

50th Anniversary Feature—

Information Technology and Libraries: Toward the Year 2000

Susan K. Martin

Some current trends will intensify and begin to make major changes in the way that libraries operate and the way that society uses information technologies in the next century. Among the trends are: more focus on user needs, with users accessing electronic information directly; an increasing tendency for information users to bypass the library; the obsolescence of first- and second-generation systems; a contention between optical products and online access; and a focus in the United States on formulation of major information policies. Inherent in these are both challenges and opportunities for libraries.



wise man once said, "We should all be concerned about the future because we will have to spend the rest of our lives there."¹ Of course, in an exercise of prediction, it doesn't really matter too much whether you are accurate or wrong about the future; by the time we all get there, no one will remember what you said, so you receive neither the credit for your wisdom nor the mockery for your folly.

The year 2000 is now clearly within reach, and individuals and institutions of all kinds are using it as a benchmark on which to hang special celebrations, and special sets of predictions. This gives the occasion for some old predictions, whose authors sincerely wish everyone would forget, to reemerge. A recent issue of *Life* (February 1989) previews the world in 2000 and beyond. Publishing that issue gave the editors the delight of recalling Thomas Watson's words in 1943, when the future chairman of IBM predicted a "world market for about five computers."²

Forty-five years later, this author sat comfortably at home in front of an IBM-AT

clone with 20 megabytes of storage, a color monitor, and an internal modem, key-boarding her words. In fact, libraries were already experienced users of data processing equipment and computers within twenty years after Watson spoke. Even earlier, Ralph Parker had created a circulation system for the University of Missouri-Columbia.³ Librarians in the 1960s used second-generation hardware and software to create catalogs and circulation systems. Where today's average PC has 640 kilobytes of memory, the computers of the 1960s had 8, or perhaps 12.

Prognosticators cause us to vacillate back and forth, between feeling that change is rapid and has the characteristics described by Toffler's *Future Shock*, and believing that change is more evolutionary than revolutionary.⁴ Under both scenarios, much attention must be paid to the way in which our society deals with change. We know that change is difficult for most people; as librarians, we also know that we often lead our users into changes involving information technology. But we cannot lead them faster than they are ready and willing to go;

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if we try, we will lose them.

What will information technology be like in the year 2000? Will some major hurdles of today be overcome? If so, how accurate is the scene hypothesized by designer Philippe Starck: "We'll be able to transmit physical objects. The fax machine is the start. We won't have to move about any more. People will become like big brains connected to a global knowledge. . .

. . . Since all communications will travel by satellite, those who own satellites will control the world."⁵ Farfetched? Maybe, in part, but we must increasingly consider those members of our society who work in their homes, either in their own businesses or as telecommuters; there are 23 million people in this category, and many of them are connected to the outside world by fax and satellite.

LIBRARY TECHNOLOGY: THE MOVE FROM THE BACK ROOM TO PUBLIC SERVICES

What are some of the analogous changes that have taken place in libraries? How is information technology likely to proceed in the future? In talking about automation in our society, John Diebold defined three stages: (1) you automate what you have been doing manually; (2) you find that what you do changes; and (3) societal changes in response to these forces.⁶

Is this farfetched? No. In fact, we are already in the middle of the third stage. In the 1960s and 1970s, we automated what we had been doing manually. In the late 1970s and this decade, what we have automated has been changing the way our libraries work. Quite recently, we have become part of a changing world of information technology in which the users of the information are beginning to access and use information differently than they did in the past.

We are a bit worried about this. We are concerned that libraries may be left behind; that they may become museums; that users will find their information needs satisfied through the information marketplace and will not want or need to come to the library any more. In a sense, these worries are amusing. In the past, we worried that we would not reach this stage; many advocates of information

technologies and of libraries urged a more rapid adoption of technologies and warned that libraries were imitating in machine-readable form what they had been doing by typewriter or by hand.⁷ In fact, the use of technology in libraries has usually been somewhat ahead of most of the rest of the world. It is with a sudden shock that we are now able to look around us and see that the general populace is becoming acquainted with many of the arcane and mysterious methods to which only we and a few others have been privy.

