General Academic/including Sci-Tech can expect price increases from the six publishers ranging from 6.6 percent to 22.4 percent, with an average increase of approximately 13.87 percent.

An interesting discussion of the problem from the point of view of one scientific library has been prepared by Peter Brueggeman, Head of the Scripps Institution of Oceanography (SIO) Library at UCSD.^[5] At SIO, journal subscription prices inflated 57 percent in the five years from 1992 to 1996; the average increase for 1995/96 alone was 19 percent. During the period that subscription costs rose 57 percent, SIO's recurring collections budget increased just 2.3 percent. Brueggeman singles out Elsevier and Pergamon for particular analysis, finding that "Elsevier titles had a 28 percent increase between 1995 and 1996 and a 32 percent increase between 1992 and 1993. Pergamon titles had a 29 percent price increase between 1995 and 1996 and a 17 percent price increase between 1992 and 1993".

The University of Wisconsin-Madison reports similar effects of serials price increases on its institution.

Between 1970 and 1990, the cost of journals in chemistry and physics rose by a factor of 12 in current dollars; in psychology, linguistics, and business by a factor of 8 . . . The total campus serials expenditures for 1995 were \$4,647,713. One publisher's titles accounted for 17.2% of this figure (almost \$800,000), even though this publisher provided only 3% of all serials subscribed to on campus. In the case of the Health Sciences Library, two commercial publishers' titles cost 31% of their budget but represent only 14% of their serial titles. Prices for these journals have been increasing far more than the costs of other Library operations, and double-digit increases are projected for this year.^[6]

Likewise, at Cornell, Ross Atkinson notes: "While our acquisitions budget was increased this year [1995/96] by a reasonable 4% (the average acquisitions budget increase for the forty largest North American research libraries was 3.7%), the prices of science journals are expected to increase by ca. 18%."^[7]

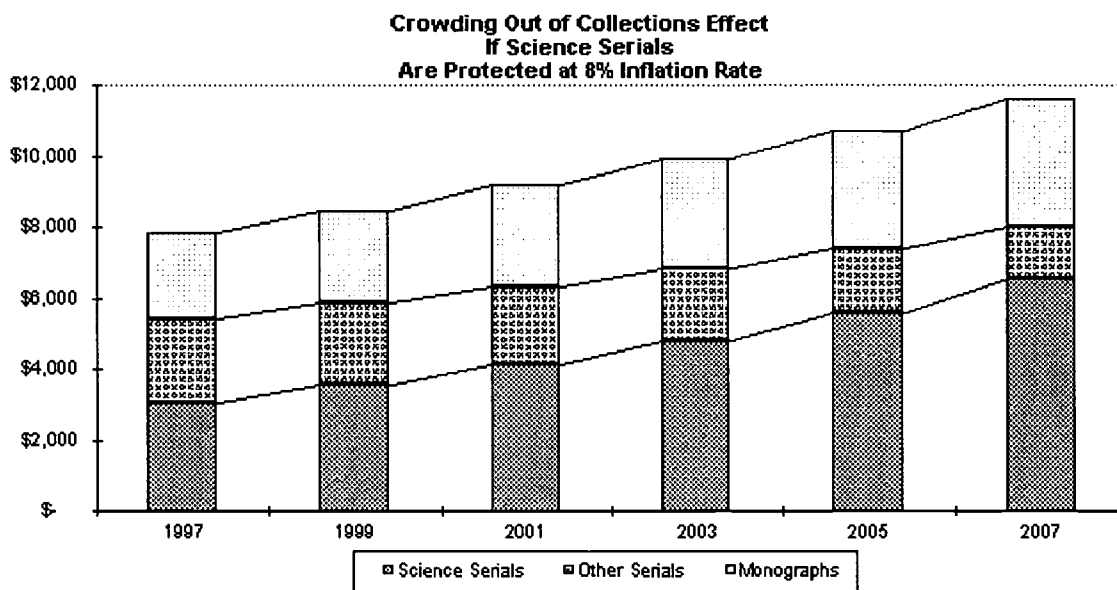
Various authors have demonstrated that not only do the highest cost journals experience the highest rates of inflation, they are also among the most used. Chrzastowski and Olesko^[8] found that over a period of eight years, the cost of acquiring the ten most-used Chemistry journals increased 159 percent in comparison to an increase of 137% for the 100 most used journals. During the same period, their usage increased 60 percent in comparison to an increase of 41

percent for the top 100 journals.

Given library budgets that inflate more slowly than the rate of inflation for scholarly journals, there will be a steady decline in the number of titles held in each library. If libraries cancel journals on the basis of use, high-value, high-inflating publishers' titles will be protected, resulting ultimately in a gradual homogenization of collections among libraries. Lesser-used titles, many with low prices and low inflation rates, will be crowded out faster than the general rate of decline in subscriptions held by the library.

The graph below demonstrates a hypothetical scenario. This scenario assumes that the collections budget is inflated by four percent per year and that the expenditures for monographs are inflated at the same four percent rate. However, the average rate of inflation in the cost of scholarly publications is greater. The graph shows that if science journals, because they demonstrate high usage patterns, are canceled more slowly than other titles, and if monograph expenditures are allowed to inflate at the same rate as the overall budget, then science journals will eventually crowd out other journals. In the example, the budget for science journals is allowed to inflate at approximately 8 percent per year (slightly less than one-half the actual inflation rate, but twice the rate of inflation in the total collections budget). Other, lesser-used journals, with lower subscription prices and lower rates of inflation therefore must be canceled more rapidly in order for the collections budget to be balanced. Within a very few years, the high-use/high-price/high-inflation journals could crowd out virtually all other library materials. While no particular library might implement a budget strategy exactly like that depicted in the graph, all libraries tend to retain longest the highest use journals and to cancel first the lesser-used journals. Although the curve may be more gradual, and the time-line longer, the eventual result will be similar to that shown.

