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The Changing Nature of Collection Management in Research Libraries

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The contemporary history of collection management in North American research libraries began midcentury. Since then, several issues have influenced the evolution of collection management with new forces emerging in the 1980s. In this article, we point to the challenges librarians face in managing the transition into a new and uncharted environment, including differing needs and scholarly communication patterns. We anticipate digital information will bring fundamental changes to scholarly communication and thus to collection management and point to a shift from a decentralized system of duplicate print collections to one of fewer central repositories. We believe print collections are not likely to disappear but the importance of secure storage for digital materials cannot be overemphasized. In the digital age, the "library model" for funding and sharing information will be scrutinized for its applicability in a world of access. Collection management librarians must take the lead in wedding print collection management to new storage and electronic access and delivery options to maintain and preserve the record of knowledge.

Historical Background

The contemporary history of collection management in research libraries in North America began in the middle of the twentieth century as the United States and Canada emerged from World War II. Over a period of about 35 years, from roughly 1950 through the mid-1980s, collection management in research libraries in America became codified and professionalized. Three important issues greatly influenced the evolution of collection management during this formative period: (1) the rapid expansion of higher education, scholarship, and library collections; (2) the shift from collection development to collection management; and (3) attempts to collect cooperatively as duplicate collections grew.

Rapid Growth in Size and Scope of Research Library Collections

Information overload may be the greatest challenge that scholars and librarians have faced in the twentieth century. In 1870, 840 papers were published in mathematics; by the middle of the 1990s, 50,000 new mathematics articles were being published annually (Odlyzko 1995). The second half of the twentieth century has been a time of spectacular growth in all fields of knowledge, especially in scientific disciplines. According to Cummings et al. (1992, 61), book production in the United States began an "extraordinary expansion" in 1945 that was "particularly rapid during the first half of the 1960s." The creation of new science journals, as reported by *Science Citation Index* source publications, dramatically increased in the four decades from 1950 to 1990, with the 1970s being the decade of the most dramatic scientific journal growth (Cummings et al. 1992).

Librarians whose careers spanned the pre- and post-1950's worlds noted a marked

expansion in the scope of scholarship in America. Before World War II, academic research in America concentrated on Western culture and classical areas of science. After the war, American research horizons expanded to cover all areas of the world as well as applied and specialized fields of science (Holley 1987). Library collections grew rapidly to house the products of this expanded research effort. In the 1950s and 1960s many university librarians found themselves in the midst of a "golden age" of collection development when acquisitions funds seemed plentiful, U.S. currency was strong, and there was still room in academic library book stacks.

From Development to Management of Library Collections

Osburn (1979) documented the rapid growth of higher education and the reshaping of the academic research agenda in a post-Sputnik era. He stated that the patterns of scholarship in America were undergoing profound changes in the second half of the twentieth century, and research librarians needed to understand better and be more responsive to this new academic agenda. Among other changes, the emerging dominance of the sciences in the university's hierarchy of disciplines, the demands of government funding agencies for "relevant" research, and the decline in foreign language competencies made the older humanities-based model of collection development in research libraries less effective. Osburn concluded that a more service-oriented model of collection development, one that emphasized currency, responsiveness, and focused attention to user needs, was needed.

Kent et al. (1979) reported one of the most comprehensive and controversial collection use studies in the literature of librarianship. They described how the library collection at the University of Pittsburgh was used (or not used) over a seven-year period. Kent and his research team found (10) "that any given book purchased had only slightly better than one chance in two of ever being borrowed." As books on the shelves aged and did not circulate, their likelihood of ever circulating diminished to as low as 1 chance in 50. The team also found that journal use, in general, to be low. Kent et al, like Osburn and others, used these findings to argue for better "collection management" and for more effective cooperative collection development and resource sharing among libraries.

