Management Information Systems In the Library Environment

A Literature review

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Abstract: Libraries are business organizations and, like any business, are run by managers. Management responsibilities include planning, organizing, directing/motivating, controlling, making decisions, and solving problems. To fulfill their responsibilities, managers need information about what is occurring internally and in the external environment (Fulweiler, 2001, p 386). The library environment is undergoing a rapid change. There are many internal and external influences pushing libraries to think about some important questions like: What are they doing? Who are their clients? How are they performing? Can they do better?

To answer these questions, effectively many libraries are redesigning their missions, changing their structures, and their processes. The goal of libraries is to use information better to achieve positive outcomes, which makes librarianship move towards Management Information Systems (MIS) to help achieve better results in decision-making.

In this review the researcher presents the definitions, concept, and applications of MIS in an electronic library environment. The review will consist of literature concerning the evolution of MIS in library science, academic library management, organizational structures, performance indicators, decision-making, models and approaches, MIS, and DSS (Decision Support Systems).

1.1 Evolution of MIS in library science:

The importance of performance measurement was recognized by librarians in the first systematic study in the UK carried out in 1960`s at the University of Durham (Durham, the PEBUL Project, 1969). In the 1970`s Evans reviewed the criteria used to measure library effectiveness (Evans, 1972). Broadly, Lancaster discussed techniques that can be used to evaluate public library and technical services through the use of objective procedures (Lancaster, 1977). Both Evans and Lancaster introduced the concept of using criteria for measuring library effectiveness.

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In the early 80`s, Du Mont pioneering proposal, for a conceptual basis for library effectiveness, was using a systems-based model which responds to environmental change (Du Mont, 1980, pp103-111). One year later, Aversa addressed some of the criteria that have been used in measuring library effectiveness, which evaluate the basic models and recommended a systems approach based on efficiency rather than effectiveness (Aversa, 1981, pp27-45). Later on, Cummins looked at the input and output measures in public services operations and addressed specific functions including document delivery, collection development, provision of information, and library instruction (Cummins, 1988, pp10-13). These studies set the pace for applying MIS principles in library science.

In 1986, McClure started two important studies related to performance measures. The first one was a review about the output measures for public libraries (McClure, Output, 1986, pp 49-52). The other one was about performance measures for costing in public services of academic libraries (McClure, A View, 1986, pp 323-336). French and Hernon, also addressed performance measurement to the ACRL (Association of College and Research Libraries) committee responsible for establishing the performance measures of academic libraries (French, 1987). Hernon described utility measures for library reference services to encourage managers to renew their commitment to user information needs (Hernon, 1987, pp 449-459). Both Braunstein and Cummins described the term productivity, which involved balancing the need to change what is inappropriate with the equally important need to strengthen what is a worthwhile library operation more likely to succeed (Braunstein & Cummins, 1988, pp 201-215).

The above studies introduced new concepts such as output measures, utility measures, users information needs and productivity which are integral to the MIS model.

1.2 Review of Previous Work:

Among the first studies is that of Clark from CERLIM* (Center for Research in Library and Information Management) in the University of Central Lancashire, describes the EQUINOX* project on the development of performance indicators for the electronic library. The project addresses the need to develop and use methods for measuring performance for all libraries in the newly networked environment, within a framework of quality management. The project aims to develop international on electronic library performance indicators emphasizing information access, delivery, costs, and user satisfaction. It aims also, to develop an integrated quality management and performance measurement software tool. Adams` report is a research project sponsored by the British Library "Decision support systems and performance assessment in Academic Libraries", aims to show step-by-step detail of how to purchase an off-the-shelf decision support software package and installing it in the library system (Adams, 1991, pp 8-9).

Michalko`s study describes the production function as an economic theory, which correlates an organization's inputs with its outputs of goods and services. It is a planning model, which was used in libraries that have multiple outputs such as information provision, collections and preservation that need to be reassessed. (Michalko, 1993, pp 11-22).

Note: *

- CERLIM at: http://uclan.ac.uk/research/cerlim/
- EQUINOX project at: http://equinox.dcu.ie/

The above studies focused on the importance of determining performance measures for increasing the quality and efficiency of electronic library services which emerged in the 90s.

Gumilar and Johnson have examined the potential and actual use of computer generated information and MIS applications in decision-making by academic library managers. A survey of eight academic libraries in England showed that automated management information systems are not widely available to library managers. Problems at that time include the crude form of automated library systems, a lack of agreement on what data is required for management purposes, and a lack of expertise on the part of library staff in interpreting data (Gumilar and Johnson, 1995, p57). This study was perhaps, one of the early attempts of investigating the potential of applying MIS in Academic libraries.

