Administering Archival Automation: Development of In-House Systems

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Abstract: For many archivists, the best route to an automated information system may be through use of their home institutions' central computing facilities. These in-house systems can be custom-designed to meet local needs and can be relatively inexpensive. This article will focus on the planning, implementation, and maintenance of in-house automated access systems for archives. The article's management focus will have a broad application to those pursuing other routes to archival automation.

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An abbreviated version of this article was presented at the 47th annual meeting of the Society of American Archivists, 8 October 1983, in Minneapolis, Minnesota.

ARCHIVISTS AND MANUSCRIPT CURATORS are in the business of managing information. One of the profession's fundamental challenges is the development of fast and precise information retrieval systems to meet basic program goals. Such systems must be able to provide researchers with answers to their questions, document the archives' past progress and future needs, facilitate appraisal, and support other archival functions. All this should occur without impeding other program activities such as acquisitions, conservation, and outreach. Thus, the archivist's success as an information professional is dependent on the quality of the archives' own information system.

Many of these services and administrative needs can be met by computer-based information systems. While such systems have been used widely in business, government, and libraries for several years, archivists have been cautious in adopting automated access systems because of concerns about cost, obsolescence of software and hardware, incompatibility of systems, and professional disagreements over priorities. With recent developments in the archival profession and in computer technology, many archivists have begun to study computer software, hardware, and networks as they move to automate their repositories.

In the process, archivists have discovered that their primary information needs are quite different from those of business, government, and libraries, where volume and similarity of transactions argue for sharing software and/or data. Some management needs (e.g., budgeting, staff schedules, supply inventories, and form letters) can be met by packaged systems already developed for other users. The model of library automation has been instructive but not particularly adaptable to archival needs. Library systems are focused primarily on the circulation of books and exchange of repetitive cataloging information.

Thus, archivists have found that their core information retrieval needs can best be met by systems designed specifically to maintain information and produce reports on accessions, processing, records scheduling, user statistics, and subject content of collections. Because the content and format of archival descriptive systems vary from repository to repository, and because each repository has different priorities, independent development of automated systems has been a common response.

The administrative mechanisms that have allowed the development of these diverse systems can be divided into four basic structural environments: 1) participation in national systems and databases—primarily OCLC for manuscripts and the Research Library Group's new format for archives and manuscripts; 2) acquisition of utility, or off-the-shelf, software (e.g., SPINDEX, SELGEM, or microcomputer-based programs) for use on local machines; 3) purchase or lease of stand-alone computers (primarily microcomputers) for the sole use of the archival or manuscript repository. (This approach normally involves development of software by the archives staff); and 4) development of archival automation through use of equipment, software, and systems personnel located in the computing center of the archives' home institution. In this last approach, the archives becomes one of several units that use a central, mainframe computer and support personnel on a time-sharing basis.

To these four structural environments, one should add a fifth which would be a mixture of two or more of the basic approaches. In fact, the literature on archival automation suggests that the "mixed structural environment" may be

the most common.[1] This article, however, will refer to these categories in their pure or unmixed form.

The first three approaches—national systems, off-the-shelf software, and microcomputers—have received considerable attention in recent issues of professional journals and in the programs of recent meetings. The fourth approach—local development through time-sharing facilities—has been neglected; however, this approach, which we will call "in-house automation,"[2] is an effective way to meet diverse needs of archival managers.

The major advantages of in-house automated systems are threefold. First, the archives can obtain an information system custom-tailored to meet locally determined priorities. Second, when archivists can obtain access to the computer center's equipment and personnel, they need not worry about purchasing and updating their own equipment or about learning computer programming themselves. Third, the entry-level costs, especially for major equipment and software, often can be kept to a minimum.

In-house automation has been successful at academic, business, governmental, and museum archives, including those at the University of Illinois, the University of South Dakota, the Illinois State Archives, Deere and Company, and the Smithsonian Institution. These and other repositories have found that their information storage and retrieval needs can be met by working with their home institution's central computing offices to develop programs and obtain access to equipment.