Codification of Collection Management as a Profession

In the late 1970s and throughout the 1980s, the American Library Associations Resources and Technical Services Division (which was renamed the Association for Library Collections and Technical Services [ALCTS] in 1986) issued a series of "Guidelines for Collection Development" (Perkins 1979) and held regional institutes on collection management and development. These guidelines and institutes helped to codify and professionalize this emerging field of librarianship. When Paul Mosher, then the head of collection development at Stanford University and one of the leaders in this new field, gave the keynote address at the first Collection Management and Development Institute (Mosher 1981), he set the theme for all the subsequent Collection Management and Development institutes. He challenged librarians to move away from a traditional "collection development" perspective, which emphasized only acquisitions, selection, and collection building, toward a new vision of "collection management," which encompassed a much broader range of policy, planning, analysis, and cooperative activities (Branin 1993). Thanks to the efforts of Mosher and other librarians who prepared these guidelines and regional institutes, "collection management" came to be a recognized functional

field of librarianship by the mid-1980s. This field includes the theory and practice of collection policy development, materials budget allocation, selection, collection analysis, collection use and user studies, training and organization of collection development staff, preservation, and cooperative collection development.

Attempts at Cooperative Collection Development

Cooperative collection development, which in some sense is the ultimate activity of this new functional field of librarianship, has proved difficult to implement and to sustain. It is clear, both in theory and practice, that no single library can collect the entire record of knowledge; and, as use studies show, no library really needs to do so to satisfy most user needs. A reasonable approach might be to coordinate collection development locally, regionally, nationally, and internationally to maximize local use of library collections and broad coverage of all fields of knowledge. But, a number of national attempts to collect cooperatively have failed, and these include the Farmington Plan of the 1950s and 1960s, the National Periodicals Center of the 1970s, and the Research Libraries Group's *Conspectus* project of the 1980s (Holley 1987; Biggs 1985; Mosher 1986).

The Center for Research Libraries, however, emerged as a viable model for depositing and sharing highly specialized research material. Some carefully focused regional efforts, such as the one involving the academic libraries in North Carolina's Research Triangle, did provide some longstanding cooperative collection development opportunities for the libraries involved (Dominguez and Swindler 1993). By and large, however, most cooperative collection development experiments from the 1950s through the mid-1980s were not successful. The strong political pull of local library autonomy, combined with the technical difficulty of moving print material quickly and economically over geographic distances, tended to make cooperative collection development difficult and impractical (Brinin 1991).

Emergence of New Forces Shaping Collection Management, 1985-2000

Economic Constraints

In the mid-1980s many universities and research libraries found themselves in a period of fiscal constraint and even decline. Association of Research Libraries (ARL) statistics indicate that the average research library's share of a university's education and general expenditures began decreasing each year after 1983, from 3.92% in 1983 to 3.26% in 1995 (*Library Expenditures* 1996). Tighter budgets and skyrocketing serials costs affected the buying power for library acquisitions, forcing research libraries to buy fewer and fewer monographs (particularly internationally published monographs) and serials each year. Between 1986 and 1996, ARL member institutions reduced their annual monograph purchases by 21% and their serial purchases by 7% (ARL 1997). Chrzastowski and Schmidt (1996) found that over a five-year period, from 1988 to 1992, five Midwestern research libraries (Illinois, Iowa, Michigan State, Ohio State, and Wisconsin) canceled a total of 13,021 serials titles from their subscription lists. It is possible that this rate of serials cancellation resembled the rate in the rest of the country.

Economic constraints affected all aspects of research library operations. In fact, personnel reductions seem to have been steeper than acquisitions declines. Between 1982 and 1991, the typical portion of a total research library budget spent on acquisitions remained constant at 35%,

while the portion of a total library budget spent on salaries declined from 56% to 52% (Cummings et al. 1992). Staff downsizing and personnel reorganizations in research libraries have surely affected collection management programs. Anecdotal evidence points to fewer full-time heads of collection development, bibliographers, and subject specialists in research libraries as the twentieth century closes.