Bertot and McClure were among the first to focus on electronic library services, such as internet-based databases, website development and maintenance, and on-line reference, which are considered as difficult to measure. This was as a part of developing new measures for electronic library services. They attributed the lack of e-library measurement to the lack of agreement about what to measure, how to measure, and interpretation of the data. In their "Issues and Strategies for Developing National Statistics and Performance Measures for Library Networked Services and Resources" they propose strategies and techniques for assessing networked library resources and services (McClure & Bertot, 1999).

In the third Northumbria international conference (1999) on performance measurement in libraries and information services some important themes emerged: defining and measuring value, electronic library and network measurement indicators, benchmarking, the scorecard models and their use in performance measurement, government involvements in library assessments, quality service measurements and applications, and activity-based costing.

1.3 Review of current studies:

In this part of literature review the researcher searched the bibliographic databases of Lisa and science direct, to obtain reference information during the period 2000 to 2003 in the fields of MIS/digital libraries in particular and MIS/libraries in general, as well as EJ management systems and EJs/Decision-making process or policies. One study in knowledge systems, two in EJ management systems, and two in MIS in libraries were found only.

Sitko, et al. (2002) studied EJ management systems. Recent developments in e-journal management systems offer libraries a variety of solutions for enhancing the visibility and flexibility of their electronic journals. This article examines and compares four current e-journal management programs that create and integrate multiple lists of journal titles, regardless of format, into a single list: Serials Solutions, JournalWebCite, TDNet, and Serials Cybrarian. These systems can reduce or even eliminate common serials control problems for librarians (Sitko, Tafuri, Szczyrbak and Park, 2002, p176).

Bluh, Truitt, and Boissy (2002) studied a serial system that focuses on the criteria for selecting a serials management system that are often the same as those for selecting an integrated library system. In the post-selection/production environment, the library vendor relationship, which matures as a new operational framework, is established. Serials management systems must become more efficient and make better use of electronic commerce, especially as a greater emphasis is placed on access to electronic journals (Bluh, Truitt, and Boissy, 2002, p 93).

Gunnlaugsdottir (2003) conducted research on organising knowledge using groupware systems. He states that certain tools must be employed to organise knowledge into the groupware for it to function as a solution for knowledge management. These are the tools, which the library and information specialist, trained in records management, has at his disposal. The groupware can produce definite benefits for the management of any organisation and for its knowledge management. However, in order for the groupware to meet expectations, the introduction of it must be planned and it must be correctly implemented, to become the solution for organising and preserving the knowledge base of the organization (Gunnlaugsdottir, 2003, p 364).

Two current studies that were found and which are the most relevant to the present research are discussed below.

Four primary modules were conducted by Fulweiler (2001): financial/budgeting, collections, services, and feedback. Financial data are used to monitor and control operational expenses. Information about the collections is used to justify current expenditures and plan future acquisitions. Data about bibliographic instruction and reference services are intended to measure staff productivity and student learning. In addition, there are formal user feedback mechanisms applied in evaluating how the library is doing, and to identify the need for new initiatives. Information on facilities, staffing, and the university community is collected less often but is no less important. The Sawyer Library's MIS is based upon staff determining the structure and content for the form used to compile the data, manipulating the data gathered into useful and understandable information, and then structuring the outputs for review, analysis, and feedback so as to influence directly the strategic planning and evaluation processes (Fulweiler, 2001, pp 386-387).

The above study is perhaps the only one which discusses the application of MIS in the new libraries.

Ndagna and Ndgana (2003) made their review of the potentials of management information system operations in Nigerian libraries. The study investigates 3 major areas of application of computers: MIS; library management information from computer based systems; and decision support systems. It advocates the need for training of MIS managers and their employment in libraries (Ndagna and Ndgana, 2003, pp 69-75).

1.4 Academic Libraries Management

Academic librarians are challenged to explore new opportunities and implement change in the following critical areas:

1) Establishing new roles and responsibilities for library professionals that result in quality services.
2) Determining knowledge, skills and abilities required for all staff.
3) Creating new partnerships, and
4) Redesigning organizations and realigning their culture (Kelleher, 1996).

Since academic library managers need to use a more formal planning process to focus their services on meeting users` needs, it should be processed as: establishing overall objectives, allocating library resources to programs, and evaluating attainment of objectives. Gumilar and Johnson believe that at the institutional level, all academic library managers must negotiate the library’s resource requirements through various supervisory committees. Academic libraries need information, which can be presented

to these committees about how effectively the libraries contribute to the objectives of the parent institutions (Gumilar and Johnson, 1995, p58-60).