**Crowding Out Effect
If Science Serials
Are Protected at 8% Inflation Rate**



Electronic:

There is no evidence that the emergence of electronic journals will change the fundamental economic problems in the cycle of scholarly communication in the short term, at least with respect to commercial publishers. The basic premise of these publishers is that they must both protect their current revenue base and secure guarantees to cover future inflation and increases in content. Thus, publishers frequently structure their initial subscription pricing for digital journals upon the actual cost of paper subscriptions acquired by the institution with which the publisher is negotiating. Often the proposed base subscription rate includes all subscriptions-library, departmental, personal, and other types-identified with the campus, thereby having the effect of greatly increasing the price that the library would have to pay to receive the digital journals. Clearly, publishers are concerned that availability of electronic journals on the campus network will undermine non-library subscriptions to the print versions. After a period of negotiation during which agreements are reached about the institution's existing base cost of print subscriptions, the tougher bargaining begins.

In early 1996, Ann Okerson reported that:

In general electronic licenses so far have cost on average 1/3 more than print equivalents . . . For full text many publishers also have the expectation that higher price will be asked and should be paid. Publishers are setting surcharges of as much as 35% on electronic journals, and libraries simply do not have the capacity to pay such monies without canceling a corresponding number of the journals of that particular publisher or dipping into other publishers' journals.^[9]

Other institutions report that publishers are now agreeing to provide licenses to electronic publications at the same, or marginally increased, price that the institution is paying for print journals. To secure these initially low prices for digital content, the library is asked to consent to such provisos as the following:

1. That there be multi-year (often three) price increase guarantees to compensate for inflation, often at somewhat lower rates than the historical rates for print materials;
2. That there be upward price adjustments for increases in content, often capped at lower rates than typical for print journals;
3. That the publisher be protected against declines in revenue through cancellation;
4. That fair use rights typical for print journals be abrogated for the digital journals.

Although libraries find attractive the ideas both of maintaining a combination of print and electronic subscriptions for a multi-year period without incurring substantial new marginal costs for electronic versions, and of ensuring a "cap" on inflation; neither "feature" of these new licenses will alter the basic economic difficulty in which libraries find themselves: inflation in the price of scholarly information outstrips libraries' ability to pay. In fact, by locking themselves into multi-year agreements that ensure price increases to particular publishers, libraries hasten the rate at which other journals and monographs are crowded out of the market.

Not all scientific publishers have negotiated as described above. For example, both the American Physical Society and the American Mathematical Society offer electronic versions of their journals free to subscribers to the print editions. Clearly, publishers must find revenue streams that will enable them to survive, and the pricing structures for both print and digital journals are the key to those revenue streams. To base a pricing structure for electronic publishing on the costly print model will not be economically viable in the long run (it may, in fact, be unsustainable in the short term as well), as libraries' declining budgets will result inevitably in cancellations to avoid the structural problems associated with double digit inflation, thereby undermining the publishers as well.

The current economic model for scholarly publication cannot be sustained. Continued escalation in the prices for scholarly journals, stagnation in library budgets, and isolation of the creators and consumers of scholarly information (the faculty) from the effects of the economy is the collapse of the system of scholarly communication itself.

Operations Costs in Libraries:

Library operations costs associated with printed scholarly journals include the costs to acquire, process, preserve, and circulate journals. Each library's costs differ based on the organizational structure, degree of centralization and/or decentralization of processes, differentials in salary and benefit scales, effectiveness of automated systems, success at process re-engineering and other factors.

University Libraries and Scholarly Communication reports that "salaries as a percentage of total library expenditures have declined over the past two decades, while 'other operating expenditures' (heavily reflecting computerization) have risen markedly." (p.xxii) While the report infers that the increases in other operating expenditures reflect automation of technical service operations such as acquisition, cataloging, [serials control] and circulation, it simultaneously notes, however, that despite the decline in salaries as a percentage of total library expenses, and the increase in other expenditures, "the number of volumes added per staff member has declined" (p.xxii). Although the decline in acquisitions resulting from inflation certainly affects the ratio of volumes added to staff, it is not possible to discern from ARL statistics the extent to which libraries have programmatically reallocated staff in response to declining receipts and the implementation of automated technical processing and circulation systems. Presumably, greater efficiency in processing and circulation, coupled with declining acquisitions should have resulted in substantial shifts of personnel away from the "back room" of technical processing to provision of direct service to faculty and students. Nevertheless, at least as measured by the ratio of volumes added to staff FTE, it would appear that libraries have not become more efficient overall.

Moreover, University Libraries and Scholarly Communication reports that, on average, library staff increased by a total of 7 percent from 1970 to 1985, and by 6 percent from 1985 to 1991. Thus, the rise in non-salary operations expenses percentage of total operating expenses has not occurred through staff reductions. There has been no systematic study of how the additions in library staff have typically been assigned to various programs. Ironically, the ARL Index ranks research libraries in part on the number of staff they employ; improving productivity and reducing staff accordingly would have the paradoxical effect of reducing a library's ranking vis-a-vis its peers.

The inability to learn from the ARL reports how libraries might be changing their services reflects a serious flaw common to almost all analyses of library costs relating to both collections and operations. Expenditure reports and rankings typically reflect inputs such as volumes acquired, number of serial subscriptions maintained, size of staff, or operational statistics such as the number of circulation transactions, titles cataloged, hours of opening, items borrowed through interlibrary services rather than programmatic outcomes, for example research supported or learning outcomes of students. The problem of defining productivity of knowledge workers was mentioned thirty years ago by Peter Drucker^[10], and is further examined by Manuel Castells in his recent book, The Rise of the Network Society.^[11]

Also lacking in the library literature are large-scale studies of process re-engineering and its effect on the cost structures of particular library operations. Although there has been a great deal of analysis of the costs of materials themselves, and of the scholarly communication system which generates those costs, libraries have thus far been less rigorous in identifying cost centers for processing and other routine library operations. Thus it is not obvious to what extent non-salary investments, for example in automated systems, have actually improved processing productivity or the quality of services rendered by staff; nor is it clear whether or to what degree these investments have moderated the rate of rise of operations costs.

William Massy and Robert Zemsky, discussing the use of information technology to enhance academic productivity in general, remark on its transformational potential, calling it a "modern industrial revolution for the university" which can create economies of scale, deliver broad information access at low marginal cost, and allow for mass customization.^[12] The analysis they provide for the academy at large would appear to be even more relevant for libraries, many of whose functions are of a processing nature similar to those in industry, and whose services can also be generalized to a greater degree than is possible for teaching and research.