Howe (1993) described the emerging situation as the "decentering of the library" within institutions of higher education. According to Howe, a history professor and interim director of libraries at the University of Minnesota, the library might still have been the symbolic heart of the university, but for several reasons it was losing its central place as a funding priority on many campuses. First, new information technology was creating alternative paths for access to scholarly information, and investments in technical infrastructure and computing centers diverted funding from the traditional library. Second, the decline in arts mid sciences and the rise of science and technology programs in universities eroded the power of disciplines that most directly supported the traditional library. Third, the profession of librarianship itself seemed to be in disarray, fraught with uncertainty and anxiety over its future in the computer age. Fourth, libraries were not competitive enough in the new, aggressive environment of higher education. Howe emphasizes that new leadership was required to assert that libraries still played a central role in supporting teaching and research. The library could no longer take for granted a special status in the university.

Digital Information Systems

While confronting adverse economic conditions in the 1980s mid 1990s, collection management librarians faced an even more powerful force for change: the emergence of digital information systems. The online catalog was followed by electronic reference databases, and by the mid-1990s full-text digital articles and journals and digital collections vied for collection management librarians' attention. Librarians now had to balance the demands of print and digital materials, even as they sought to understand the nature and consequences of digital, networked information and the impact a new information system would have on library operations, including the budget. At the same time, scholarly publishing also experienced dramatic change. With fewer orders from libraries, university presses had to cut back the number of monographic titles they published, while commercial journal publishers, at least some of the largest science and technology publishers, expanded mid flourished. All concerned struggled with the impact of the Internet; it was unclear whether this new avenue for networked communications would bring freedom or more restrictions to the collection and dissemination of knowledge.

Because of these changing conditions, the new field of collection management, begun exuberantly in the 1950s, had little opportunity to mature and form a solid base of practice or tradition. Current budget conditions in research libraries and developments in information technology and in publishing have quickly led to modifications or even reversals of recently established ideas about how best to operate collection management programs. A constricted library economy, the emergence of information in digital format, and the commercialization and consolidation of the publishing sector have combined to produce profound mid surprising changes in collection management in research libraries at the beginning of the twenty-first century.

Managing the Transition

Expectations and Needs of Different Users

Collection management librarians face a new and uncharted environment. Libraries have much less buying power than they had a decade ago. With fewer full-time staff in collection management, many selectors and bibliographers work at collection management part time while handling a much broader range of disciplines and formats. The technical advances in digitization are truly revolutionizing the way scholarly information is published, organized, and maintained, and both the scope and extent of this change are difficult to comprehend and manage.

Unanswered are the questions of how radically collection management will change in the next five or ten years, and of how it is changing on a day-to-day basis right now.

As difficult as it was to manage a print collection, librarians now have two equally formidable formats to consider: print and digital. The introduction of digital resources in research libraries led to a good deal of conflict between the old and new formats. What might be called the cultural wars between print and electronic proponents began with the demise of the card catalog and moved to the fear of digital content taking over print. For a taste of these print versus digital skirmishes in libraries, one can consult Baker's pieces in *The New Yorker* on the demise of the card catalog (1994; 1995; 1996) and Golden (1997) on the controversy surrounding the weeding of print collections when the San Francisco Public Library moved into its new building. These overt battles might now have eased or even ceased in most libraries as both librarians and users have become more accustomed to digital information systems, but serious tensions still exist over priorities, allocations, and the desires of different constituencies of library users.

Different Communication Traditions in Scholarly Disciplines

In fact, current practices and traditions in scholarly communication are at the base of the conflicts within collection management. The divergence among disciplines—and even within disciplines in the sciences (Kling and McKim 1998)—is noteworthy. Scholars in the sciences publish their research results in journals, rather than in monographs, in part to be able to report as rapidly as possible. They are, for the most part, comfortable with digital access to journal articles and, in many cases, communicate widely and share initial results of their research electronically, e.g., through the use of electronic preprints. In some disciplines, such as mathematics, scholars regularly use back issues of journals in their fields; in others, such as computer science, they do not. In some areas of the humanities, however, such as history, monographs, not journal articles, are required for tenure and promotion. Rapid dissemination of results is less important in the humanities than in the sciences (hence the different editing practices), and older publications are consulted more frequently than in many scientific disciplines. There are some areas of the humanities, such as philosophy, however, where monographs play a much smaller role than do journal articles.