Fulweiler states that library managers review and evaluate the information found in formal reports and the informal feedback to plan and make decisions about the library. Many library managers are satisfied with their simple yet effective MIS. Others have a very complex and powerful MIS based on relational databases and extensive external environmental information, and may dedicate staff to this function. Libraries with a complex MIS use the data made available by their automated library system and integrate it with information available elsewhere from the University and the external environment, such as census data. Often, these libraries are in large institutions with capabilities and resources generally not available at small- or medium-sized institutions. Yet, a smaller institution that may not employ a complex integrated database may still have an effective MIS. Academic libraries are required to be accountable. MIS can be used as part of their strategic planning and evaluation processes to demonstrate and prove effectiveness (doing the right things) and efficiency (doing things right). Recently, assessment has become a more visible and discussed aspect of accountability (Fulweiler, 2001, p 388).

1.5 Organizational Structure

An organizational structure is a means to incorporate various functions in order to pursue some predetermined objectives. Gumilar and Johnson state that there are two ways to organize libraries: specialization, which can be interpreted from two angles: a) departmentalization (the organization is structured horizontally by identifying and grouping similar or related required activities or tasks into departments) and b) hierarchy (the creation of a vertical hierarchy, with the individuals located on the top of organization having more authority than those at successively lower levels); and coordination and integration, which means bringing all individual efforts together to achieve particular objectives.

In the first issue of departmentalization, two main approaches can be adopted, which are function and subject. Function is dominated by the administrative function, and subject is the alternative approach, which is strictly functional with services and processing entirely subordinate, and splits the staff (Gumilar and Johnson, 1995, p60-61). In the second issue, Line proposed a flat structure as one possibility for libraries (Line, 1991, p97-103). Cargill described the flat management structure as having fewer middle managers, and more reliance on the two extremes, the senior administrators and lower level staff, to make decisions (Cargill, 1989, p49-55).

1.6 Decision-Making and Information Needs

In 1981, Radford defined decision-making as “the formulation of alternative courses of action to meet the situation under consideration and the choice between these alternatives after an evaluation of the effectiveness in achieving the decision maker’s objectives. One of the most important factors is information from which an appreciation of the decision can be made”(Radford, 1981, p1). Gumilar and Johnson add to this definition that decision-making is “the conversion of information into actions, which are planning, organizing, directing and controlling of activities to achieve objectives”. According to Ahituve and Neumann there are three stages in decision making: 1) intelligence which encompasses the collection, classification, processing, and presentation of the data necessary for the later stages of the decision making process; 2) design which requires the decision maker to outline alternative solutions that each involve a set of actions to be taken, and are usually quantitative

techniques and design tools such as are common in management science and system analysis, the data gathered in the previous stage is now examined in statistical and other models to forecast possible outcomes for each alternative; 3) choice which faces the decision maker with various alternatives and one should be selected as a formal decision (Ahituve and Neumann, 1990).

Gumilar and Johnson state that there is managerial stratification for organizations whether large or small (or flat). The tasks of top management are to develop the organization's domain, manage the interface with external environments, establish and develop rules, procedures and polices for day-to-day operations, and technical management sees that services are rendered and polices carried out. They also suggest that decision-making at different managerial levels is not necessarily an identical process, and there are clear implications for the type of management information required (Gumilar and Johnson, 1995, p61, 62).

According to Homer unstructured decisions are usually made at the strategic planning level and semi-structured decisions at the operational management level. The most structured decisions are reached at the operational control level (Homer, 1986, p141-145). Therefore, library managers need access to information, which is appropriate to their level of decision-making. There are two kinds of management information, formal and informal. Both of them derive from sources external and internal to the academic library, but informal management information is mostly found externally such as from the users and the administrators who govern budgets. Libraries should have systematic procedures for allocating resources in line with objectives and ways must be found to monitor and control these resources such as: performance assessment, management information systems, and decision support systems (Gumilar and Johnson, 1995, p62, 63).

Brophy suggests that the operational managers need consistent and reliable sets of data about the services for which they are responsible. A process model approach may be particularly appropriate since at the operational level the key issue is to manage the use of resources (people, money, information, and so on) through processes to produce outputs such as: full-text download, web pages accessed, etc. (Brophy, 1997).

Fisher and Oulton discuss the DECIMAL project (Decision-Making In Libraries) by the Commission for the European Communities (CEC)* that identifies the decision-making process in small to medium-sized libraries, determines the information needs of library managers for decision-making and to design and develop a decision support module.