This situation exists because many archives are part of large institutions—universities, state government, research or museum facilities, and businesses—which have substantial automated data processing (ADP) departments to meet core institutional needs. These ADP departments often are centralized bureaus established to aid large numbers of diverse departments. For example, the University of Illinois's Office of Administrative Information Systems and Services serves the business, admissions, institutional research, and financial aid offices. To meet these needs, the office employs about 100 individuals and purchases and maintains major computer hardware, peripherals, and software. The University of Illinois's Archives benefits tremendously from being part of an institution that maintains such facilities and employs personnel the archives could not afford on its own. Similarly, the Illinois State Archives has developed its automated system using equipment and personnel from the Data Processing Department of the Secretary of State's office. The Illinois State Archives is a relatively small user of a large facility established primarily to handle automobile, driver, and corporation registrations.[3]

[1]The literature on automated techniques for archives is growing rapidly. In addition to the *American Archivist*, two valuable sources for monitoring current developments are: *SAA Newsletter* and *SUN: Newsletter of the Spindex Users Network*. For discussions of the theoretical problems of automation, and step-by-step guides to analysis and planning of systems, see: H. Thomas Hickerson, *Archives & Manuscripts: An Introduction to Automated Access*, SAA Basic Manual Series (Chicago: Society of American Archivists, 1981); Lawrence J. McCrank, ed., *Automating the Archives: Issues and Problems in Computer Applications* (White Plains, N.Y.: Knowledge Industry Publications,1981); David Bearman, "Automated Access to Archival Information: Assessing Systems," *American Archivist* 42 (April 1979): 179-90; Richard M. Kesner, comp., *Information Management, Machine-Readable Records, and Administration: An Annotated Bibliography* (Chicago: Society of American Archivists, 1983).

[2]The term "in-house automation" could also be applied to locally developed systems based on a microcomputer. For purposes of brevity, however, this article will use the term exclusively for locally developed systems based on time-sharing, mainframe computers.

[3]"On-line Subject Access," *For the Record . . . Newsletter of the Illinois State Archives* (Winter 1984): 2-3. See also "System NEBO," Ibid. (Spring 1982): 1, 3.

The essential characteristic of these in-house systems is that the archives' automation is not a primary or major user of the computing office's facilities and services.

Case Study: University of Illinois

Work on the University of Illinois Archives system, PARADIGM, began in the late 1960s, and the first application was completed in 1971. The system has been developed to provide administrative and intellectual or subject control of holdings. Data are entered on-line by archives personnel into the university's central administrative computer (an IBM 3081 with 370 operating system). Printouts of files are used for inventory control and analysis of subject descriptors. Programs written by personnel from the computer center produce both statistical tables on size of holdings and printouts (or Computer Output Microfiche), which serve as subject indexes and guides to archival holdings.

PARADIGM's development has been gradual. The first programs were written to produce statistical tabulations on the volume of holdings. Programs for subject indexing were added three years later. At that time, there were strict limits on the number of subject terms that could be assigned to a record series or manuscript collection; also, only about one-third of processed record series were indexed. Later, as subject indexes proved their value and as staff experience with the system increased, programs were revised to eliminate the limits. Meanwhile, with the assistance of a grant from the National Endowment for the Humanities, the archives extended PARADIGM to provide analogous control over the American Library Association Archives and to develop a national union catalog of manuscript and archival sources for the history of librarianship at other institutions.

Experience with PARADIGM has demonstrated several advantages of using in-house time-sharing facilities for archival automation. The need for the archives staff to have ADP training or experience has not been crucial because we have been able to rely on computer center personnel for programming. When it is necessary to make changes, we can return to the progammers and obtain the benefit of their broad experience. Few archives can afford permanent ADP staff, but central computing facilities often will provide access to the requisite expertise on demand. In sharing a large computer and programming staff with the rest of the university, the archives has access to sophisticated hardware and software and to trained personnel.

At the University of Illinois, use of shared equipment and the initially limited scope of the automated system enabled us to keep start-up costs low, approximately $350 in supplies and computer costs from 1968 to 1974. Thus, we minimized the risk of over-investing in an automated system that might not have accomplished all that was promised. This approach made the development of an automated system eminently feasible for a shop that is small in both budget and staff.

Thus, a major advantage of in-house automation can be its low cost. The archives may not need to purchase any hardware or software at the outset. If data entry equipment can be borrowed or shared, initial expenses can be limited to programming time and data entry costs. In many situations, computer time may be obtained for little or no cost from an institutional computing facility if the archives' work can be fit into the system's slack times. Moreover, institutional accounting procedures often include special, low-price schedules for internal users, or may make charges in a way that will not directly affect the rest of the archives' program budget.