Yet another field of study, law, is radically different from both the humanities and the sciences. Articles are generally not peer-reviewed but are reviewed by the law school students who usually edit these journals. The journals are inexpensive and largely subsidized by the universities that publish them. Commercial journals are not the most prestigious; rather the prestige of a law journal generally comes from the ranking of the law school that publishes it.

Cronin (1999, A25) commented on the differences among academic disciplines within

the changing world of electronic publishing. He stated: "Interestingly, cross-field variations are largely independent of the highly visible tools and technologies associated with electronic publishing. Common platforms don't breed common approaches. Rather, publishing practices and expectations within a given research community are shaped by prevailing norms and conventions. Nothing new in that. Traditionally, a refereed conference paper has counted for something in computer science, but is likely to be given short shrift by a promotion and tenure committee in a business school. A monograph (preferably one published by a reputable university press) will be expected of a junior scholar in English, but not of an aspiring mathematician. This being so, our *ex cathedra* pronouncements about publishing really should be grounded in the multiple realities of tribal life in academe."

Limitations in Library Staff and Budget Adaptability

Within this complicated picture of needs and traditions, rapidly increasing prices of science journals have literally eaten up limited collection budgets. In fact, despite cancellation of hundreds of thousands of dollars worth of journals since 1986, the 110 largest research libraries in the United States and Canada have spent 124% more on serials to purchase 1% fewer titles, according to ARL (ARL 1998). Although monographs increase in price at a slower rate than journals, fewer monographs are purchased by libraries because of the need to fund expensive journals (both electronic and print) in the sciences. With fewer orders from libraries, scholarly presses have reduced the number of titles and the quantity of print runs; therefore, it becomes more and more difficult for a scholar to find a publisher for a monograph.

To complicate the picture further, universities and libraries have had to scramble to develop the technical infrastructure and staff expertise necessary to participate fully in the new digital information realm. Some departments in the academy still lack up-to-date computer equipment and support, while others have long had a strong information technology infrastructure and continue to improve it. The organization of libraries and the education of many library staff were designed for work in a print information system. It is not easy to change operational procedures, organizational structures, and established work habits and outlooks; such social changes generally lag behind technological change.

The amount of digital information is growing faster than most librarians would have predicted. According to Negroonte (1996), the World Wide Web doubled in size every 50 days in 1996, with a homepage added every four seconds. Despite this phenomenal growth, research libraries, for reasons stated above, are still largely dominated by print resources, both in acquisitions and collection management. It is unlikely that more than 10% to 15% of a research library's collection budget is used today to purchase or provide access to digital information. It is clear that research librarians need to turn more of their attention, effort, and resources to managing the new digital information system. It is unclear how the Worldwide Web, with its phenomenal growth, can be made useful for students and scholars. Also, we have not defined who will select, catalog, and maintain worthwhile Web sites.

The OCLC Online Computer Library Center is attempting through its Cooperative Online Resource Catalog (CORC) project to provide an automated means of cataloging or otherwise describing Internet resources, including e-journals, articles, or other resources. CORC's underlying software captures the resource description and puts it into a template where it can be edited and then saved as a Dublin Core document or a machine readable cataloging record and exported into a local catalog. CORC can suggest subject headings, Dewey call numbers, and

eventually will have an authority component. With CORC users can assemble "portal pages" or "pathfinders," which essentially are Web compilations of individually described resources and can be incorporated into bibliographies (Kaplan 1999).

Understanding the Nature and Consequences of Digital Information

Digital Format Items as Additions to Collections

The fundamental structure of how scholarly information is published has yet to be altered in any significant way. Authors still submit manuscripts, now more often than not in electronic form, to publishers. Publishers take ownership of the manuscripts, turn them into both print and electronic books and articles, and sell them to individuals and libraries (To Publish and Perish 1998). Research librarians and faculty members are loathe to give up their print collections and journal subscriptions until digital products are more stable and mature and are able to be archived successfully. In fact, many publishers still require that libraries purchase a print version along with their electronic product.