Massy and Zemsky suggest that although capital investments in technology to enhance productivity will increase the ratio of capital cost to labor cost, they may not actually reduce overall costs. But they offer three major advantages to the shift away from the handicraft mentality resulting from larger capital-labor ratios:

First, real labor costs tend to rise with economy-wide productivity gains (say two percent per year, on average), whereas technology-based costs tend to decline due to learning-curve effects, scale economies in production, and continued innovation. Increasing technology's share of cost will reduce overall cost growth until the rate differential reduces technology's share to the point where labor again dominates. By this time, however, total cost will be lower than it would have been without the injection of technology. If the real cost of technology were to decline at a 25 percent annual rate, after ten years the alternative scenario would cost about 12 percent less than the baseline. If the rate of decline is only 10 percent, the saving ten years out would have passed 9 percent and still be rising. Given the differential growth rates of labor and technology, one can expect positive long-term returns on investment even when returns are negligible during the first few years.

Second, technology-based solutions also tend to be more scalable than labor-intensive ones. While our model does not address economies of scale, one should expect that additional students could be accommodated at lower cost with technology than with traditional teaching methods.

Finally, technology provides more flexibility than traditional teaching methods once one moves beyond minor changes that can be instituted by individual professors. The "career" of a workstation may well be less than five years, whereas that of a professor often exceeds 30 years. Workstations don't get tenure, and delegations are less likely to wait on the provost when particular equipment items are "laid off." The "retraining" of IT equipment (for example, reprogramming), while not inexpensive, is easier and more predictable than retraining a tenured profession. Within limits, departments will gain a larger zone of flexibility as the capital-labor ratio grows.

Further, Massy and Zemsky argue: "The benefits of shifting away from handicraft methods, coupled with scale economies and increased flexibility, argue for the adoption of IT even when one cannot demonstrate immediate cost advantages. For example, the ability to break even during the first few years provides strong justification for going ahead with an IT solution, provided the effects on quality are not harmful." Similarly, within the library, use of information technologies, even without generating immediate savings can improve services. For example, online catalogs and automated circulation services provide users with more rapid access to information about the library's holdings, reduce errors in borrowing records, and allow more timely inventory control. Use of online indexing and abstracting services rather than the print versions preserves the scarce time of scholars.

The primary purposes of automating processing operations in libraries have been to reduce the rate of rise of labor costs and to improve timeliness and accuracy of information. Nevertheless, despite the improvements that automation has brought, labor costs to perform library processing operations such as ordering/receiving, cataloging, maintenance of the physical inventory, and certain user services including interlibrary lending and borrowing remain substantial. A transition to electronic publishing of journals would enable libraries to reduce or eliminate many of the costs of these labor-intensive operations, enabling reallocation of the freed-up resources into higher priority services, necessary capital investments in technology, or provision of technology-based information resources. The benefits to end-users would also be significant—less time spent in finding and retrieving physical objects. Ultimately, restructuring of library operations in response to electronic scholarly publishing can, in theory, both improve the quality of services and reduce operations costs. However, to reduce operations costs significantly, libraries will need to define better the desired outcomes of their operations investments, measure those outcomes effectively, and engage in rigorous re-engineering of processes.

There have been several studies which attempt to quantify typical costs of acquiring journals. In a study funded by CLR, Bruce Kingma^[13] found the average fixed cost of purchasing a journal subscription to be \$62.96. In discussing the economics of JSTOR, Bowen estimates the costs of processing, check-in and binding to be approximately \$40.00.^[14] In 1996, Berkeley estimated the physical processing costs, including check-in of individual issues, bindery preparation, and binding for print serial subscriptions received and housed in the Main Library, to be as low as \$17.47 for a quarterly journal to \$113.08 for a weekly journal. Berkeley's figures exclude the costs of ordering and order maintenance under the untested assumption that they will not differ significantly in the case of electronic journals. They also exclude staff benefit costs and overhead and therefore understate the true cost to the university of receiving print subscriptions. Assuming an average annual processing cost of \$50.00 per print serial subscription, a research library subscribing to 50,000 titles may incur an operations cost of \$2.5 million per year to acquire scholarly journals.

Once the library acquires these journals, it begins to incur the costs of making them available to students, faculty, and other users. In the late 1980's, Michael Cooper reviewed the costs of alternative book storage strategies.^[15] He found that circulation costs ranged from a low of \$.53 per transaction in a medium sized open-stack research library to a high of \$9.36 per transaction from a remote storage facility. Adjusted for inflation of 3 percent per year, these costs would range from approximately \$.67-\$11.86 per transaction today. Berkeley calculates that an average circulation transaction costs approximately \$1.07 and Bowen estimates \$1.00. According to ARL Statistics, 1995-96, the mean number of initial circulations per library was 452,428. Using the average circulation transaction cost of \$1.00, the average ARL library spent almost \$500,000 to circulate materials during FY 1995/96.

Reviewing the costs of acquiring and circulating print journals, it seems fairly obvious that a transition away from acquisition of print and toward electronic journals would reduce annual library operations costs related to providing the university community with the fruits of recent scholarship. Although large recurring expenses in support of historical print collections would continue, they would gradually diminish over time as the aging of the collection reduces the rate of usage. The long-term cost reductions could be substantial in the sciences where currency of information is of utmost importance. Moreover, systematic conversion of high-use print collections to digital form could also generate recurring operations savings. Ultimately, the shift from labor-intensive processing operations to capital investments in electronic content (current journals and retrospective conversion of high-use print collections) could have the kinds of effects envisioned by Massy and Zemsky.

However, caution must be exercised in forecasting these types of potential savings. Despite the potential of long-range savings, they are unlikely to occur to any significant degree in the short term. The pace of transition from print to digital journals is moving slowly, and only those publishers with a strong financial base will be likely to succeed in quickly providing online access. As noted above, and in the section of this paper relating to publishers' cost structures, there is no clearly viable path economically to move to digital publishing. Moreover, libraries will need to maintain print collections, both historical and prospective, into the foreseeable future, requiring that they maintain investments in operations to sustain access to them.