FOCUS ON USER NEEDS

Whether we want to or not, we are being brought into the twenty-first century. Some of us are kicking and screaming, some are welcoming the future and all it holds, and probably most of us are cautiously optimistic, with some caveats in very specific areas.

The back-room technologies, as applied to libraries, need no further discussion. We know how to do it. We can catalog locally or through networks, we can order and pay for materials online, we can check in serials and circulate books. To be sure, there are functions that have not yet been automated or that require improvement, but we know that this is just a matter of time, not of capability.

Much more interesting and far more to the point is information technology as applied to the user. After all, what are libraries for? Librarians? Of course not. Library collections and services are provided for the users, and the market that publishers and database services address is an intricate combination of users as filtered by library decision makers in their purchase of automated systems and databases.

We began to look at information technologies and their relationship to users when we started to evaluate online catalogs and their "friendliness." Before that time, we had catalog and circulation products; we did not, however, consider their impact on the user. The online search services were geared to the user, but the development of these systems was out of our hands; we merely made the decision whether to offer the service, and if so, whether to subsidize it.

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Library research, notoriously inadequate in any case, has so far offered no assistance in the question of how best to provide information services to users in an age when information is being made available in an increasing number of formats, for differing costs and with differing results. Let me paint a verbal picture for you:

Professor B., a member of the history department faculty, sits at his PC, located in his departmental office and linked to the campuswide local area network (LAN), to consult the library catalog by scanning the holdings for definitive works in his area of interest. He finds that three items are on the shelf and sends a computer message to the library requesting that they be charged out and delivered to his office. Finding that a fourth item is already charged out to another user, he places a hold on it. He is disturbed to find that two desired books are not in the collection, so he files an order request with the acquisitions department. Another book is not in the local catalog, but he is able to switch his request to a national database, where he locates the item at Princeton. He then places an inter-library loan request. He also finds an article in a journal held by the University of Michigan and requests telefacsimile transmission of the article. Without setting foot in the library building, Professor B. has thus perused the holdings of dozens of libraries, has made arrangements to secure desired material, and has received a copy of a pertinent article—all in a matter of minutes. Indeed, he continues by using the library's online system as a gateway to external full-text databases of interest to him.

Most of that scenario comes from a document written in the early 1980s. That is why there is no mention of CD-ROM databases or networks and little mention of gateways and links to other systems. But otherwise, it is neither out of the realm of possibility nor obsolescent: it is just about where the technology, the providers, and the users are right now. Because monetary resources rather than technology are the restraining factor, most of the next decade will be spent in putting these pieces into full working order in the largest and most affluent libraries and in beginning to provide such services in less wealthy environments. Just that, however, is a major step forward, and one that finally begins to address what many have been calling for during the past two decades—libraries that are oriented to the future rather than to the past.

In fact, it would be more precise to say that the goal is libraries that are oriented to both the past and the future. The collections developed by libraries over the years are reflections of our culture; they cannot be swiftly put aside, and by no means is all information available electronically through some new information technology. Instead of putting aside one approach to information and replacing it with another, libraries must add to their responsibilities by providing access to data in computer-readable form. This approach places stress on the budget as well as on staff who must adjust by assuming new information roles.

In addition to funding, implementors of information technologies must deal increasingly with a chaotic environment in which there are few standards and no clear guideposts toward the “true” future answer to present-day problems.

PRODUCTS AND SERVICES THAT BYPASS THE LIBRARY

Inevitably, there will be products, services, and access to information that bypass the library. The minor panic we feel when we think about the future of information technology is really the fear mentioned earlier, namely, that users will find information on their own, without relying on us; that publishers will aim directly at end users, bypassing us; and that we will

become museums rather than active information centers.