Sewell, a collection development expert at Rutgers University, recently described the current electronic environment as one where myriad different interfaces exist; search engines crash; local loading, remote access, and operating systems have regular and recurring problems; radically different terms and conditions are found in licensing agreements; and wide fluctuations in the pricing of similar electronic products are found. He believes, however, that most research libraries have become extraordinarily adaptive in this chaotic and formative period (Sewell 1999). At this point, the digital information system is simply too immature for it to become a trusted and reliable medium for the collection and preservation of the record of scholarship. Yet librarians often hear from students and young scholars, "If it's not on the Web, it doesn't exist."

Change in the Scholarly Communications System

Despite its imperfections, the digital information system has and will continue to have a profound effect on scholarly communication. In the 1990s, several authors wrote of the magnitude and significance of fundamental changes in scholarly communication as well as the great potential offered to the community of research and scholarship by developments in information technology (Cummings, et al. 1992; *Changing World* 1996; *Technology and Scholarly Communication* 1999). Fundamental changes in scholarly communications are certainly in store. The traditional book and journal as organizing frames for scholarship will likely change as will basic production, distribution, and archiving. Ginsparg, a physicist at the Los Alamos National Laboratory, Odlyzko, a mathematician at AT&T Bell Laboratories, and Atkinson, a research librarian at Cornell University, all have written provocatively about the demise of the traditional scholarly communication system and what its replacement might be. Taking full advantage of desktop publishing capabilities, networking, and powerful computer servers, Ginsparg (1996) envisions the development of an electronic "global raw research archive" managed by a consortium of professional societies and research libraries. Odlyzko (1995) believes the new digital information system will allow scholars to become their own publishers and archivists. According to Odlyzko (49), "Publishers and librarians have been the middlemen between the scholars as producers of information and the scholars as consumers, and are likely to be largely squeezed out of this business." Atkinson (1998) predicts the design of

new, networked-based, hypertext, document structures that may "represent fundamental revisions in the every modality of communications" and that "may affect and alter some of our basic assumptions about the nature of information itself."

Alternatives to the three-hundred-year old model of scientific communication are emerging. In recent years, none has been quite as all encompassing as the one proposed by Varmus, Director of the National Institutes of Health (Varmus 1999). This initiative, PubMedCentral (formerly E-BioMed), would provide an online archive of scholarly papers in the life sciences. As have previous "revolutionary" proposals, this one has already caused considerable debate (e.g., Kiernan 1999; Bloom 1999; Relman 1999; Wadman 1999). When fully operational, the PubMedCentral site would make the research literature in biomedicine, plant, and agricultural science widely available over the Internet. There are numerous benefits envisioned by this proposal: open access to scientific studies and reports, larger data sets than are available in print, and more rapid dissemination of the results of research, as well as a possible reduction in cost. The program seeks to enhance the availability of papers that would have been peer reviewed and of preprints that would have been vetted by a gatekeeper.

Varmus foresees a continuing role for scholarly societies in determining what papers would be archived. Publishers, however, fear that subscriptions would be cancelled as a result of the free availability of papers on PubMedCentral, and some have not signed on to the initiative. And, within the scientific community, debate rages regarding the critical evaluation of research results in this environment. Members of the Association of Research Libraries (ARL), the Association of Academic Health Sciences Library Directors, and the Canadian Association of Research Libraries have endorsed the Varmus initiative.

New Boundaries and New Structures for Collection Management

The Integration of Digital Resources and the Impact on What a Librarian Does

The nature and structure of scholarly archives need to be changed to manage better the growing quantity, specialization, and cost of scholarship. Rather than a highly decentralized system as exists today, with duplicative print collections spread across the country, digital technologies have the potential to provide more centrally organized information storage and highly distributed, quick, and cost-effective access. Battin and Hawkins (1998, 7) stated very clearly:

It has become clear in the past decade that traditional notions of libraries and information technology organizations are no longer intellectually and economically sustainable. Digitally produced volumes of paper publications rendered obsolete the concept of self-sufficient site-dependent collections. College and university libraries can no longer meet the information needs of their faculty and students through the traditional avenue of simply adding to their collections.