Interlibrary borrowing and lending is a growing cost within research libraries, and its rate of increase promises to escalate as the inflation-generated rate of serials cancellations escalates. According to the ARL, The average annual increase in interlibrary borrowing between 1986 and 1996 was eight percent, and the average annual increase in interlibrary lending was 4.9 percent. Faculty and students borrowed more than twice as many items through interlibrary loan in 1996 as they did in 1986.^[16] The University of California Libraries recently reported an annual increase approaching ten percent per year. Interlibrary services are very labor-intensive operations; in 1993, the ARL conducted a cost study which determined the average cost of a borrowing transaction to be \$18.62 and that of a lending transaction to be \$10.93. The average ARL university library processed 17,804 interlibrary borrowing transactions and 33,397 interlibrary lending transactions during 1995-96, incurring an annual average cost of approximately \$700,000. Given the rate of rise of interlibrary resource sharing transactions as well as the rate of rise of labor costs, research libraries are likely to experience increasing interlibrary borrowing/lending costs of at least 10 percent per year.

Capital Costs:

Capital assets in libraries are of three basic types: buildings, collections, and equipment. Expenditures for the most costly of these assets, buildings, are not a part of Library budgets, and therefore are not generally considered by librarians in their discussions of library costs. This paper will not attempt to discuss capital costs for library buildings in any depth except to cite several relevant studies. In the late 1980's Cooper estimated the construction cost per volume housed in an on-campus open stack library to range from \$4.33 for compact shelving to \$15.84 for traditional open stacks; he calculated the construction cost per volume of a remote regional storage facility to be \$2.78. In 1976, Folk^[17] estimated the cost of construction to be \$4.00 per volume. These costs would be substantially higher today. Bowen uses Cooper's construction costs, adjusted for inflation, and Malcolm Getz' lifecycle estimates, to calculate an annual storage cost of \$3.07 per volume. Lemberg's^[18] research substantiates Bowen's JSTOR premises regarding the capital cost avoidance possible through digitization of high use materials. He demonstrates that, even considering the capital costs of technology necessary to realize a digital document access system, substantial savings accrue over time, within research libraries *as a system* if documents are stored and delivered electronically rather than in print form. He concludes:

The results of the various model alternatives for costing the digitized document system and the paper-based document system . . . indicate that very large net present value cost savings can be realized over the assumed model life cycle if a large-scale digitization project is undertaken by academic and public libraries nationwide.

Extrapolating from Bowen's estimate of an annual storage cost of \$3.07 per volume, a research library subscribing to 50,000 journal titles per year, each of which constitutes one volume, accrues \$153,000 in new storage costs each year. Over ten years the cumulative cost to house the volumes received through the 50,000 subscriptions would exceed \$8 million.

The growing dependence on information technologies to deliver scholarly information requires that universities make new investments in capital equipment and allocate recurring operations resources to the maintenance of that equipment and the network infrastructure. Although universities have invested heavily in network technologies, the true costs are still inadequately understood, and it is clear that increasing dependence on digital, rather than print, scholarly information will require that reliable funding models for technology be developed. While capital costs for print libraries entailed buildings and collections, both of whose construction costs fall within known ranges and whose lifecycle is long, capital costs for the digital library are distributed across the campus, and, indeed, the world. However, there is no clear formula to indicate how much initial capital investment in technology might be required to deliver a given number of digital documents to a given size academic community. Moreover, the lifecycle for capital assets relating to delivery of digital library content is typically very short, perhaps as short as five years. Thus capital funding allocations must be made frequently and regularly to ensure continue access. At Berkeley, for example, the Library estimates that annual equipment replacement costs would be approximately \$750,000, assuming a five-year lifecycle. But there has never been an explicit capital budget to support that expense, so capital investments in computer equipment, networking, and equipment replacement have been made through redirection of the operating budget. Thus, for the digital library, the library is asked to support, through the operating budget, costs for storage, that, in the print world, are funded from outside of the library's budget. The situation at Berkeley is not unusual, and further work needs to be done to understand more fully the capital cost differentials between the physical plant investments required for print collections and the network investments required to make digital information available to the campus community.

It is possible that if libraries and their parent institutions, universities, could avoid some of the capital and operations costs associated with print-based dissemination of scholarly publications, these resources could be reallocated to capital investments in technology; provision of additional information resources available to the academic community; service improvements within libraries; and restoration of control of the system of scholarly publishing to universities and scholarly societies rather than the commercial sector.

THE ECONOMICS OF ELECTRONIC PUBLISHING: A VIEW FROM THE UNIVERSITY OF CALIFORNIA PRESS

The market realities described in the first portion of this paper are sobering, but the basic outlines have been well known to libraries and scholarly publishers for more than a decade. This section, discusses the realities for nonprofit journal publishers (university presses and scholarly societies) as a way of answering the question, "So why don't publishers just reduce their prices--at least for electronic publications?". Although the focus is on nonprofit presses, the basic economics are equally true for commercial publishers, except that they require profits and have the considerable advantage of greater access to capital to fund innovation.

For all publishers, the largest constraint on their ability to change the price structure for electronic publications radically is the first copy costs--which commonly range from 70 percent to 85 percent of the print price (See Table below for an example of first copy costs for University of California Press journals).

UC Press First Copy Costs Average, 1994-95 15 February 1997

	Social Humanities	Sciences	STM	Press- Owned	Contract	Program- wide
Composition/Print	\$284,722	\$253,005	\$50,125	\$362,488	\$226,127	\$588,615
Mailing	\$12,696	\$15,839	\$3,266	\$19,792	\$12,009	\$31,801
Postage	\$30,138	\$40,970	\$5,574	\$44,808	\$31,874	\$76,682
Royalties/Edit. support	\$133,602	\$797,662	\$27,697	\$246,796	\$712,164	\$958,961
Press staff	\$254,931	\$412,675	\$33,290	\$401,613	\$350,036	\$751,649
TOTAL COSTS	\$716,089	\$1,520,151	\$119,952	\$1,075,491	\$1,332,211	\$2,407,708
First copy costs	74.14%	87.94%	71.74%	77.14%	88.22%	83.27%

These first copy costs will remain, whether the format is electronic, paper, or both. Any pricing model must provide sufficient income to cover these costs, in addition to the unique costs associated with publishing in any particular medium. Publishers are not wedded to maintaining

print revenues per se but to maintaining enough revenues to cover their first copy and unique-format costs and to covering the costs of the technological shift. In the transition period, when print and electronic editions both must be produced, this will inevitably result in prices that are higher than print-only prices. Whether wholly electronic publications are, in the long run, more economical will depend on the costs of producing uniquely electronic product and on the size of the market. If substantially fewer libraries subscribe to electronic publications than subscribed to their print predecessors, the cost per subscription will inevitably increase in order to cover a larger share of first copy costs.