Part of this fear is justified and should spur us to action; part of it is unreasonable. After all, it has always been possible for users to seek and find their own information, and publishers and purveyors of information have always had direct contact with their readers or users. Why are we afraid? Because in the age of information technology, we believe that someone might discover that libraries are unnecessary.

ABILITY TO OFFER TRADITIONAL AND INNOVATIVE SERVICES

Often, the impression is that librarians are not willing to take up the challenge to become twenty-first-century information providers and servers. This impression stems in part from the fact that while many libraries have automated the back-room functions, relatively few seem to have begun to plan for a solid transition to an institution that could provide both the traditional and the innovative information service.

The recent experience of Apple with its program called "Apple Library of Tomorrow," in which they awarded Macintosh systems to organizations that qualified with the best proposals, demonstrates that the popular impression is far from accurate. Apple expected to receive 250 or 300 proposals; they received 1300 in competition for the twelve systems to be awarded. They were stunned by the numbers, which reflected a large number of good, solid proposals and ideas.

If this response is an indication of people's thinking and planning, then the fault in the system does not lie with lack of imagination or creativity among the librarians.

FISCAL UNCERTAINTY

Rather, it is a fiscal matter. The question is not one of replacing one type of service system with another, but instead of adding on to an already burdensome budget. Thus, libraries are finding it increasingly difficult to find resources to make the next leap, from the library-oriented informa-

tion technologies to the user-oriented information technologies.

Typically, a library that is a user of a bibliographic utility such as OCLC or RLIN, and has invested in its own local circulation system/online catalog, will have asked its parent institution to devote unusually high levels of funding toward these efforts. Some situations are made worse by a decision maker's belief that automation would ultimately save money, a hope that can only be borne out in relative terms, not in absolute dollars spent. With a history of this kind of expenditure, librarians may be less than successful in persuading the powers that be to invest in the next major step toward full implementation of information technology.

The image of the library in the eyes of user and funder alike tends to be consistent: libraries are good, many people need them, "our library" should minimize its costs by taking advantage of as many resource-sharing programs as possible, and "my material" should be on the shelf whenever I need it. A persistent problem can be described by the statement that the library is everyone's second priority. Everyone's first priority is his or her primary field of work. But if one assumes that accurate and up-to-date information is an increasingly important requirement for many professions and activities within twentieth century society, it stands to reason that the library or information service may well be everyone's most important support function—after the primary funding needed to get the task done.

In moving the library toward the twenty-first century, the librarian can and should be able to take advantage of the novelty and sparkle of the information technologies. Decision makers at the corporate level want their entire institution to be in the forefront, and if the new services proposed by the library are also desired by the users of the library, a significant barrier can drop. Where automation of cataloging and circulation procedures can make a nonlibrarian's eyes glaze over with boredom, the concepts surrounding the ability to use innovative technologies to access any kind of information located anywhere in the country or the world are

appealing to the visionary instincts of many institutional leaders.

CHANGING SYSTEMS

There are several technological issues that will loom large during the next decade or two for libraries. One that has already begun to be a problem for larger organizations is the obsolescence of the library's "first" system. That is, circulation systems created in-house in the 1960s, or turnkey systems purchased in the early 1970s, while both satisfactory performers, are no longer practical or economical for continued use.

Industry's rule of thumb used to be that a computer system would last about seven years, or at least be amortized in that period of time. In fact, industry often changes systems much more frequently, taking a faster depreciation of the hardware and software. Also, in the last few years there have been such rapid changes that it is unclear if the old rule of thumb can be applied to the real world any longer. Particularly with the entrance of microcomputers and their generations of both hardware and software, bets seem to be off concerning the prediction of a system's lifetime.

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It was only in the 1970s that libraries in large numbers were able to participate in the computer revolution. Only during the past two or three years has much attention been paid to the need to change automated systems and how to go about doing it. In libraries that developed their own systems, the changes and upgrades are fully within their control. Most librarians, however, bought turnkey systems from vendors, and many of these vendors have cleverly managed to persuade the libraries to upgrade over the years to more sophisticated hardware and software—at a price, but not a steep one-time cost.

