10-1993

The Houston Academy of Medicine--Texas Medical Center Library Management Information System

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The Houston Academy of Medicine–Texas Medical Center Library management information system

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A management information system (MIS) provides a means for collecting, reporting, and analyzing data from all segments of an organization. Such systems are common in business but rare in libraries. The Houston Academy of Medicine–Texas Medical Center Library developed an MIS that operates on a system of networked IBM PCs and Paradox, a commercial database software package. The data collected in the system include monthly reports, client profile information, and data collected at the time of service requests. The MIS assists with enforcement of library policies, ensures that correct information is recorded, and provides reports for library managers. It also can be used to help answer a variety of *ad hoc* questions. Future plans call for the development of an MIS that could be adapted to other libraries' needs, and a decision-support interface that would facilitate access to the data contained in the MIS databases.

INTRODUCTION

While management information systems (MIS) have been in use in the business world for the past three decades, they are less common in libraries. But, given the present convergence of factors affecting libraries, this situation could change.

Within the library, the growing use of technology, increasing costs of materials, and the labor-intensive nature of library services all conspire to increase library costs. At the same time, the explosion in the amount of information published and in online access to it increases the demands for services. And as libraries become more complex, management needs objective, standardized data on which to base decisions [1].

Libraries always have collected data in one form or another. The data will not be well utilized if they are not collected consistently and accurately, if they are not easily accessible to all who need them, or if they are not stored in a manner that readily permits analysis. An MIS can help overcome these problems.

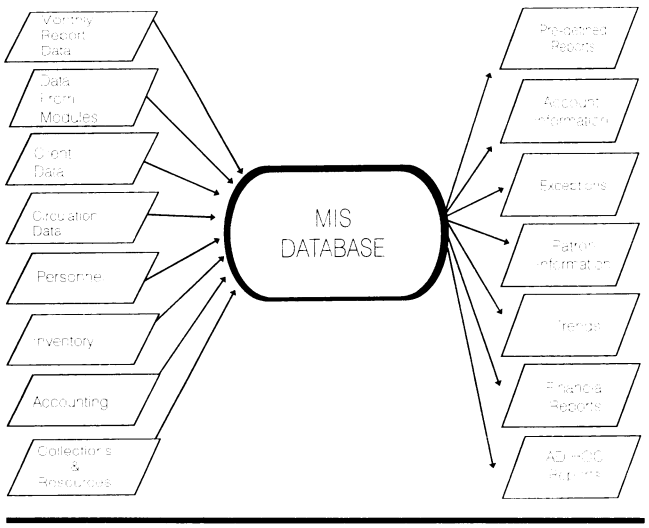
The MIS developed by the Houston Academy of Medicine–Texas Medical Center Library (HAM-TMC) integrates data into a single resource and provides tools to manipulate and analyze the data. This system produces information that is essential to efficient management of the library.

Richard Lyders, executive director of the HAM-TMC Library, wrote the MIS proposal that won a grant from the Hearst Foundation to fund the development of the system. Sanjay Chadha has been the systems analyst and programmer throughout the project. This paper describes the hardware and software needed to run the MIS, the principal features of the MIS project, the sources of data that make up the major MIS resource, the mechanisms by which data are collected, the benefits derived from the system, and future developments now being planned.

OVERVIEW OF THE MIS

To set the stage, a working definition of an MIS may be helpful: "given a multilevel organization having component groups that perform a variety of functions

Figure 1
MIS inputs and outputs



to accomplish a unified objective, an MIS is an integrated structure of data bases and information flow over all levels and components, whereby the collection, transfer, and presentation of information is optimized to meet the needs of the organization" [2]. Certainly a library is such an organization, and the HAM-TMC Library system has been designed to fulfill these functions.

The HAM-TMC Library's MIS is a microcomputer-based system that collects data from a variety of sources in the library and stores them in files that are accessible to all departments. These data can be analyzed and compared to derive useful management information. The MIS contains fifty data tables, and each table has an average of twelve to fifteen data elements. The 600 to 700 total data elements make it possible for the MIS to assist with a wide range of management decisions.

Environment

The HAM-TMC Library is the principal library for the institutions of the Texas Medical Center (TMC). Within the TMC are fourteen hospitals; two medical schools; four schools of nursing; and graduate programs in physical therapy, occupational therapy, nutrition, health care administration, public health, dentistry, allied health, and biomedical sciences. The library also serves the members of the Harris County Medical Society. The total active cardholders number more than 15,000.

Hardware and software

Designed to operate with off-the-shelf hardware and software, the MIS runs on the library's local area network (LAN), which consists of seventy IBM-compatible microcomputers with approximately seventy users. Available on the LAN are electronic mail and software such as WordPerfect, Lotus 1-2-3, SuperCalc, and Paradox.