Electronic Pricing models:

There are a number of models for pricing electronic resources. But all of them ultimately boil down to various ways of obtaining revenue to cover the same set of costs--they all ultimately depend on the same formula of first copy costs plus print costs plus electronic costs.

Let's look at humanities journal x:

Print only

First copy costs	\$48,000	80%
Print/paper/bind/mail	\$12,000	
Print edition costs	\$60,000	
Subscriptions to 1000 libraries @ \$60	\$60,000	

Print and electronic

First copy costs	\$48,000	
Print/paper/bind/mail	\$12,000	
Electronic Costs	\$12,000	
Total Costs	\$72,000	
Subscriptions to 1000 libraries @ \$72	\$72,000	
% increase in total costs		20%

Electronic access provided "free":

Publishers that are providing electronic access "free" with print subscriptions are, in fact, subsidizing the costs of the electronic edition out of the surplus revenues generated by the print publication; the print publication already covers the first copy costs allocated to each subscription. For relatively high-priced scientific journals with high first-copy costs, this can be done without inflating the price too substantially; the uniquely electronic costs are then subsidized by all institutional subscribers and hidden as a percentage of the total cost of

publication. Because the basic subscription price is high enough, relatively modest additional increases will also cover the cost of lost individual subscriptions (since individual subscriptions typically cover the run-on costs of producing additional issues but make only a partial contribution to first copy costs). This approach has the added advantage of sidestepping for now the problems of negotiating prices and guarantees with libraries (and the associated overhead costs). However, it does not contribute to developing commonly understood and agreed upon cost recovery models which will cover the costs of electronic scholarly communication in the long run.

Extra charge for electronic access, bundled with paper:

This is essentially the same cost recovery model, but the increase to cover electronic costs is made explicit. This may be especially necessary for journals whose base rate is not so high, so that the markup for electronic costs cannot be covered by a typical inflationary increase. It still has the advantage, for publishers, of spreading the cost over all institutional subscribers and of simplifying licensing negotiations.

Negotiated price by library based on paper subscription base:

This model takes the basic institutional print subscription base and guarantees this revenue for a period of years (typically three). Publishers are willing to guarantee limits to inflationary increases for this period in exchange for the guaranteed income and protection from cancellations to help cover transition costs. Again, this works better with higher priced journals, where the added costs of electronic publishing are a smaller proportion of the total cost.

Separate price and availability for electronic and paper, with an incentive for bundling:

This model-the one basically deployed by SCAN and by Project Muse-offers more flexibility to libraries, since libraries are allowed to cancel print and take only electronic, or to select among the publications offered, although there are discount incentives to encourage maintaining paper and electronic subscriptions (both projects) and/or ordering larger groups of journals (the entire list for Muse; discipline clusters for SCAN). This has the advantage of making the costs of electronic publishing clear. (See the revenues section below for a discussion of the adequacy of this model for supporting humanities publishing in the long run and of the impact of consortia discounts.)

In all these models, the ultimate economic effect in the transition period is the same-costs for libraries go up. Publishers must cover their first copy costs, continue to provide paper editions for individuals, many libraries, and international markets, and to generate revenue to cover the infrastructure and overhead costs of electronic innovation. For nonprofit publishers, at least, these costs must all be supported by the revenues from current journal subscriptions.

Electronic costs:

It is likely, in the long run, that eliminating print editions entirely will reduce costs somewhat for some kinds of journals. However, for journals which are trying fully to exploit the new

capabilities offered by electronic technologies, it seems likely that the additional costs of generating links, specialized formats, etc. will continue to cost as much, or nearly as much, as the cost of printing and binding. (See The Astrophysical Journal at <http://www.journals.uchicago.edu/ApJ/>, Earth Interactions at <http://earth.agu.org/ei/>, or any humanities journal with lots of multimedia). But even for simpler humanities journals, the experience at the University of California Press raises questions about the assumption that ongoing electronic costs will be substantially lower.

Covering costs of development:

The University of California Press' original economic model assumed that the development costs were largely one-time expenses, that there was a single learning curve and set of expertise to master, after which electronic publishing would be largely routinized; additional expenses would be easily absorbed by the margin generated by the savings in the paper edition. On the basis of the past three years, it seems apparent that this was a flawed assumption. UC Press dedicated 3,500 staff hours on the SCAN project in 1994 (gopher site development); 4,100 hours in 1995 (WWW site development); and 3,700 hours in 1996 (largely on WWW development and on laying the groundwork for SGML implementation). It is apparent from ongoing trends in technological innovation that Internet technology and expectations for electronic publishing will continue to evolve very rapidly for at least the next twenty years. The Press' "bad luck" in initially developing for an outmoded platform (gopher) is an inevitable occurrence over the long-term for electronic publishing projects. As a result, it seems foolhardy to assume that there will be substantially less investment necessary for technical research, experimentation, and site redesign and revision in the future. Any viable economic model for the University of California Press must thus assume one or two technical FTE positions as part of ongoing overhead (please note, this does not include file server maintenance and enhancement, since the costs of file-service are presently borne by University of California/Berkeley Library for the SCAN project).

In addition, the SCAN project has experienced ongoing instability in technical staff-at the Library and at the Press. Being located in a region with such a strong high technology industry has actually proven to be a disadvantage, since current and potential employees can make so much more money at other jobs. This results in long staff vacancies and with repeated training on the specifics of the project. It's another way in which there is not one but rather a continual series of learning curves.

There is a third implication to this vision of a continually changing future. Combined with the Press' commitment to long-term responsibility for viable electronic access and to archiving, continually changing platforms and functionality demand implementation of a coding system which is totally portable and highly functional. As a result, the commitment to SGML seems more and more wise as time goes on. This commitment leads the Press to reject image-based solutions like Acrobat which would be less work and which would be faster to implement but which do not have long-term migration paths. Having once lived through the painful process of having to completely re-code each individual file, the Press does not want to face the same problem with a much larger set of files in the future. The necessity and the difficulty of repeated conversions of legacy text is currently sadly underestimated by many publishers and librarians. Scalability-an important and underrated issue in any case-becomes even more vital in a scenario in which larger and larger amounts of material must be converted each time the technological environment evolves.