As not-for-profit institutions, libraries are woefully undercapitalized for coping with major change in the tools that they use. Computers are obviously no exception; in fact, their existence and developmental path demonstrate the inadequacy of library budgets and boards to deal with the concept of continuing change. Change management is essential. The library administrator must not only make appropriate technical decisions, but also ensure that the library keeps on working as smoothly as possible, that staff are comfortable with the change, and that users and members of the community have some understanding of what is taking place.

SPECIFIC TECHNOLOGIES

Specific areas of technological development will be of particular interest during the coming decade and into the twenty-first century. To repeat an earlier generalization: the pace of change in information technologies is far faster than institutions and individuals can easily cope with; the changes are chaotic, with relatively little being truly standardized; the marketplace is offering more, newer, different products every day, and buyers are purchasing whatever appeals to them, often without carefully thinking through the implications of becoming involved with one kind of technology or another.

To become involved with a specific technology is to make a major commitment. Think about the PCs you have bought and then the decisions you made about word processors or database management systems. You may be happy with your decision, but the instant that decision was made you were locked into a situation that made it difficult or impossible for you to share information or move files easily. Ostensibly there are programs that convert from one language, one set of control codes, to another; it is true, nonetheless, that these techniques rarely work as smoothly as advertised.

The analogous problems with mainframes and other kinds of technologies are only more difficult and expensive to deal with. Much of the next decade will be spent in implementing new and interest-

ing applications and taking advantage of higher density storage and more telecommunications. But simultaneously a great deal of time will be spent trying to sort out the problems that arise from a combination of rapidly changing technology and marketplace-based systems.

CD-ROM

Obviously, CD-ROM is a current favorite in terms of developing technologies. Increasingly, information will be made available on some optical medium. However, the process of assimilating this technology into the range of document delivery services is much slower than most ever thought. Remember that we began talking about the potential of optical disk in the mid to late 1970s. Only now, in the late 1980s, are optical disk products available either on 12-inch optical disk or CD-ROM. Most of the products currently on the marketplace are information-locating tools—indexes to periodical and other literature.

Why hasn't the technology moved more rapidly? There are several primary reasons:

1. *Cost.* Despite the fact that optical disk subscriptions may be more economical than online searching for many users, these subscriptions are still beyond the reach of most medium-sized libraries. Also, librarians cannot disregard the impact upon users, who may now be asked to pay in order to access a supplemental online database or to search an optical disk file and print out abstracts.

2. *Lack of standards.* Until recently hardware manufacturers used differing standards. Now the High Sierra standard seems to be making it easier for software publishers to deal with the equipment.

3. *Logistics.* Possibly the most daunting issue for the future is logistics. Now libraries are purchasing standalone dedicated computers, one for each CD-ROM subscription. It does not take long for the finances to become unwieldy, the reference room to become overcrowded, and the patrons to become confused about the lack of interchangeability of workstations. The multiuser, multi-CD-ROM jukebox may present a partial solution. In the course of the next decade, however, on-

line access and the associated telecommunications costs will once more put online electronic access in the forefront of information delivery.

4. *Content of disk.* Even a five-inch CD-ROM contains more than 500 megabytes. This is a lot of information, and publishers are having some difficulty determining logical groupings of information to assemble on a disk.

5. *Graphics and color.* Only now are graphics and color beginning to be available.

6. *User readiness.* Users are not yet ready to move from the printed page exclusively to electronic data.

7. *Validity.* Articles solely in electronic form are not yet perceived as valid contributions in the publish-or-perish cycle; they may not have the same stringent scholarly review and they are not yet trusted by the scholars.

8. *Copyright.* The Copyright Act of 1976 did not address emerging information technologies. The library and publishing communities are attempting with only some degree of success to effect a compromise between the interests of the two groups. The copyright issue will become even more intense as full-text documents are increasingly available in electronic form.