At the University of Illinois, these conditions permit us to perform on-line data entry and searching without direct charges; a small charge is made when we order output directly from the computer. Somewhat larger charges are made when we run off-line programs to generate statistical tables or produce guides and subject indexes to holdings. In the past year, annual report statistical programs cost about $30, and program runs to produce a guide and subject index to 3,600 series in the archives cost about $50. Substantially higher charges have been made for writing and revising programs, but most program changes (except those related to the 1976 conversion from PL1 to COBOL, when we went from punched cards to on-line) have cost less than $300. Over the past three years, data entry, storage, printouts, and program runs have averaged $600 per year.[4]

The University of Illinois system has been developed with local resources to meet local priorities, but it has not evolved in isolation. Developments in computer hardware and software, library automation, and the archival profession have been monitored closely and incorporated into system changes where possible and necessary. Through operation of the system and analysis of its relation to both national trends and local needs, we have learned a great deal about automated information systems for archives. A review of this experience in three areas —planning automation; development, implementation, and maintenance; and liabilities and limitations—will be of value to any archivist interested in archival automation, even if the in-house, time-sharing model seems to be inappropriate to the circumstances of a particular archives.

Planning Automation

Because institutional circumstances vary, the first step in planning for any archival automation, in-house or otherwise, is to conduct a feasibility study to examine the condition and needs of the archives, as well as the parent institution's automation resources. A careful and thorough feasibility study will require a modest investment of staff time, but it is absolutely essential if the resultant decision is to be both feasible and appropriate to the repository's needs. The structure of the study, however, should be kept simple. Archives staff should be fully capable of coordinating it with a minimum of outside assistance.

The most important component of the feasibility study is a self-study of the archives. This should be a systematic analysis leading to a summary report on the condition of the archival program and its needs and resources for developing an automated information system.

It should begin with an analysis of the condition of the archives. While automation can be a tremendous aid in broad areas of archival work, it cannot remedy program deficiencies resulting from inadequate support or weak management. Therefore, an honest assessment of how well the archives is presently meeting its goals in acquisitions, processing, conservation, reference service, publicity, and records management will provide the basis for a sound decision on whether to proceed with automation. For example, an archives with a large processing backlog would be ill-advised to embark on a time-consuming automation project to create repository-wide subject indexes. Likewise, archives with insufficient staff

[4]These cost figures are provided for rough comparison only. While attention often focuses on the cost of programming and machine time, the far greater expense of automation is that of archives' personnel time needed for planning, coding, data entry, and system maintenance. Use of inexpensive labor (i.e., students) has kept these costs to a minimum, but they still can run as much as six to seven times greater than computer costs.

to handle their reference load should avoid committing personnel resources to a system for administrative and statistical reports.

Once the archives has determined how well it is doing its job and how staff time is being spent, it must establish and articulate exactly what it wants the automated system to produce. The traditional division between administrative reports and intellectual control tools is a useful one. Archivists must determine where their information needs are the greatest and which needs are most amenable to automated systems. At the University of Illinois, the initial product was a program to produce inventory lists and analytical statistical tables on the number and volume of holdings for annual reports. At the same time, however, we began planning for a repository-wide subject index to improve intellectual control over holdings and enhance service to patrons.

While PARADIGM had its origins in the need for administrative reports, most modifications made from 1974 to 1983 were designed specifically to improve intellectual control. In 1980–81, administrative needs dictated further system development to provide statistical reports and record-series-level control over all files listed on the records disposal authorizations which the archives prepares for university offices. In the near future, we plan to meet another administrative need—shelf location information and tabulations—through further revisions of the PARADIGM system. Thus, before an archives embarks on planning a system, it must develop a carefully defined list of desired products.

In addition, archivists are well advised to begin with modest goals and then expand the list of desired products after the system becomes operational in the initial areas. Efforts to design an all-encompassing system to produce statistics, subject indexes, shelf locators, and text processing are likely to overload the system or overwhelm the archivist before tangible benefits are received.

Finally, the self-study should ask why the archives wants to automate. Is it to gain prestige, to join in a general trend to computerize, to satisfy an administrative superior, or to improve service? Often a combination of factors will be present, but archivists should focus solely on the question of what automation can do for the archives: can it simplify tasks now being performed manually, or can it do something not currently possible, such as repository-wide subject indexing?