Paradox, a microcomputer-based relational database product, functions as the MIS engine. It was used to design all the MIS modules that are described in this paper. It also is used to accomplish all the reporting functions and data analyses.

The network server that supports the operations of the MIS is a 40 megahertz, 386 machine with 300 megabytes of storage capacity. The library estimates that the MIS will generate approximately fifty megabytes of data each year.

MIS inputs and outputs

Figure 1 is a simplified illustration of the flow of data in and out of the MIS database. The input includes monthly report data gathered either electronically or manually; data from modules used to record client transactions; data from the library's circulation system; and administrative and support data such as personnel, inventory, and accounting information. All these data are stored electronically and are available for analysis.

As indicated in the output elements of the figure, administrators can use the MIS to prepare reports automatically for their review. These reports might concern important performance indicators such as interlibrary loan turnaround time, exceptions (e.g., to alert the library whenever ILL turnaround is more than seven days), or account information (e.g., outstanding invoices more than forty-five days old). From the managers' point of view, the capability to use MIS data to prepare *ad hoc* reports based on any of the data in the system is one of the system's most revolutionary attributes.

FEATURES OF THE MIS

Apart from the obvious goal of gathering data and providing necessary management information, the library had several other objectives when it began developing the MIS. A key goal was to standardize the data collected and to create a unified system of reporting these data. To do this, all departments were surveyed to determine what data they collected and how each data element was defined. Departments disagreed over even basic definitions such as what constituted a "ready reference question" or a "directional question." These definitions were standardized, and a standard format for all management reports was designed.

The MIS can be visualized as a multilayered system

that consolidates the library's existing systems and information sources. At the heart of the MIS is a transaction processing system, used to record clients' requests for service, to print work forms, and to monitor work flow. The data collected to process these requests become part of the permanent MIS database and an important information resource for library managers.

The MIS also is designed to help enforce library policies consistently and uniformly. For example, only certain categories of cardholders are allowed to charge services to institutional code numbers, and the MIS stops the transaction if an individual in a noneligible category requests such a charge. The MIS warns library staff if a client has overdue materials or owes fines, and, in extreme cases, the MIS enforces a "stop service" policy.

In the future, clients may be able to submit requests directly to the MIS for services such as computer searches, photocopying, or interlibrary loans. At present, the library staff uses the MIS to record the information needed to process service requests. However, a terminal could be made available so that clients could complete the information themselves. That way, clients could request service without coming to the library, even if the library were closed.

The data provided by the MIS are performance measures insofar as they count how often an activity took place. By combining data elements, it is possible to get an idea of the quality of service. For instance, by calculating the ratio of database searches to reruns of searches, the quality of the original work can be inferred. The next step in the development of the MIS is for each department manager to define a set of performance measures that will provide a snapshot of how well the library is functioning.

SOURCES OF MIS DATA

At its most basic level, the MIS can be viewed as a reservoir of data describing the library's clients, resources, and activities. These data enter the system through various means, as follows.

Monthly report data

Monthly report data, which describe the work of individual departments, enter the system through a spreadsheet application called the Monthly Report Generator (MRG). Each department is responsible for gathering these data and recording them in the MRG. Some are recorded electronically, others through the use of hash marks on a piece of paper. The MRG stores the data in the MIS, and automatically compares the data for the current month to the data for the corresponding month of the previous year. A report then is prepared showing percent change in various library activities. Data collected in this manner include the exit count, number of items reshelved, and number of classes taught. Although these data enter the MIS through a spreadsheet application, they are also available for comparison to data that enter through the various Paradox applications. Eventually the transaction processing system is expected to feed the data directly into the MRG.

Client data

Client information (e.g., name, library card number, notices of fines and overdue materials) is downloaded from the library's integrated library system (ILS) each month. Because the MIS and the ILS are not able to share information, outside this periodic procedure, some redundant data entry is required to maintain changes in the client database. Until the two systems can share data more directly, this double-entry system must be maintained.