Fisher and Oulton found from the survey of DECIMAL that most of the strategic decisions relating to finance, recruitment and premises are taken by the most senior level of management (management executive/board of directors). Librarians usually take operational decisions that directly affect the running of the library (Fisher and Oulton, 1995, p15). They have also concluded that a decision support model should be compatible with the system used in the wider organization in terms of access and data transfer. Such a system would provide guidance in the location and

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* note:

- **DECIMAL Project:** at:http://www.mmu.ac.uk/h-ss/lis/research/decimal.htm.
- **DECIDE Project:** at:http://sisgate.sis.se/sis/decide.htm
- **EQLIPSE Project:** at:http://www.dcu.ie/library/eqlipse/
- **MINSTREL Project:** at: http://elsa.dmu.ac.uk/minstrel/ or at: http://www.dmu.ac.uk/~camile/Minstrel.htm

use of appropriate information resources textual or numeric, group or interpersonal contacts and incorporate instructions on methods for data collection and analysis for performance measurement. The same model would ideally facilitate communication, internally and externally, and provide a vehicle for professional networking. However, it is important to have a longer-term goal to aim for to ensure that systems suppliers and software developers work in the direction, which librarians want to go. It is also important that library managers, as professionals, become more knowledgeable of how to gather and use information, more aware of the capabilities of non-library information systems and more understanding of their own decision-making processes. The project recommended the establishment of common standards, a library management textbook and training in management skills (Fisher and Oulton, 1995, p18).

The CEC calls for research and development in models and tools to support decision making in libraries. There are three more projects supported by CEC "DECIDE, EQLIPSE (Evaluation and Quality in Library Performance: System for Europe), MINSTREL (Management Information Software tool-Research in Libraries)".

A wide range of issues emerged which impact on the decision-making process, such as organizational culture and external constraints, and the information used to support the decision. One of the project's findings was library context which emphasizes the diversity of management information needs between different library types and sizes. In this case, the availability of an explicit set of objectives and an organizational mission statement are invaluable reference documents in terms of planning and justifying existing or new services and for long term strategic planning. In the issue of management, many libraries viewed their activities and services as an integral part of the organization and some did not (Fisher and Oulton, 1995, p10).

Interpersonal sources of information, such as professional colleagues and other members of staff and sales people, are also very important in supporting the librarians in their decision-making process. The main problems associated with management information concern lack of resources and insufficient access to information systems. McClure adopted a strategy to overcome this problem, including extending access to information throughout the organization, maintaining open file systems of reports, and circulating summary data quarterly around departments (McClure, 1980).

1.7 Performance Assessment

Gumilar and Johnson define performance assessment as encompassing both performance indicators and performance measures. This means a systematic measurement of the extent to which a library has achieved its objectives in a certain period of time to make the library work, internally, effectively and efficiently and externally, to justify the budget by library managers. It could be applied to: service input cost measures, service output measures, service effectiveness measures, and service domain measures. There are four types of performance indicators: operational performance indicators, effectiveness indicators, cost effectiveness indicators and impact indicators. Performance indicators are intended to improve decision-making and service performance, aid public accountability and help define and evaluate polices (Gumilar and Johnson, 1995, p63, 64).

While it has proved possible to adapt many existing indicators to the needs of the electronic library, it has been necessary to adopt different approaches in some situations. The recommendations of the effective academic library regarding integration between the library services and institutional academic work can be

expanded readily to incorporate electronic services (Ad-hoc working Group, 1995). The most obvious example of this occurs with the development of indicators, which are the equivalent of the traditional library's measurement of 'number of documents delivered'. However, in an electronic environment it is virtually impossible to define a 'document'. Also the key issue for users is not the number of documents they can download but the range and depth of resources, which are available to them (Brophy, 1997, p3).

The IFLA Report in 1995 combined a set of performance indicators that would be applicable in academic libraries all over the world. Only those indicators were included that would allow for an immediate evaluation of the quality of a service and that could be set in relation to a distinct user-oriented goal of the library, in order to give help in setting such goals, for an academic library including details about collection building, access and facilities, information policies, and preservation.

Commission of the European Communities, Fourth Framework (Telematics), and Libraries Program:

1) Project EQLIPSE (Evaluation and Quality in Library Performance: System for Europe). The overall objective of EQLIPSE was to specify, develop and validate an open IT based system to support quality management and performance measurement in libraries of all types. The resultant system is based on client-server architecture and offers compatibility with library systems from various library suppliers (Ifla Report, 1995).

2) Concerted Action CAMILE (Concerted Action on Management Information for Libraries in Europe).