If automation plans can be reconciled with program needs and resources, the self-study should analyze the existing manual information systems. If one is automating intellectual control, how consistent is the manual descriptive system? Is there a common level at which all series or collections are described? Does this common descriptive tool provide valuable information that facilitates research access? How do collection inventories relate to series descriptions or subject indexes? Inconsistencies in descriptive terms, numbering schemes, or naming conventions that may coexist quite happily in manual systems can cause endless problems in writing and implementing computer programs. For example, the manual system at the University of Illinois used a carefully developed notational system for assigning numbers to each record series; however, there could be as few as three or as many as five fields in a given record series number. This seemingly minor problem ultimately required both the renumbering of many series and a considerable amount of programming to accommodate these inconsistencies. Computers do not easily digest nonconformity.

An important element in the self-study is an analysis of the archives' staff

resources. How many staff hours can be devoted to the planning, implementation, and maintenance of an automated system? If additional staff cannot be added, the self-study should suggest which program activities and staff functions can be modified or de-emphasized to permit development of the automated system. Despite claims made by the information industry asserting that automated systems can save labor and increase productivity, experience shows that they often create new or additional work. In the best circumstances, however, the automated system will produce benefits that outweigh the necessary work. As archivists analyze their staff resources, they should also consider whether present staff members have the appropriate background, training, and attitude for automation.

The result of this self-study should be a concise internal planning document outlining the archives' automation needs, present condition, and resources available to conduct the project. The self-study and planning document is essential if the planned automation is to benefit the program rather than create confusion and hinder service. The planning document is crucial as the archives moves to the second stage of the feasibility study: a survey of institutional automation resources.

Thus far, the feasibility study is not substantially different from the study that would be made if the goal were to purchase a microcomputer, acquire off-the-shelf software, or participate in a national network. For archivists interested in in-house automation, however, the survey of the institution's automation resources is essential. The archivist should seek to answer a battery of questions: How many and what type of computers are available? How many and what types of departments have access to these time-sharing computers? What is the storage capacity and response time of the equipment? What devices are available for input (e.g., card readers, optical character scanners, on-line CRT terminals, microcomputer or smart terminals) and output (e.g., high-speed printers, photo composition, Computer Output Microfiche)? Do regular users have problems obtaining access when needed, i.e., is the system overloaded? Are system-wide failures frequent? To limit the impact of failures, what backup and recovery procedures are available? What software packages can be used with the system? What is the size and experience of the programming staff? What are the rate schedules for services, and are the charges for core users different from those for more peripheral users like the archives? Who has authority to grant access to the facility? What is the computer center's institutional mission, and can the archives articulate its needs in terms of this mission?

Definitive and reliable answers to all these questions may be difficult to obtain. In pursuing this informtion, however, the archivist will develop a sense for the computer facility's responsiveness and the kind of working relationship that may be expected. The facility's willingness to answer questions, share information, and listen to the archives' needs probably will provide a better basis for a decision than would specific positive responses to the archivists' questions. Whenever possible, the archivist should review the facility's annual report and other descriptive literature to obtain a basis for intelligent questions and a clear perception of the breadth of services offered.

Archivists lacking experience with computer centers may find it hard to evaluate their responsiveness and ability to meet the archives' needs. At the same time, since most computer facilities have had no experience with archival informa-

tion systems, they may be hard pressed to estimate costs, production schedules, and results. A way around this problem is for the archivist to consult with a number of other low-volume users of the facility. In so doing, one should steer clear of core system users such as accounting, vital records, or statistical analysis bureaus. At the University of Illinois, the experience of the Office of Admissions and Records would not be very instructive, whereas that of smaller part-time users, like the Film Center or Chemical Stores, might be quite relevant. Their information systems will differ from those of the archives, but they can provide insights on questions such as the responsiveness of analysts and programmers, access and response time, system failures, and actual costs. Comments from their experience can assist the archivist in evaluating the information being received from the computer center and determining how well the automated system can be tailored to archival needs.

Once an assessment of available computing resources is completed, the results should be combined with the archives' self-study exercise to provide the basis for a decision. The information gained from the feasibility study should be compared to information about microcomputers, off-the-shelf software, or national information systems, and then should be related to local needs. The archivist then must decide which system best meets these needs and which is most feasible in his or her institutional setting. In some cases, where local computing facilities are inaccessible, overworked, poorly managed, or unresponsive, participation in a national system or purchase of software and/or a microcomputer may be the best way to automate the archives. In other instances, where local facilities have strong software and hardware, a commitment to service, and equipment that may be borrowed at the project's start, in-house automation may be the most feasible way to meet local needs.