Administrative and support modules

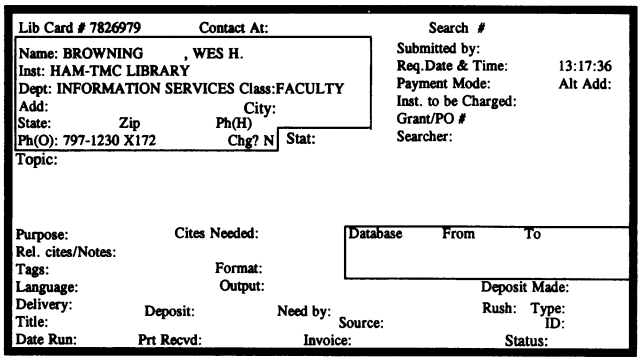
These modules include a Serials Module, Personnel Module, Inventory Module, and the Lost Materials Module. The Serials Module contains the titles of all serials received by the library, ISSN numbers, vendor information, and invoice information. Much of this data, especially invoice information, is provided in machine-readable format by vendors and is loaded directly into the MIS. It is useful for budgeting purposes as well as collection development decisions. The Inventory Module includes information such as date of purchase and cost for all items owned by the library, except for books and journals. The Personnel Module includes information about employees such as date hired, pay grade, and work schedule. It does not contain copies of annual reviews or other confidential materials. The Lost Materials Module, which at this writing had yet to be implemented, will provide information about types of materials that often are declared lost and the cost of replacing these items. All data contained in these modules, except that in the Serials Module, are entered by library staff.

Service modules

HAM-TMC Library service modules are the final source of MIS data. The service modules are data-entry screens designed to replace paper forms that had been used to record requests for services. These modules record transactions, ensure uniform implementation of library policies, and generate work-forms. They are primary sources of data regarding the work of the library.

The service modules include the Circulation Module, used to record changes in client data and to han-

Figure 2
MIS Search Request Module



dle monetary transactions; the Accounting Module, which receives notices of monetary transactions from other modules and generates invoices; the Desk Log, which records transactions at the library's information desk; the Search Module, used by information services librarians to record a computer literature search interview and to generate a workform; the Search Log, which is used to log information about the search, including cost and databases accessed; and the Photocopy and Interlibrary Loan Modules, used to record requests and to generate workforms.

Library staff members record data in these modules at the time a client requests library service and update the information when the service is completed.

HOW A MODULE WORKS

To gain some understanding of the scope of the data that can be collected by the service modules, it is useful to look closely at one of them. The Search Module is a good example (Figure 2).

This module would be used by a librarian during a search interview with a client. To initiate use of the Search Module, the librarian identifies the client by using their name or library card number. Once a valid client is identified, the system automatically adds all pertinent information to the module. At this time the system also verifies that the individual is a cardholder and is eligible for this library service. If necessary, changes to the client's address can be made. The client can specify an alternative address as well as the method of payment and the method of delivery (i.e., pick up, courier, mail) for search results.

Once this information has been entered, the librarian uses the module to record the nature of the client's search request. Each request is stamped automatically with the current date and time. The system generates a work form, the search request is filed, and the information is available for later review.

When the librarian has completed the database search, the client data is recalled and updated with cost information, the names of the databases searched, and vendors used. Cost information is shared automatically with the circulation and accounting departments so that money can be received and recorded or an invoice generated, as necessary.

Thus, the module helps manage the work flow and automatically provides the accounting department with necessary information. It also captures important data for further analysis that will help answer questions such as

- Which databases are we searching and how frequently?
- What is the length of an average search on X database?
- Which Texas Medical Center client groups are or are not using our search services?
- How much did we bill clients for searches last week or last month?
- What time of day are we most likely to receive a search request?
- What is the average search turnaround time?
- Has the turnaround time changed in the last year?

These are a few of the questions that can be answered from just one of the MIS tables. Considering that there are more than forty separate tables, that there are hundreds of fields within these tables, and that data from one table can be compared easily to any other data in the MIS, the number and scope of questions that can be answered clearly are enormous.

For example, suppose the data show a significant decrease in the number of searches being run. The MIS can be utilized readily to explore a variety of factors that might have this effect. Is this decrease simply an aberration or a seasonal variation? Data from previous months and years are available for easy analysis. Is the decrease due to a fall-off in the use of one database, or is it across the board? Did the decrease come about because a group of regular users requested fewer searches? Has the turnaround time increased such that people are doing their own searches or are using other information sources?

Data from the MIS can be the first indication of a problem. It also can offer insights into the nature of the problem. Not all answers will be found through the MIS—the problem may have been caused by something outside the library, but the data do provide a starting point in the library's quest to improve the quality of services.

BENEFITS OF THE MIS

The primary objective of the MIS is to provide information needed by library decision makers. The

system also has resulted in some significant time savings. During implementation, most of the staff experienced an increase in work load due to the MIS. Busy departments such as photocopy and interlibrary loan had to maintain their traditional work load while also learning the new system and implementing new procedures. The staff had developed a "shorthand" for taking photocopy or ILL requests over the phone, and the MIS slowed this process. Some cardholders were willing to wait an extra minute or two for the computer, others were not. During this period, many staff members questioned whether the benefits of the MIS would outweigh this disadvantage.