Broadly, HEFEC suggested that a framework of coherent and generic performance indicators, suitable for assessing academic libraries. The Ad Hoc Group has arranged the indicators contained in the report into four areas:

- **Integration**: the level of integration between the mission, aims and objectives of the institution and those of the library.
- **Delivery**: Whether the stated objectives are being met and is the volume of outputs high?
- **Efficiency**: Are outputs related to resource input?
- **Economy**: Cost per student (HEFCE, 1995).

The HEFEC report builds on the approach taken in the Effective Academic Library (EAL) that used a fivefold structure to gauge overall library effectiveness, and these are: Integration, Quality of Service, Delivery, Economy and Efficiency.

A similar set of criteria was considered appropriate for the electronic networked environment (ENE), which is as follows: Extensiveness, Efficiency, Effectiveness, Service Quality, Impact, and Usefulness (Orr, Van House, Weil & McClure, 1973, 1990 & 1997).

Boekhorst as a member of the Working Group of the Section of University Libraries and other General Research Libraries in Germany, has developed the following criteria for guidelines for performance measurement to improve the quality of their services. These are: 1) to concentrate on academic libraries 2) to include only measures that would be applicable in all countries (developing as well as developed) and all kinds of academic libraries (big or small, computerized or not, with free access or closed stacks) 3) to measure effectiveness, not efficiency (cost-effectiveness) 4) to include overall indicators such as user satisfaction as well as indicators for separate activities, 5) to concentrate on user- oriented indicators.

The following indicators were tested by the Working Group: availability, document delivery (DD), collection use, acquisition speed, book processing speed,

interlibrary loan speed, user satisfaction. According to the changes in academic libraries, which show great varieties in organizational, financial, and technical conditions, a new indicator might be added, when an old one might not fit. The guidelines define performance measurement as comparing what a library is doing (performance) with what it is meant to do (mission) and wants to achieve (goals). This is done by collecting statistical and other data describing the performance of the library. Boekhorst defines performance as "the degree to which a library is achieving its objectives, especially in terms of users` needs". He also, draws a mission statement, which can be adapted to the specific framework within the library to describe whom the library is meant to serve, and what kind of fundamental services it is meant to offer (Boekhorst, 1995, p278).

Thus, evaluation, or performance measurement, is considered as an important part of MIS. Only by putting in place relevant performance measures can managers know how their library is faring on a day-to-day, month-to-month, and year-to-year basis. Operational indicators can highlight levels of performance that need attention. The exact levels will depend on the individual library and its particular goals. Much of the data on target attainment can be derived from an automated system and built into the routine reporting system of the library. Once a system is established, only extraordinary performance measures need to be reported to senior management along with suggested tactics for dealing with the situation (Cullen, 1992, p153).

1.8 Automated Integrated Systems

Introduction of technology in libraries has provided a basis for applying MIS because they bring with them information about the processes being performed and at the same time how this information can in itself affect the tasks performed by machines and the workers in the organization. Zuboff calls this "informating" technology, suggesting that it has an underlying duality- that is; the computers that automate and monitor the processes of the organization also produce information about those processes at the same time.

Data is generated by automated integrated systems in academic libraries by circulation, reserve collection, acquisitions, serials, and cataloguing. The data from these subsystems, which are almost universally based on bibliographic databases, are the 'informating capability' essential for the application of MIS that helps librarians discover which of the many reports generated by automated systems are most useful in managing the library and the system (Cullen, 1992, p155, 157).

1.9 Models and Approaches

The knowledge model: This is an important competitive advantage for any organisation. Increasing competition, continuous changes and mergers in industry have made the risk of losing valuable knowledge, due to transfer or termination of employees, a real problem. Organisations must, therefore, preserve their knowledge base and take steps to utilise effectively both the internal and external knowledge, which is of relevance to their operations, and make it explicitly available to their employees. One way to manage and share this knowledge is to employ for this purpose a computer-based information system, the groupware, which is a collection of computer software and work processes. Many organisations have realised this and have embraced **knowledge management** as a way to discover, collect, document and organise a knowledge base which the employees of the organisation can later retrieve, distribute and use in their individual daily work and in their collaborations with their colleagues (Gunnlaugsdottir, 2003, pp 364-366).

The essence of knowledge management is:

- Connecting people with people.
- Connecting people with information.
- Enabling conversion of information into knowledge.
- Encouraging innovation and creativity. ([Abell & Oxbrow (2001)]).