Development, Implementation, and Maintenance

At the point of development, implementation, and maintenance, the challenges and opportunities unique to in-house automation become apparent. The in-house automator now must take great initiative to insure satisfactory development of a system custom-tailored to archival needs. Hitherto, most activities associated with the feasibility study differ little from the analysis that is prerequisite for any kind of automation. The prospective participant in OCLC or RLIN, for example, also should examine closely the archives' information needs and the status of its manual information systems before deciding on these networks.

Successful automation requires that archival operations be well organized in the first place. Before programming and data entry can begin, the existing systems will have to be analyzed, and a method will have to be developed to reconcile inconsistencies and develop input procedures. While automation can be used to solve problems in existing systems, it works best when there is a functioning manual system that merely needs to be converted to an automated one.

At the same time, if the goal is to create an automated system to carry out a task that has never been done before, or a task that has been done poorly or inconsistently, it is crucial to think through the problem carefully and completely. Before approaching a systems analyst, the archivist should prepare a careful statement of the desired output, a description of information in the manual system, and suggestions on how this information can be put into the automated system. Quality control of input data is essential if an automated system is to function and produce usable information. The archivist will have to establish forms and procedures so that input can be monitored

and rechecked as problems develop.

Perhaps the greatest challenge of in-house automation is maintaining successful working relations with systems analysts and programmers. Even when automation personnel are competent and responsive, it is the archives staff that bears the greater burden for insuring that archival needs are addressed. The archivist must articulate needs carefully and explain existing and desired systems. Most important, while the archivist can and should suggest ways of coding information or output formats, he or she should analyze requests and proposals continually to make sure the system is not being constrained by them. At the University of Illinois, we have learned not to second-guess programmers by proposing solutions to computer problems. Rather, it is best to describe the problem, or the desired output, clearly and then let the programmer develop a solution.

Dealing effectively with ADP personnel also requires that requests be written in terms assuming no knowledge of archival principles or practice. The competent systems analyst generally will inquire about the archives' operations so that the resultant system will be matched to needs and resources. At the same time, archivists must appreciate that seemingly simple program changes can be very involved, while others that appear to be too expensive or difficult (e.g., addition of another field to indicate conservation status or shelf location) often are rather easy. The best approach is to avoid preconceptions and to request exactly what is desired. Once a programmer has this information, he or she is best suited to comment on feasibility and cost. Then, as test runs are made and sample output is provided, archivists should scrutinize the results closely to insure that all expectations are being met. If there are gaps in communication between archivists and programmers, they are best resolved at this stage.

A key to success in developing in-house systems is to keep programming requests reasonable. Care should be taken to avoid overloading the system with excessive amounts of information. Automation enthusiasts will stress the idea that an information system can be designed to include all types of data on an archives' holdings and operations and that it is best to enter or convert data only once. This may be true, but it is not always realistic. It assumes that all data elements are of equal value, requires the forecasting of all possible information needs, and suggests that the advantages of automation should be foregone until all needs can be met.

Instead, the archivist should review carefully the operation to be automated and determine what information is essential to meet immediate needs. While adding further coding and categories of information later in the process will require additional conversion/entry projects, it is often preferable to focus on the essential first, rather than attempt to create a comprehensive information system *ex nihilo*.

By beginning with a limited project and perfecting it before moving to automate more functions, the University of Illinois Archives has taken advantage of one of the most attractive features of in-house automation—its ability to grow with the archives' changing needs and increasing ability to handle automated information systems. Since PARADIGM was installed in 1971, each biennium has seen additions to its capabilities. Rather than beginning with a complete system, we have attempted to master the system's design and output and locate its defects before proposing revisions and additions.

In-house automation using time-sharing facilities is particularly amenable to this evolutionary approach. Other institutional work keeps the computer center personnel occupied for the time the archives does not need them (more than 90 percent of the time), but when

new archival systems are desired, the staff and expertise are readily available. Meanwhile, the computer center staff has sharpened its skills through work on projects for other units, additional training, and continuing education.

Concurrently, the institution may improve its software and hardware. In the past five years alone, the PARADIGM system has been enhanced through the University of Illinois's purchase of new or updated on-line editing and database management software and new equipment such as large telecommunication processors, page printers, and Computer Output Microfiche machines. These improvements in personnel, software, and hardware represent a major advantage of the use of in-house central computing facilities. The archives has not had to expend its limited funds to obtain improvements that substantially benefit our operations.