9. *Physical restrictions.* The need to place single-purpose terminals in public areas or to identify exactly what one wants in a jukebox system makes CD-ROM, while appealing in many ways, difficult to work with. Also, tests indicate that the lifetime of data on a CD-ROM disk may be at most ten years.

Online

Recent studies have been conducted, primarily in the United Kingdom, to assess the effectiveness of retrieving information online as opposed to searching other source tools. Surprisingly, researchers are finding that of the various mechanisms available, hardcopy is the most successful tool, with online searching coming in a distant third or fourth.⁸ For various reasons, there will be increasing use of electronic publishing of a wide variety of materials—although not the novel or even

necessarily the article that one wants to read straight through. CD-ROM's current economic advantage will be found to be of limited applicability, and a combination of lower storage costs and better telecommunications structure will refocus our attention on gateways, remote databases, and electronic publishing by the end of this decade.

COPYRIGHT ISSUES

That, of course, brings us to the issue of copyright, a question that is not even close to resolution. The current copyright law can be applied to electronic data, but it requires a juggling act to do it. Publishers—especially traditional print publishers—have determined that whatever is in the computer can be counted. Some publishers are talking about charging for browsing, a scenario that librarians could not easily tolerate. One reasonable approach is to assume that an electronic document belongs to the publisher. That publisher can charge minimal royalty fees for access to the data on a screen; when the data are downloaded or otherwise taken as a separate physical copy, the user can then be charged, just as though the copy were purchased from a store.

This issue will take a long time to sort itself out. We will be dealing with questions of copyright and fairness, and fair use, well into the twenty-first century.

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TELECOMMUNICATIONS

Standards

The problems of standards as they relate to computers apply with a vengeance in the area of telecommunications. For example, with the Linked Systems Project the library community has been able to come to some agreement about what needs to be done and how it should be accomplished, and in fact has made major strides in

achieving these goals.

The problem arises when we wish to communicate, or network, with other pieces of the world. For example, the university library system really needs to be a part of the university's local area network and needs to be able to provide access for users to remote databases in their fields. However, most academic installations use a different telecommunications standard: TCP/IP. Now it is necessary to link an OSI system (as defined by the Linked Systems Project) with a TCP/IP system. Although academic computing centers will indicate that TCP/IP will be supplanted by OSI, there is no evidence of movement in that direction. The only reason for organizations successfully running on TCP/IP to change is if there is some external force, usually in the form of regulations or money or both, to cause such a change.

Gore Bill

In the last session of Congress, Senator Gore introduced a bill in which he proposed to establish an information highway system for the country, just as his father had introduced legislation for the interstate highway system.

If Gore reintroduces his bill in the 101st Congress and it passes, it stands a good chance of being one of the forces that would create standardization in telecommunications. Gore envisions a nationwide system that would allow researchers and educators to communicate using supercomputers as large nodes and all other kinds of computers as lesser nodes on the network. As can be imagined, EDUCOM is very interested in this bill, wants to support it, and has met with LC's Network Advisory Committee to state its position and attempt to draw support from the library field.

Except for the fact that the proposed costs are immense, the Gore bill could be a fascinating solution to the telecommunications standards question.

RELATIONSHIP BETWEEN LIBRARIES AND COMPUTER CENTERS

One of the possible focuses of change in the next decade revolves around the rela-

tionship between the library and the computing center. On the one hand, organizations change slowly, especially universities. On the other hand, there seems to be a moderate amount of movement toward the establishment of "information czar" positions, not only within universities but elsewhere. The business of information resource management is drawing much attention within the government. Information resource management pulls together telecommunications, administrative records, computing, and almost everything one can think of in the way of information except libraries and archives. Some additional movement will occur in this area, but the inherent conservatism of large institutions will prevent wholesale change toward the merging of libraries and computing centers. In addition, librarians are beginning to learn that such a combination is not necessarily advantageous; in many instances they are making good cases to their administrations for remaining separate.