Gunnlaugsdottir adds that internal knowledge is either documented or not. It is created in the daily operations of the organisation. Basically it is of three types. First, there is the knowledge, which rests in the minds of the employees such as the work experience of employees, how things are done, knowledge of customers and their needs, various personal contacts. Second, there is the documented knowledge which we find in the various records of the organisation, not necessarily available or known to the employees in general. Finally, we have a relatively recent phenomenon, the **groupware**, where the knowledge base of the organisation is organised, managed effectively and is accessible to all authorised employees, provided the system is properly implemented, this could be in the form of incoming and outgoing correspondence—including faxes and electronic mail—internal and external supporting material, minutes from meetings, agreements, internal memos and reports, plans, contracts, and other related matters. He mentions that we can learn from our employees in many ways by documenting their experience. Some organisations have created knowledge maps or directories that chart where particular knowledge is to be found within the organisation. Many organisations have developed databases of best practices where they have documented the preferred ways of doing things which their employees have discovered through trial and error what works best in a particular situation (Ibid, pp 356-357).

Thus, groupware is a collaborative technology which allows people to communicate with each other, co-operate on projects and share information and knowledge. They are a collection of computer software, employees and work processes within an organisation. It links employees together and connects them with the information and knowledge base of the organisation, offering them the opportunity to use it and expand it. Records are safely stored in an organised, central database where all authorised employees have access to the latest versions of manuals and other documents and records. The system offers also version control, that is how many versions were made and who wrote each version. They do also eliminate duplication of effort and provide for the sharing of information, which many employees were previously collecting and entering onto their personal computers for their private use. The groupware offers effective collection, storing, organisation, retrieval and distribution of information. Any good groupware has also a records management solution equipped with an internal classification system (Gunnlaugsdottir, 2003, pp 372-373).

The Stakeholders Approach: The most important study in the MIS model for the e-library was achieved as a stakeholder approach which draws the attention of managers to the need to explore a wide variety of perspectives, such as quality management (‘fitness for the customer’s purpose’ and ‘conformance to the customer’s requirements’), as providing the basis which underpins management decision-making (MDM).

In the first dimension of the approach Brophy (1997) identified the library staff at management levels as follows: 1) senior managers (e.g. deputies, chiefs, and strategic planning); 2) middle managers (e.g. heads of major divisions, day-to-day operations); and 3) line/technical managers (e.g. service desk superintendents).

Table 1.1: The knowledge model of ELF

Resource Discovery	Resource Delivery	Resource Utilization	Infrastructure Provision	Resource Management
Resource identification Location identification	Request Acquire Deliver to user	Exploitation tools	Space Equipment Networks Support services	Prioritization Value for Money

A second dimension to the model is provided by the analysis of the electronic library functions (ELF), which are shown in Table 1.1, and described as: resource discovery, resource delivery, resource utilization, infrastructure provision, and resource management found in the traditional library (Owen, 1996) but in the electronic environment introduce new levels of complexity. This is because many of the information resources are not 'owned' by the library in any real sense. These library functions have been combined (Table 1.2) with the managerial 'tasks' to provide guidance on the sort of decisions, which managers of the electronic library need to take (and hence need performance indicators to inform them).

a. Resource Discovery can be described as the range of resources, which defines the map provided to users of information, and landscape features to which they can gain access. The quality of such resources, equivalent to the accuracy and scale of the map, which defines whether items can be retrieved with accuracy and reliability. The resources are bibliographic sources, indexes and web sites.

b. Resource Delivery: indicators used for resource discovery depend on the delivery services offered.

c. Resource Utilization is information managers may need on the availability of tools such as bibliographic databases, and the extent of using that tool.

d. Infrastructure Provision is the information operational managers will need on the adequacy and use of the infrastructure provided. This will include whether sufficient workstations are available, whether the network and support services are adequate and reliable.

e. Resource Management is an indicator of efficiency using the cost of providing the service (Brophy, 1997).

Table 1.2: The Stakeholder Approach

*	*Resource Discovery*	*Resource Delivery*	*Resource Utilization*	*Infrastructure Provision*	*Resource Management*
Operational Management	Ease of use of OPACs	Speed of document supply	Appropriateness of conversion software	Availability of PCs	Peaks in demand for services
Forward Planning	Which bibliographic indexes to provide?	Agreements for document supply	Emerging document formats	Number of networked PCs to be provided	Predicted costs of alternative services
Strategic Management	Clumps	Co-operative (e.g. regional) agreements	New classes of software tools	Development of off-campus infrastructure	IPR legislation for electronic sources

*Taken from Crawford " The Stakeholder Approach to the Construction of performance measures" in 1996 (Brophy, 1997).