Advantages became clearer during processing. Because the MIS modules require that certain data elements be completed, the number of incomplete requests declined. The MIS also provides complete client information, so there was less of a problem with incorrect addresses and phone numbers. The big time savings came at the end of the month, when statistics were counted. In a matter of a few minutes, the MIS can count and analyze statistics that had normally taken hours or even days to gather. At the touch of a button, the system can reveal how many requests were filled, how many pages were copied, and the average turnaround time. Special reports can answer questions about which user groups are taking advantage of the service, which journals are being requested frequently, how people prefer to have their copies delivered, and so forth. Work loads for a particular time of the year, or even for a particular day of the week, are easy to predict.

The circulation department, which has been using its MIS module for some time, has found that communication with clients is easier than ever. Because the MIS data can be manipulated using Paradox, it is easy to generate mailing lists. Circulation has used the MIS to identify and to notify clients whose library cards were about to expire. The MIS also has been used to generate mailing lists of card holders sorted by institution or by client category.

The MIS automates the billing process for database searching and for photocopy and interlibrary loan services. Each of these modules contains a section where staff can enter relevant charges. These data are shared instantaneously with circulation and accounting. If a client asks to be billed for the service, then the MIS will prepare an invoice to be mailed. If a client prefers to pay cash, then a staff member at the circulation desk (which has the only cash register in the library) can check the system to determine how much money is owed and can record the receipt in the MIS. Automating these functions has reduced paperwork significantly.

Finally, the MIS can be used to support *ad hoc* decisions. What would happen if the cost of photocopying were raised by five cents per page? How many shelvers are needed to keep up with the work load during the week of Christmas? Do the orientations offered by the library's education department have an effect on the type of questions received at the information desk? What staffing pattern at the information desk is the best utilization of staff? Which academic departments are (or are not) taking advantage of the library, and which services are they utilizing? These are only a few of the questions that can be posed. The MIS has the data and provides the tools necessary to analyze data to produce useful answers.

DIRECTIONS FOR THE FUTURE

The MIS has become a reality at the HAM-TMC Library. There is some fine-tuning left to do, as well as time to consider future development of the MIS. Two priorities have been identified: the development of a "generic" MIS, and the development of a decision support system interface (DSSI).

In speaking to outsiders about the MIS, HAM-TMC librarians have become convinced that many libraries are interested in using this technology, and that it would provide considerable benefits through its use. The MIS, as it now exists, is specific to HAM-TMC needs. For instance, the format of the modules reflect forms that have been used at HAM-TMC for many years, and the policies that the MIS enforces are not in use at all libraries. Some libraries might want to capture different data, and some may perform functions not now covered in the MIS. But the MIS does capture data that is common to nearly all libraries. With some modification, the MIS could become a valuable tool for most academic medical libraries.

The MIS is a flexible tool. It does not require exotic computer hardware, and the software—Paradox—is a common database package. The modules that capture much of the key data can be changed easily to reflect another library's needs and preferences. Still, development of a generic product probably will take a year or more and likely will take place in three phases. The first would be the definition phase, during which hardware and software specifications would be defined along with a set of needs, features, and functions that would serve most academic medical libraries. Decisions would be made regarding what data should be collected, how it would be collected, and how it would be reported.

During the second phase, screen design, programming, and testing would take place, as would the development of set-up and configuration procedures. At the end of this phase, the generic MIS would be ready for testing and debugging. This third phase would include beta testing at one or two other libraries. Help screens and user documentation would also be written during phase 3.

As with the HAM-TMC Library MIS, the generic

MIS could enforce a library's policies; handle its client information; provide public service modules for recording service requests from clients; handle accounting functions, such as billing and invoicing, online; and provide a reporting structure to gather monthly data from library departments. The data collected through these components would be available for *ad hoc* decision making.

The DSSI would be written to make the MIS easier to use as a decision support tool. Currently, some skill (or, better yet, some help) is required to use Paradox to extract meaningful information from the MIS. Although using the system is not extremely difficult, some study is required to develop the skills, and this obstacle can prove limiting and frustrating if these skills are not used regularly. To take full advantage of the MIS, it is also helpful if the user is familiar with the various data tables and field names. A printed guide can help in this regard. However, the DSSI holds promise for overcoming the need for both advanced Paradox skills and familiarity with the database.

As envisioned, the DSSI would allow a user to pose a question in natural language, which the DSSI would translate into a request understandable by the MIS. The MIS then would generate a report for the user's consideration. Work on the DSSI will not progress until development of the generic MIS is in phase 2.

The MIS is living up to expectations. It now is incorporated into the work flow of HAM-TMC public service departments and is being used by managers to analyze situations and to make decisions. It is a tool that, while still evolving, has important applications in the larger community of medical libraries.

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Received September 1992; accepted December 1992