In addition, electronic publishing is adding new duties (and requiring new resources) within the Press, without removing present duties. For example, the Press has added .5FTE in the journals production staff (a 25 percent increase) to handle liaison with suppliers, scanning and archiving of all images being published, archiving of electronic files, and routine file conversion duties. This position will clearly grow into a full-time position as all the journals are mounted online; only the slowness of the online implementation permits the luxury of this low staffing level. The seven people working on Project Muse or the seven people working on The Astrophysical Journal Electronic Edition confirm this assumption. In addition, clearing electronic rights for images in already-published books and journals and maintaining an ongoing rights database creates an ongoing staff responsibility, since many rights holders are requiring renewal of rights and payments every five to ten years. This is a wholly new function which must be incorporated into ongoing job functions and overhead. The need for technical customer support is still essentially unknown but surely represents some portion of an FTE.

Marketing is another area requiring addition of new expertise and staff. Successfully selling electronic product requires a series of changes within the publishing organization. The marketing necessary to launch a new print journal successfully or to sell a book is expensive and time-consuming, but the approaches and tasks are familiar and can be performed by existing marketing staff as part of their existing marketing jobs. In contrast, successfully establishing a customer base of licensed libraries for electronic product requires new skills and abilities, a substantial staff commitment, a higher level of staff expertise and authority, and substantial involvement from the licensing library. Marketing electronic services requires all the brochures and ads that print publications do. In addition, it requires substantial publicity efforts, a travel schedule to perform demonstrations at a wide range of library and end-user meetings, participation in appropriate listservs, and at least one staff member who has the requisite knowledge and authority and who can dedicate a large portion of their time to outreach, negotiations, and liaison with potential and actual license customers and subscription agents. There are also demands for ongoing customer relations work, including the provision of quarterly or annual use reporting. The Press has found it very difficult to fit those new functions into its traditional marketing and distribution job descriptions and workloads. As the Press moves more seriously into electronic publication of frontlist books, it will surely need to hire a new person to market online books; it will not be possible to integrate these functions into the already busy jobs of books marketing professionals with their focus on current season bookstore sales.

In short, the Press anticipates a permanent addition of at least three or four full-time staff to the overhead of the publishing operation. For now, some of these positions are covered by the Mellon Foundation grant, and some of them have been deferred (to the detriment of the project), but in the long run the electronic publishing model must absorb these additional \$200,000 in annual costs.

Finally, the Press and the Library have just begun to step up to the costs of long-term archiving (including periodic refreshing of technology and the requisite reconversion of files-another argument for structured standardized coding of text).

Income for electronic product:

Unfortunately, in a period when electronic publishing generates additional costs which must be

funded, there are several trends apparent in the emerging purchase patterns of electronic products which limit the income available to support publication costs and which create further pressures on publishers to increase prices.

Slowness to adopt:

University presses which are attempting to sell electronic product directly (as opposed to bundling it automatically in the paper price, and offering "free" access to the electronic product) are finding that sales to universities are progressing more slowly than projected. Project Muse sales, for example, are at 378 after 2 years; sales to MIT's electronic-only journals hover at around 100; in no case are there more than fifty library subscriptions. There are under 25 subscriptions to the online edition of The Cigarette Papers at the University of California/San Francisco Library's Brown and Williamson Tobacco site after nine months (<http://www.library.ucsf.edu/tobacco/cigpapers/>). Sales to SCAN are a handful (although access has been restricted for less than one month at the time this paper is written). Even for publications for which no additional charge is being made, library adoptions are still slow in coming-The Astrophysical Journal Electronic Edition, for example, has 130 libraries licensed to date. There are, of course, good reasons for this slowness; libraries face the same difficulties in building infrastructure, funding, and staff expertise that publishers do. But the low sales nevertheless make funding the transition more difficult, because publishers can't count on sales income from the electronic product to help to cover the costs of electronic publication. The growth curves to which publishers are accustomed from launching paper journals (even in this age of low library adoptions) are too optimistic when applied to electronic publications. This has real consequences for funding electronic innovation.

New discount structures:

In addition, the emerging business practices and discount expectations lessen the income per subscribing institution (at the same time as the efforts necessary to obtain that subscription are intensified). The expectations of consortia for deep discounting (both for number of consortia members and for adopting a bundle of publications) can go as high as 40 percent for academic institutions, with non-traditional markets receiving even deeper discounts. If one assumes that the 70-85 percent of the list price represents the first copy costs, a 40 percent discount means that these subscriptions are no longer carrying their full share of the first copy costs. This can't be a long-term pricing strategy.

In addition, there are often other consortial demands (for example, demands that inflationary increases not exceed a certain percentage for several years, or that access be provided to high schools free of charge) which further lessen the ability of publishers to fund electronic innovation out of electronic product sales. Again, it is easy to empathize with these library positions and to understand why they are evolving. But these efforts by libraries to control costs actually have an inflationary pressure on overall prices, since the base price must increase to make up the losses.

Loss of subscriptions:

In addition, publishers are worried about losing subscriptions. Some losses will surely happen:

another major wave (or waves) of cancellations as libraries try to cope with the ongoing costs of paper and electronic subscriptions from the major commercial science publishers; and the loss of any duplicate subscriptions still remaining on campuses. In addition, publishers are haunted by the potential for substantial shrinkage of individual subscriptions/society memberships as more and more scholars have "free" access from their campuses, though loss of individual subscriptions is less sure than library cancellations (by December 1996, almost 60 percent of SCAN uses were coming from domestic non-.edu addresses as more and more people obtain access from home workstations; it is possible that individuals will pay for the convenience of non-campus access, just as they now do for non-library print access.) Nevertheless, because individual subscriptions play an increasingly important role in financing many journals (especially journals launched within the past ten years, when library support has been so eroded), widespread cancellation would have a substantial impact which would force journal prices higher.

Possible increases in sales:

There are two possible new revenue sources that may somewhat balance the losses in income described above, although both are highly speculative at this point. First, publishers may obtain new institutional markets and wider distribution as consortia bring institutions like junior colleges and high schools to scholarly publications. Project Muse has begun to see this trend. It is not clear, however, that these will be long-term subscribing customers. Given the present nature of scholarship, many of these new subscribers may conclude that any amount of money is too much to pay after two or three years of very low use statistics, especially when by-article access on-demand becomes widely available. There will be a substantial market for scholarship at junior college, high school, and public libraries only when the possibility of wider audiences through the Internet fundamentally changes the ways in which scholars write and present their work--a change that will surely take many years to materialize. Other publishers are more optimistic about this potential source of income.