An important related aspect of in-house systems is that most central computing offices have a wide variety of software packages available for users. Often programmers will specialize in certain types of software; development of an archives' information system could thus involve a number of specialists in different computer languages. For example, in 1980 we encountered an indexing problem not easily solvable by the COBOL used for most of our programs. Our analyst then consulted with MARK IV specialists to develop a program to remedy the problem. Reliance on several specialists can present additional communications problems; but no single programmer can know all the possibilities available in each of the software packages handled by the computer center. Moreover, communication problems can be minimized if the archives prepares clearly written statements of desired products and then diligently, but flexibly, insists that these needs be met.

Liabilities and Limitations

It would be unrealistic to expect that all institutional computing facilities be this responsive to users' needs, or to deny that we have had problems with development and communication. A brief outline of our problems will help establish the context for our overall satisfaction.

An inherent liability of using a time-sharing central computer is that access to the computer, input/output devices, and personnel must be shared with other users. Because the archives is not a high-priority user, we may have to wait for a dial-up connection, revision of a program, or production of a Computer Output Microfiche guide. This limitation has been most troubling during major developmental stages of PARADIGM, when we needed to enter large quantities of data. We have coped with this problem by surveying work and planning ahead to provide enough lead time to compensate for programming delays, and we have scheduled data entry for low-use times.

Perhaps the most serious limitation is that in-house automation involves the use of programmers, software, and hardware not specifically trained or developed for archival applications. The danger is that the archival system's characteristics could be determined more by the computer facility's limitations and the analyst/ programmer's time, interest, and initiative than by the needs of the archivist. Many computer facilities have little inherent understanding of archives and may not perceive archival needs clearly or appreciate the professional practices that lead archivists to request certain features in an automated system. Our analyst recently questioned the necessity of revising a program to accommodate more than 100 subject descriptors for a given collection. She noted that because only a few collections had that many descriptors, the revision would require a lot of work for an apparently small benefit. To

archivists, the need for the revision was obvious.

These and other limitations show that we cannot say in-house automation is the ideal system. The ideal might be a national automated system designed by archivists and computer personnel to meet all the needs of archivists, while still being operable in several different computers throughout the country, and flexible enough for each archives to select only those features needed locally without precluding the possibility of exchanging data. This is an admirable goal, but one that may not be realized for several years. Meanwhile, the difficulties of having in-house automated systems designed by personnel unfamiliar with archives can be minimized if archivists make their needs and practices clearly known. For example, once the archives decided that the 100-subject descriptor limit was artificial and unacceptable, we communicated this to the analyst, who then cooperated fully. This situation highlights the importance of planning documents that clearly articulate needs based on a careful self-analysis of archival operations.

A related liability of in-house automation is that software and hardware may not be compatible with the software and hardware of other institutions or those developed nationally. Nevertheless, there are several reasons why archivists should not delay automation while waiting for development of *the* national system. First, a large number of archival information needs do not require, or lend themselves to, national exchange of data about archival holdings. Second, extant or future national systems might not meet local information needs as well as an in-house system developed specifically for those needs. Third, if one has immediate automation needs and good in-house facilities, one should take advantage of the opportunity and proceed.

Fortunately, archivists may not be faced with the hard choice between a national or a local system. Several recent developments should facilitate the design of local systems that are compatible with other systems. These developments include: completion of the work of the Society of American Archivists' National Information Systems Task Force, establishment of SAA's Committee on Archival Information Exchange, work on a MARC format for archives and manuscripts, and the related pilot projects of the Research Library Group.[5] The resultant data element dictionaries and field format documents represent variations on a basic list of standard data elements for description of archives and manuscripts. These documents can provide a common vocabulary around which both national and in-house systems can be built. If individual archivists consult these documents when planning local automation, the resultant systems should be able to meet local needs while not precluding future national exchange networks.