LOCAL SYSTEMS AND NETWORKS

Clearly within our control is the library's use of local systems, and it is unlikely that there will be major surprises in the coming years. There are successful local integrated systems; there are local systems that have failed or are failing. We will continue to be provided with a wide variety of choices of hardware, software, and all sizes and types of systems for all sizes and types of libraries. Local public access catalogs may become the primary focus of CD-ROM production for libraries. The bottom line is that the primary functions that librarians wanted in a local integrated system have been provided in several different kinds of products. This means that the goal stated by Bill Axford at Florida Atlantic University 25 years ago has been reached!⁹ The task for the individual institution is to determine its own needs, weigh the various products on the market, make its decision, and work within that structure.

Within the next few years, however, the need to link local systems to other local systems, bibliographic utilities, and re-

mote databases will become critical. The most valuable task that librarians can perform is to ensure that the local systems they specify and purchase have the capability of using OSI protocols to communicate outside the institution. At the present time, this goal generates lip service but very little action. Action, however, is needed, and librarians control the dollars that will finally cause vendors to produce the desired product.

TELEFACSIMILE

The surprise of the year has been telefacsimile. It is almost a matter of "now you don't see it, now you do." A few years ago the author purchased telefax machines for the libraries at Johns Hopkins University, only to find that there were relatively few institutions to communicate with. Even at Hopkins, people were not thrilled with the process or the output.

A major change has occurred in just twelve or eighteen months. Many of us have become dependent on telefax; now we are routinely putting people's telefax numbers alongside their telephone numbers. The technology is inexpensive, the process is much faster than it used to be, and the functionality of the more sophisticated fax machines is appealing. The group IV machines promise even more improvements. This is a simple case of combining several convenient technologies to create an extremely useful product. What will the decade bring? Certainly the ability to copy from books without first photocopying the pages. Probably faster and better quality output, and more management information.

IMAGE OF THE LIBRARY

One objective for librarians in the coming decade is to retain the image of motherhood and apple pie, but to add a modern and functional twist to ensure that potential users become actual users, traditional users are not frightened away, and funders perceive the value of the library's functions to their institutions.

Using innovative information technology wisely and carefully is one way to meet this objective. As information technologies become more widely available, li-

braries must adopt them. In no case can they replace the traditional functions of the library; the new information technologies are an add-on costing more in time, staff, and equipment, but the value will be considerable. Otherwise, library users will spend those same dollars elsewhere, getting the same products but from a different source.

Librarians cannot become so carried away by information technologies that they are far ahead of their users. That is another good way to lose users. Librarians must remember the influence that changing generations will have on library services. Right now, the adults in our libraries grew up with books. Ten years from now, the adults will have grown up with computer games and computers in school labs. The entire environment and receptivity, and expectations, will have changed. We may remain the same, but our users will not.

INFORMATION POLICIES

The government is responsible, directly or indirectly, for many of the changes we see in our lives and in our institutions. The Paperwork Reduction Act, the Copyright Act of 1976, the Freedom of Information Act, the MARC format, communications regulations, and the General Agreement on Trade and Tariffs (GATT) are only a

few of a vast and almost undecipherable set of information policies that make up our country's information policy. Within the next decade we will have either the reauthorization of LSCA or a new Library Improvement Act, the Gore bill, the reauthorization in some form of the Paperwork Reduction Act, reexamination of the Government Printing Office and its role, and unquestionably a rethinking of intellectual property issues.

These represent mammoth policy issues. They are at once daunting, challenging, and fun. Librarians should be in a good situation to look at them carefully and have a major impact in those areas that relate particularly to libraries, because it is expected that early in the 1990s there will be a second White House Conference on Library and Information Services (WH-CLIS). At the first WHCLIS, technology was discussed; at the second, we will be able to approach earlier issues with the wisdom gained through experience and to make a real difference for the future. All librarians should become participants in this process in which librarians and information professionals of the country put on a major conference for users, elected officials, and taxpayers. Discussions held and decisions arrived at in that forum are likely to have a pervasive impact well into the twenty-first century.

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