Second, there may be a substantial revenue stream in sale of individual chapters and articles to scholars whose institutions do not have access, who do not have an institutional base, or who are willing to pay a few dollars for the convenience of immediate access at their workstations (people who are now presumably asking their research assistants to make photocopies in the stacks). And there may be substantial sales among the general public. This new product may represent substantial income which could relieve some of the pressure on journal finances, if the process can be entirely automated (at \$6 or \$7 per article, there is no room for the cost of an employee ever touching the transaction). There will need to be substantial traffic here, as it takes seven or eight article sales to cover the first copy costs of one typical humanities subscription.

Of course, the ability to purchase single chapters or articles will also diminish subscription revenues, as some libraries choose to fill user needs on demand and to cancel their present subscriptions. It is too soon to tell what the mix of new audiences and subscription cancellations will be, and whether the revenue stream from new sources will replace that from canceled subscriptions.

Aggregators:

So far, the models we have examined have all assumed that the publisher is providing access to electronic resources. Publishers could, of course, avoid many of these costs by providing electronic files to aggregators and leaving marketing, file-service, file conversion, and archiving to outside suppliers who would provide a single point of purchase for libraries and individuals. This scheme offers a number of advantages from a library point of view. The instant connection between search engine and ordering ability which the larger services like Uncover and OCLC offer may potentially bring more end-users.

But from a publishing point of view, there are two very large disadvantages. The first is strategic. In an electronic world, one of the major values which publishers have to offer is the branding value of our imprints as symbols of excellence resulting from peer review and gatekeeping-functions which will be ever more valuable in the time-starved world of the Internet. This brand identity is inevitably diluted in an aggregated world, especially if the aggregator is handling marketing and distribution.

Second, and more relevant to the discussion at hand, it is hard to see how the royalties most typically offered by aggregators (for institutional licenses or for on-demand use) can begin to replace the revenue lost from direct subscriptions. A 30-40 percent royalty does not cover first copy costs of 80 percent. Only by retaining the entire fee can publishers hope to generate enough revenue for on-demand sales to make a sufficient contribution to the costs of publication. A wide-scale move to aggregation would have the effect of making the first copy costs for the few remaining subscriptions very large indeed, in addition to reducing the perceived value of what we sell (yes, it is possible for a humanities quarterly to cost \$1200 annually!)

The University of California Press and most other nonprofit scholarly publishers would like nothing better than to price electronic products substantially lower than print. However, the low margins under which they operate, the demands of users that print continue to be provided, the high first copy costs typical of scholarly publishing, the need to fund the development of electronic product, and the expenses of producing full-featured electronic publications all mitigate against low prices, at least during the transition period.

CONCLUSION:

The university press and the library face economic pressures that neither can address alone. In the face of continuously escalating prices and relatively flat budgets, libraries will continue to reduce acquisition rates to balance the collections budget, and these reductions will adversely affect the revenues to university presses. In addition, the pressure from the sciences, technology, medicine and business to retain high-cost, high-use journal subscriptions will tend to crowd out lesser used scholarly journals, many of which are published by university presses. The need to maintain large physical plants and control large print inventories will continue to mitigate against libraries' employing the kinds of radical, cost-reducing changes in operations that could free up resources for investments in technology. The trends noted in University Libraries and Scholarly Communication, and in Hawkins' paper will result in a catastrophic decline in the system of scholarly communication unless there is a fundamental shift in the way in which its processes, products, and costs are analyzed. Each of the two partners, the library and the press, serves as an inadequate unit of analysis for the system of scholarly communication as a whole.

Sandra Braman's description of the three stages in the conceptualization of the information

society^[19] provides a useful context in which to view today's problems of press and library within the system of scholarly communication. She characterizes the three stages of conceptualization as follows. In the first stage, although the economy is seen to be operating normally, it is recognized as an information economy because industries in that sector are of greater importance than in the past. The second stage is characterized by commodification of forms of information never before commodified. In this stage, political controversy about information's value as a public good vs its market value as a commodity is highlighted.

In the third stage conceptualization, a more sophisticated understanding of the flow of information replaces the market as the primary feature of the information economy. This stage represents a paradigm shift in which the information economy is seen to operate in a *qualitatively* different manner than in the two previous conceptualizations. According to Braman: "key insights of this perspective include identification of a new unit of analysis, the project, involving multiple interdependent organizations, as more useful than either the industry or the firm for analytical purposes." (p. 112) She further describes the third stage conceptualization of the information economy as including a production chain-or "harmonized production flows" including information creation, processing, storage, transportation, distribution, destruction, seeking, and use-in short, all of the stages of the system of scholarly communication from author to user, including the library. In the third stage, networked information economy, economic viability stems not from maximizing profit or economic stability within each component of the system, but rather through building long term relationships and a stable *system* or *flow* of information.

Michael Hammer makes a similar point with respect to industrial or business reengineering, but applicable to libraries and presses as well:

The usual methods for boosting performance-process rationalization and automation-haven't yielded the dramatic improvements companies need. In particular, heavy investments in information technology have delivered disappointing results-largely because companies tend to use technology to mechanize old ways of doing business. They leave the existing processes intact and use computers simply to speed them up . . . Instead of embedding outdated processes in silicon and software, we should obliterate them and start over. We should "reengineer" our businesses: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance.^[20]

Both Braman and Hammer emphasize the disquieting qualities that characterize this kind of paradigm shift implied by the third stage of conceptualization of the information economy and by successful reengineering. According to Hammer,

Reengineering cannot be planned meticulously and accomplished in small and cautious steps. It's an all-or-nothing proposition with an uncertain result . . . At the heart of reengineering is the notion of discontinuous thinking-of recognizing and breaking away from the outdated rules and fundamental assumptions that underlie operations. Unless we change these rules, we are merely rearranging the deck chairs on the Titanic. We cannot achieve breakthroughs in performance by cutting fat or automating existing processes. Rather, we must challenge old assumptions and shed the old rules that made the business under perform in the first place . . . Reengineering requires looking at the fundamental processes of the business from a cross-functional perspective.