In considering the limitations of in-house systems, one should also review the advantages of national systems, off-the-shelf software, and microcomputers. National systems and off-the-shelf software often have been designed with substantial participation by archivists; they are structured around archival needs, and they hold the promise of national exchange of data on holdings. The microcomputer, with its relatively low price, prepackaged software, flexibility, and independence

[5]Charles G. Palm, "Prospects for Archival Information Exchange: NISTF Conference Report," *American Archivist* 47 (Spring 1984): 205–13; *SAA Newsletter* (November 1982): 2; (May 1983): 8; (March 1984): 10. See also: "Yale, Cornell and Stanford Awarded Grant for Development of RLG . . .," *American Archivist* 46 (Fall 1983): 477–80; and David Bearman, "Toward National Information Systems for Archives and Manuscript Repositories," *American Archivist* 45 (Winter 1982): 53–56.

from the constraints of time-sharing, also has important advantages.[6] Any well administered archival program should monitor developments in all three types of automation and make changes as new opportunities develop.

At the University of Illinois, for example, a microcomputer was installed in 1983 to meet information needs not previously addressed by our mainframe-based system. We doubt that it will replace the mainframe, but we envisage an integrated system emphasizing specialization of the two machines for those tasks each does best. For example, the microcomputer is more accessible and has better word-processing software, while the mainframe has more powerful searching and greater storage. Thus, we may use the microcomputer to enter data on diskettes and then copy these diskettes into the mainframe's storage.

The ability to link microcomputers and mainframes points to the fact that the four-part division (national systems, utility software, microcomputers, and in-house time-sharing systems) is not hard and fast. Microcomputers can be used as "smart" terminals and auxiliary data entry devices for mainframe-based systems. They also can provide more adaptable software to address needs not readily met by large central computers. In fact, our ADP office encourages new users to consider integrated micro/mainframe systems. Meanwhile, archivists using off-the-shelf software such as SPINDEX have found that close relations with local computer facilities are essential for effective utilization of the system.[7] The possibility of mixing local mainframes, national systems, and microcomputers makes it imperative that archivists regard use of their home institution's computing facilities as a viable way of meeting their information needs.

Conclusion

In-house automation using central computing facilities merits serious consideration, especially in the context of national developments such as the completion of NISTF's work, subsequent work with RLG and the MARC format, and the proliferation of microcomputers. It does not offer the interdependence of a national system or the independence of a microcomputer—two trends that should not be ignored. In-house systems, such as that of the University of Illinois, however, offer advantages that must be considered seriously by all archivists interested in automation. Such systems can be phased in gradually, can be designed to meet local needs, often can be developed for only a small initial investment, can permit borrowing of equipment and personnel in the beginning stages until the system has been proved, can provide archivists who have little knowledge of computers with an introduction to automation by putting them in contact with local specialists, and can provide a basis for national developments.

PARADIGM might not fit the needs of other archives, and other archives might find it inappropriate to develop systems along the same administrative lines as we have followed. Nevertheless, this model of negotiating for use of a home institution's computer and personnel is useful. If the institutional situation

[6]Those planning acquisition of a microcomputer should consult the growing literature in this area. A particularly useful article is Robert M. Mason, "Current and Future Microcomputer Capabilities: Selecting the Hardware," *Microcomputers for Information Management* 1 (1984): 1–13.

[7]The reports of the SPINDEX user conferences (e.g., those in 1978 at Cornell and in 1980 at South Carolina State Archives) are replete with accounts of local modifications. H. Thomas Hickerson, ed., *SPINDEX Users Conference: Proceedings of a Meeting Held at Cornell University* (Ithaca, N.Y.: Cornell University Libraries, 1979). Steven Gietschier, ed., *Proceedings of the First Special Meeting of the SPINDEX Users Network, March 24–25, 1980.*

is appropriate, archivists would be well advised to take advantage of the opportunity for a locally based system tailored specifically to their needs. There are, of course, limitations to using local central computers; but they may be no greater than the limitations of national systems, off-the-shelf software, or microcomputers.

Careful advance planning is needed to ensure that whatever automated system is adopted will serve the archivist. Like any management decision, the choice of an automated information system should be based on a study of its feasibility. One should proceed only if the study finds sufficient need, adequate resources, and a good institutional base. In the process of development, implementation, and maintenance, one must ensure that the system is flexible and is designed around the basic mission of the archival program. Thus, a clear conceptualization of the archives' needs and resources is essential if the resultant system is to be efficient. Without careful planning, the system could become a time-consuming process that does little more than permit the archivist to say the repository is automated.

Regardless of which route to automation is chosen, the key element is planning. Automation should be a response to needs and opportunities manifested in program analysis. In the rush to automate, archivists should be careful to adopt new systems only when this will improve service without unduly disrupting other program activities.