Digital technology can also foster the integration of the various components and sources of scholarly publication. In the future, researchers will no doubt use hyperlinks to move quickly online from index or bibliographic citations to abstracts to full multimedia documents with the click of a mouse. Such integration is already happening on the Web and through the efforts of library and scientific information services. The ability to use hyperlinks to integrate scholarship and to make possible interdisciplinary research online is an extraordinary feature, one with which

a print format cannot compete.

Research librarians are just beginning to make broad, organizational changes in their management of the products of scholarship. Librarians are starting to provide more access to digital information not from files stored in their own libraries or on their own campuses, but from servers that are networked with publishers, government agencies, universities, and scholarly societies that can be located anywhere around the world. Rather than selecting scholarly resources on an item-by-item basis, librarians are turning into "aggregators" who are developing their collections at a macro and integrated level.

Griffiths (1998) stated that librarians will continue to need to know their users and their needs, but in an electronic environment, librarians will increasingly be subject specialists ferreting out the accurate and useful information on the Web. Collection builders will evolve into knowledge prospectors. She added (237): "The creation of validated collections of digital materials and their relationship to validated nondigital materials will offer a significant added value to the serious information seeker, while allowing other linkages to be developed and used."

Aggregation and New Boundaries for Collections

Reference tools, electronic journals, and digital archives of historical materials now come in a variety of bundled packages. Johns Hopkins University Press, Elsevier, Academic Press, and the American Chemical Society all market their entire line of electronic journals as a complete package to individual libraries, local library consortia, and even to statewide or regional groups of libraries. Libraries are beginning to aggregate themselves by creating "virtual libraries" at the state or regional level to pool resources and services. The Ohio Library and Information Network (OhioLink at www.ohiolink.edu), Georgia Library Learning Online (Galileo at <http://galileo.galib.uga.edu/Homepage.cgi>), and the Midwest's Committee on Institutional Cooperation (CIC) Virtual Library (http://ntx2.cso.uiuc.edu/cic/third_level/library_vel.html) are just three examples of new virtual library consortia that are emerging across the country.

A strategy that counters the bundling of publications that most publishers use has emerged. California State University's (CSU) librarians and a high-level university committee from the twenty-one campuses of CSU sent out a request for proposal for a customized database that would offer full-text access to 1,279 journals selected by Cal State. This imaginative proposal moved the responsibility for selecting titles back into the hands of the institutions and their libraries and was welcomed by many as an alternative to the growing model of "all or none" site licensing of an entire publisher's journal output. A vendor, EBSCO Information Services, was selected, but the signed contract includes only about 500 of the 1,279 journals on the librarians' list. Some publishers who declined to participate were unwilling to accept the university's stipulations, which included a requirement that the university community have continued access to the articles even if a subscription was cancelled (there are no Elsevier Science journals in this contract) (Guernsey 1999; Biemiller 1999; Dalton 1999).

What these new organizational developments in libraries have in common is the strategy of using digital information services to gain economies of scale, end unnecessary duplication, and provide faculty and students with more information at less cost. This pattern of networked, integrated access to central stores of electronic scholarly material seems inevitable in a new digital scholarly communication system. At last the limitations of print collections may be overcome; self-sufficiency was never really possible in the traditional campus or departmental library, and, at the same time, there was always waste in the form of underutilized material in

these decentralized archives. The elusive but ultimate goal of cooperative collection development to coordinate the collection of the entire record of scholarship may have a new lease on life in the digital information system.