Models of Organizational Effectiveness: Cullen and Calvert used the stakeholder (or constituencies) perceptions of university library effectiveness in their research in New Zealand. They propose that the results of measurement can be used to evaluate the

performance of a library and thereby determine whether or not it is effective. They clarify that measuring performance is not necessarily the same as measuring of effectiveness. They introduce Childers and Van House's work that applies the four major models of organizational effectiveness to test their applicability to the ways in which higher educational institutions attempt to measure their effectiveness. These models are:

1) The Goal Attainment Model, in which the organization defines its goals and objectives, and attempts to measure them in order to fulfill them;
2) The System Resource Model, which assesses an organization's ability to secure resources (staffing, budget) from its environment;
3) The Internal Process Model, where stability, equilibrium and internal control processes dominate performance measurement; and
4) The Constituency Satisfaction Model, in which the organization is assessed by the degree to which its constituents, or primary stakeholders have been satisfied. Each group of stakeholders has needs and expectations, which the organization must attempt to meet.

Therefore, it has been identified in the management literature, that the primary approach to organizational effectiveness that has been used by the academic managers has been the system resources model, which counts inputs to indicate library effectiveness. However, library effectiveness is not a simple construct and ideally should address all four models of organizational effectiveness in some way. Cullen and Calvert have used the following key constituencies in their study: 1) resource allocators (that include members of the governing body in each university, e.g. university council, members of planning and resource committee, vice chancellor and any assistant vice chancellors, registrar and finance registrar; 2) senior library staff (who engage in policy and decision making); 3) other library staff (Cullen and Calvert, 1995, pp 439, 440).

Decision-Making Models: Fisher and Oulton, in the DECIMAL project, have proposed a number of models for decision-making. One of these is the rational model that provides a framework for understanding the role of performance measurement as an information input, although it is not clear how well such a model reflects the actual behavior of library managers in using information and making decisions. They also give some perspectives on performance measurement that may reflect different cultural approaches to the management of libraries. Culture refers both to the national culture (e.g. there are some differences between European approaches to "information management" and American styles of "information resource management" and organizational culture (e.g. there are some differences between libraries, which are part of publicly funded bodies, and those in commercial organizations (Fisher and Oulton, 1995, p11).

1.10 Management Information System (MIS)

Heim has defined an MIS as "the process and structure used by an organization to identify, collect, evaluate, transfer, and utilize information in order to fulfil its objectives. It is a system that provides management with information to make decisions, evaluate alternatives, measure performance, and detect situations requiring corrective action" (Heim, 1982, p59-70).

Gumilar and Johnson have defined the main objectives for management information systems as:

1) to facilitate the decision-making process in the library by providing managers with accurate, timely, and selective information that assists them in determining a specific course of action;
2) to provide for the objective performance measurement and assessment of selected relevant areas of the library (the areas are to be determined during strategic planning);
3) to provide pertinent information about the library's internal and external environments;
4) to provide information on alternative strategies and contingency plan (Gumilar and Johnson, 1995, p 64).

Fulweiler (2001) states that a management information system (MIS) is defined briefly as an "integrated reporting system specifically designed to help managers plan, execute, and control the organization's activities. A commonly deployed business MIS enables decision makers and others to ascertain company status and forecasts by generating periodic reports with attributes determined in advance to address specific concerns. In a typical business these reports provide information such as last month's revenue and profit, and may compare these figures to the previous month and year. It may also provide data comparing internal results to competitors and industry averages. The reports generated by MIS are intended for managerial planning and decision-making. The information system concept is often presented as a diagram in which inputs (data compiled about what is happening in the organization or in the outside world) are processed or otherwise manipulated. Resulting value-added information is next transformed into outputs, frequently a report distributed to managers who analyze or otherwise use the information to plan or make decisions. An important element of the system is that analysis of the feedback from the outputs is used to evaluate and revise the inputs. Information systems may be formal or informal.

Formal systems predetermine the kinds of information that are regularly complied and manipulated. For example, information on sales may be captured at cash registers all over the country, and then monthly sales reports, with analysis arranged by product, region and store, are delivered to managers. Managers may also employ informal information systems that include data gathered from conversations, the media, or past experiences. Management information systems are now typically seen as dependent upon computer technology, but a manual process or a combination of manual and automated processes can be used to manipulate inputs in meaningful ways as well (Fulweiler, 2001, pp 386-387).

Libraries with a complex MIS use the data made available by their automated library system and integrate it with information available elsewhere from the university and the external environment, such as census data. Often, these libraries are in large institutions with capabilities and resources generally not available at small- or medium-sized institutions. Yet, a smaller institution that may not employ a complex integrated database may still have an effective MIS. Typical functional categories to be characterized by a library MIS include budgeting, collections, physical facilities, services, staffing, and community or service area. Data within each functional category or module can be analyzed and related to data in other modules to assist decision makers in assessing library performance. In addition, because each library's MIS will be different, not every library will want or need to have all of the modules because each library manager will need different kinds of information—there is no point in collecting data that no one will use. Fully integrating data from the university may be difficult for many small- or medium-sized libraries, but awareness of, and

access to, that information in whatever format is available is a vital part of the library's planning and evaluating processes (Fulweiler, 2001, p 388).