Manuel Castells takes a different approach, suggesting that technology-driven productivity increases in the *informational economy* have not thus far been evident. His thesis is that while technology-driven productivity increases were steady in the industrial sector between 1950 and 1973, since 1973, despite the intensive investment in technology, productivity-- particularly in the service sector has stagnated. He suggest three factors which appear to be relevant to the library/press sector, as well as to the service sectors of the economy in general. These factors include the following.

1. **Diffusion:** before technological innovation can improve productivity markedly, it must have permeated the whole economy, including business, culture, and institutions.
2. **Measuring productivity:** Service industries traditionally find it difficult to calculate productivity statistically; thus the lack of observable productivity enhancements may in part be a symptom of the absence of relevant measures.
3. **The changing informational economy:** Productivity cannot easily be measured because of the broad scope of its transformation under the impact of information technology and related organizational change.

If Castells and Braman are correct, then libraries and presses, alone or together, cannot implement technological solutions that can transform the processes, productivity and economics of scholarly publishing.

The Mellon projects have been useful in introducing two players in the information flow to the problems of the other, and in forging collaborative relationships to aid in sustaining the system of scholarly communication. These cooperative projects between university libraries and presses are useful in helping participants to begin to understand the system of scholarly publishing as an information flow rather than as separate operational processes. But they are limited in effectiveness because outside of the parameters of the projects, the partners must still maintain their separate identities and economic bases.

In a fuller exploration of the potential of transforming the flow of scholarly information, there would be a more integrated economic model including the creators of the information as well as the publisher, the library, the university administration, and the consumers. In this system, costs and subsidies of the entire process of scholarly communication would be better understood, and resources made more flexibly available to support it. For example, it might be possible to view operational and capital savings to libraries resulting from a transition to electronic publication as resources ultimately available to sustain the publication chain, or consumers could be asked to pay some of all of the costs of creating, storing, archiving, and delivering scholarly information. A critical flaw in the current system is the existence of a part of the gift economy, in the form of the library, within a monetary economy for commercial publishers. Because the consumers of the information within the university do not pay for it, they and the campus administration see the library as a "problem" when it cannot provide the information needed within the budget allotted.

A key problem in securing the future of scholarly communication is that both presses and libraries are undercapitalized. Although libraries incur huge capital costs over time-in both inventory and facilities, they are not free individually nor as parts of the *system* of scholarly communication to reallocate present or future capital expenditures to investments in new modes of publication. However, such reallocation, if it occurs at all, will take place very slowly because

the transition to digital publication will also be slow. It is possible that a more rapid transition to electronic publishing would reduce libraries' recurring operations costs, thereby enabling them to invest greater resources in information itself. But a more rapid transition is feasible for presses only if there is a rise in demand for digital publications from libraries and from end users or a substantial increase in subsidies from their parent universities. Presses can offer electronic publications, but they cannot change the demand patterns of their customers, libraries, nor the usage patterns of the end consumers in order to hasten a transition from print to electronic dissemination. As long as a substantial portion of their market demands print (or fails to purchase electronic product), presses will be forced to incur the resulting expenses, which, in being passed on to libraries as costs that inflate more rapidly than budgets, will reduce the purchases of scholarly publications..

Ironically, in the present environment, universities tend to take budgetary actions that worsen the economics of scholarly communication as experienced by both libraries and presses. University administrators increasingly interpret any subsidy of university presses as a failure of the press itself as a business; as university subsidies are withdrawn, presses must increase prices, which reduces demand, and exacerbates the worsening fiscal situation for the presses. But in the networked economy where everyone can be an author and publisher, the value added by presses (for example gatekeeping, editorial enhancement, distribution) may be more important than ever in helping consumers select relevant, high quality information. At the same time, university administrators see the library as a "black hole" whose costs steadily rise faster than general inflation. Since library materials budgets grow more slowly than inflation in the costs of scholarly publications, the inevitable result is reduced purchasing of scholarly publications of all types, but particularly of university press materials which in general are of lesser commercial value in the commodity market. Unless the system as a whole changes, both university presses and university libraries will continue to decline, but at an increasing rate.

Although it is not possible to envision with certainty exactly how a successful transition from the present system to a more sustainable system might occur, one plausible scenario would be for universities themselves to invest capital resources more heavily in university-based information flows and new forms of scholarly publication as well as for them to place increased market pressures on the commercial sector. If universities were to make strategic capital and staffing investments in university presses during the short term, the presses could be more likely to make a successful and rapid transition to electronic publication. At the same time, intensive university efforts (i.e. investments) to recover scientific, technical, medical, and business publishing from the private sector could be made to reduce the crowding out of university press publications by for profit publishers. These efforts to recover scholarly publishing could be accompanied by libraries' placing strong market pressures on commercial publishers through cancellation of journals whose prices rise faster than the average rates for scholarly journals in general. The investments in these two areas-converting publication processes to electronic form, and returning commercial scholarly publishing to the university-could be recovered over time through reductions in capital investments in library buildings. Ultimately, the university itself would encompass most of the information flow in scholarly communication through its networked capability. That information having commodity value outside of the academy could be sold in the marketplace, and the revenues used as a subsidy to the system itself.

Another way of accomplishing a harmonization of the scholarly information economy was suggested by Hawkins: the independent non-profit corporation model^[21] in which universities and colleges would invest together in a new organization which would serve as a broker, negotiator, service provider, and focus for philanthropy. It would leverage individual resources

by creating a common investment pool.

However the solution to the problem of the economic crisis in scholarly communication is approached, there must be a fundamental change in how the process as a whole is conceived, and how intellectual property rights of both authors and universities are managed. Such a change cannot be made unilaterally by university libraries and presses, but will require the strategic involvement and commitment of university administrators and faculty within the university and among universities. Patricia Battin, envisioning an integrated scholarly information flow said almost ten years ago:

Commitment to new cooperative interinstitutional mechanisms for sharing infrastructure costs -- such as networks, print collections, and database development and access -- in the recognition that continuing to view information technologies and services as a bargaining chip in the competition for students and faculty is, in the end, a counterproductive strategy for higher education. If the scholarly world is to maintain control of and access to its knowledge, both new and old, new cooperative ventures must be organized for the management of knowledge itself, rather than the ownership of formats.^[22]

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