Managing Print Collections in the Digital Age

Managing Storage of Print Collections

The new is also affecting the old. Research librarians, running out of stack space in prime campus real estate for their library's collections and seeing new access opportunities through improvements in document delivery services, are beginning to consolidate their print materials both on and off campus. Regional storage facilities are in operation or under construction both in the United States and Canada. Scholars accustomed to browsing complete open-stack main library collections or separate discipline-based library collections in their school or department buildings find it disconcerting to see this convenient approach to library collection organization coming to an end. The high cost of maintaining decentralized archives, however, combined with the development of new digital approaches to access are making the complete main library and the traditional departmental library a convenience of the past. Direct delivery of articles to the individual's computer and electronic browsing of titles and tables of contents might help to make up for traditional shelf browsing.

Non-Digital Materials in the Library of the Future

Still, in any large research library there are a variety of print collections that will continue to require access and preservation in traditional ways. Music libraries offer a good example of how the traditional and new formats are used regularly. Any music library of strength will contain (in addition to books on music) musical scores and parts, from which performers play—and probably will continue to play into the foreseeable future. Even as students and professors use printed scores and parts to study and perform, they also use computers to compose, analyze, and listen to music. Similar scenarios exist in other kinds of departmental and special libraries, where users require a variety of media for their research, including film, slides, photographs, maps, rare books, manuscripts, and artifacts of all kinds.

Print collections, of course, are not likely to disappear from research libraries in the near or far future. The sheer amount of information in printed form from the past would be difficult to discard or to reformat (Mosher 1986). In current acquisitions, as well, print material still far exceeds digital material in any research library's collection development program. Proper storage and preservation of print collections will continue to be a challenge for research librarians. Off-site and consortial storage arrangements and digital reformatting will provide new tools and options for managing this challenge. The JSTOR project (www.jstor.org) is an excellent model of how new technology and cooperative support can be used to provide new options for access to and storage of scholarly journal backfiles.

Digital reformatting and archiving are still problematic, however. From the Council on Library and Information Resources, Smith (1999, iv) states: "What we have found is that digitization often raises expectations of benefits, cost reductions, and efficiencies that can be illusory, and, if not viewed realistically have the potential to put at risk the collections and services libraries have provided for decades." To date the digital information system has

provided wonderful opportunities to expand access to information, but equal progress in the long-term storage and preservation of information has not yet occurred. The importance to the research community of providing secure storage for digital materials cannot be overemphasized.

New Economics of Information Acquisition

Does the "Library Model" Make Sense in the Digital Age?

Ownership issues and their effect on the control and cost of information in the digital environment are serious concerns for research librarians. Libraries are usually thought of as places, collections, and services. Underlying this construct, however, is an economic model for funding and sharing information that is often taken for granted. In the print world, libraries buy books and journals that can be borrowed any number of times or that can be copied within the limits of copyright law and fair use guidelines. This traditional library model for the central funding and communal sharing of information may or may not work in the new digital environment. Will information move more toward a pay-per-use model, with vendors going directly to users online? Or, will the communal, library model expand and grow stronger with the rise of regional and statewide library consortia that exact cost discounts from vendors because of the economies of scale in larger contracts? Will information be free but paid for through advertising, or will it become a carefully guarded commodity that requires "cybercash" for access?

Ownership and Control of Information in the Digital Information System

Both access to and control over information take on powerful new dimensions in the digital age. The development of firewalls, encryption techniques, authentication devices, and cybercash has made the Internet a much more secure environment today for commerce and publishing. In fact, controls on the use of information can be much more powerful in the digital world than they were in the print world. Tighter control over access to information along with the commercialization of scientific publishing that has resulted in higher subscription prices has, some believe, begun to disrupt the free flow of scholarship. This situation may only be exacerbated as publishers exert more ownership over their digital products in the twenty-first century. If, however, authors, publishers, and librarians can bring the products of scholarship back into the "circle of the academy," the promise of better and less expensive access to knowledge in the digital age might be assured. The Scholarly Publishing and Academic Resources Coalition (SPARC), sponsored by the Association of Research Libraries, is a promising attempt to bring about such changes in scholarly publishing (www.arl.org/sparc/index.html).

Conclusion

The new procedures that made sense for managing collections only thirty years ago have been turned topsy-turvy by changes in higher education and publishing, by the emergence of the new digital information system, and by a weak library economy. In 1993, ALCTS held an Advanced Collection Management and Development Institute that focused on collection management issues in an electronic era. Several of the collection management practitioners who spoke at that institute expressed concern about the future of the field. Atkinson (as quoted in

Branin 1994, xiii), for example, stated that of all traditional library functions, the future of collection development is "certainly one of the most problematic." Ferguson (as quoted in Branin 1994, xiii) talked about the paranoia of collection developers, and Cline (as quoted in Branin 1994, xiii) eluded librarians to stop "bemoaning how bleak everything seems" in collection development programs. Why this edgy tone of uncertainty about the future of collection management? Certainly collection management practices and perspectives must change in the face of environmental shifts in information services and higher education, but will the basic goals and needs of collection management disappear as well?

When collection management as a field was being formed in 1979, Osburn (1979, 140) wrote that collection development would "have to be planned in two fundamental stages: one plan, whose rationale is service to the identifiable needs of the immediate constituency; and a second-stage plan, whose rationale is the integration of local development into the national systems of resource sharing in support of the long-range national academic research effort." In fact, the second-stage plan that Osburn called for never came to fruition. For the last fifty years collection management has been primarily a print-based, local library activity. Collection resources, services, and policies have been developed almost exclusively around the needs of the immediate constituency, that is, local campus faculty and students. But with the primacy of local print collections being questioned in a networked, digital information environment, Osburn's second-stage plan now might take first stage.

The academy itself has been hesitant and uneven in its adoption of new ways of doing its business. Even though the Internet was created by and for academic research institutions and government agencies, parts of the education-government complex have been slow to move to a networked, distributed operation. It is becoming evident, however, that fundamental change is taking place. Powerful technology' infrastructures are being built on research campuses, and in many cases they are fully operational. More faculty and students are making dramatic changes in the way they learn, teach, and do research on and off campus. Faculty are reengineering traditional courses and developing new courses and even degree programs that are competing for students on their campuses and across the country who are willing to learn in a distributed environment. An example is seen in the master's degree in library and information science offered at a distance from the University of Illinois. Nicknamed LEEP3, this highly regarded accredited program has been available since 1996 (www.lis.uiuc.edu/gslis/leep3).

With such changes taking place on their campuses, collection managers, subject specialists, and bibliographers must move from a primarily local, print collection perspective to a broader vision of "knowledge, management"—just as they had once been asked to move from "collection development" to "collection management." Scholars and librarians must recognize that the library and higher education are inextricably bound together. As Battin and Hawkins (1998, 5) have observed, "The transforming impact of information technology cannot be confined to the library but imply a fundamental reorganization of the host institution. The digital library, as the epistemological center of the university, is certainly positioned to serve as the catalyst for transforming the university to meet the needs of the 21st century society dominated by electronic technology."

Knowledge management in research libraries in the twenty-first century will require librarians to create new and expanded roles for themselves in the scholarly communications system. Librarians will have to play a much more active role in the creation of scholarly publications, whatever new multimedia and hyperlinked form those publications might take. They will have to assert aggressively their professional principles for free and unbiased access to

the world of knowledge in the face of trends to commercialize and restrict access to information. Perhaps the most critical and difficult task facing knowledge managers will be to understand and fully exploit the potential of a networked, digital information system to overcome the narrower perspective of the "local" and the "immediate." In the twenty-first century, knowledge management librarians just may achieve an ultimate goal: a freely accessible, integrated, and comprehensive record of serious scholarship and knowledge.

Collection management librarians, long knowledgeable of print collections and for the past decade struggling with the implications of the digital information system, should be leaders in organizing information resources in support of the new distributive learning environment in higher education. Librarians must now deliver resources and services online, synthesize and aggregate digital resources, help create new publications, wed print collection management to new storage and electronic access and delivery options, and maintain and preserve the record of knowledge. All this must be done in a highly distributive, coordinated way.

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