Gumilar and Johnson suggest integrating MIS into the framework of library management and not into an individual department. The integrated system will provide supporting information to determine:

- Efficiency: is the library doing things right?
- Effectiveness: is the library doing the right things?
- Competitiveness: is the library heading in a direction, which is consistent with the environment - does the library have the correct strategy? (Gumilar and Johnson, 1995, p64, 65).

Fisher describes the facilities for management information in Library Management Systems (LMS), which transform the LMS into a much more effective management tool.

1- LMS maintains records of the transformation associated with the operation of a library. Typical models are acquisitions and ordering, cataloguing and OPAC, circulation control and serials control. In recent years library managers have not only been required to produce more management reports for their managers, but are under more pressure to justify their activities and manage an effective library. Here, the focus has been on the control of transformation, with limited attention to management information. MIS is an important aid to the manager in decision-making and planning, and could generate appropriate control and monitoring data. Fisher reviews both distinct management information modules and also those facilities that are part of the other modules in the system, to see the relationship between transformation processing systems and management information systems (Fisher, 1994, p109).

2- Fisher has divided information systems into three broad categories: transformation processing systems, management information systems and decision support systems. The transformation processing systems deal with the well-structured routine processing of data within an organization. They focus on the maintenance of records concerning the transitions performed in an organization and it should be possible to summarize data about these transformations.

3- Transformation processing systems generate basic data for input to MIS and there is a close relationship between these two type of systems. LMS are the transformation processing systems mostly found in libraries, which generate management information by using some facilities. The second category is MIS that support the decision-making process in structured situations, which are able to anticipate typical information requirements. MIS draws on the data collected from different parts of an organization, through transformation processing and produces reports (summary data), mostly on a regular cycle considering trends and developing a wide perspective of the organization (Fisher, 1994, p109, 110).

5- The MIS must consider the input data, processing data and the output data. Gumilar and Johnson explain that the inputs to the MIS consist of both internally and externally generated library data.

- External information covers factors such as legislation, polices, trends in society, changes in technology, user demand, comparative statistics for other, similar institutions.

- Internal data is that derived from administrative routines and transformational information. Administrative routines include those related to personal, finance, acquisition, cataloguing, processing of materials, binding, building services and maintenance services.

Output measures include data on circulation and general user satisfaction.

Therefore, library managers need a variety of inputs necessary to process information in different ways. Different managerial levels have different needs for decision-making resulting in different types of output reports to meet those different needs.

6- At the same time, MIS requires an appropriate data processing system which is the capture, storage and processing of data for the purpose of transforming it into information useful for decision making.

Computers should easily provide four types of report:

- periodic reports (e.g. routine, statistical information in detailed or summarized form), exception reports (which require managerial attention that has been overlooked),
- on-demand reports (a response to a particular nonstandard question), and
- predictive reports (it forecasts and provides comparisons based on statistical manipulation of data) (Gumilar and Johnson, 1995, p67).

The currently employed MIS at the Mildred F. Sawyer Library has four primary modules: financial/budgeting, collections, services, and feedback. Financial data are used to monitor and control operational expenses. Information about the collections is used to justify current expenditures and plan future acquisitions. Data about bibliographic instruction and reference services are intended to measure staff productivity and student learning. In addition, there are formal user feedback mechanisms applied in evaluating how the library is doing, and to identify the need for new initiatives. Information on facilities, staffing, and the university community is collected less often but is no less important. The Sawyer Library's MIS is based upon determining the structure and content for the form used to compile the data, manipulating the data gathered into useful and understandable information, and then structuring the outputs for review, analysis, and feedback so as to influence directly the strategic planning and evaluation processes (Fulweiler, 2001, p 389).

There are some issues that need to be considered in MIS report writing: usability, ease of use, documentation, available local technical expertise, available infrastructure to deploy it, functionality (does it make reports and how complex is the analysis?) compatibility (how compatible is the system with existing local networks?) and administration/Support (does it require low maintenance and how much administrative support does it need?) (Lakos, 1997).

Fisher lists the standards of reports that relate to transformation in various modules in the system. The extent of the standard reports available may be influenced by the availability (e.g. user-friend report generator) and quality of any report generator. The information in the standard reports may be used for different levels of decision-making. Fisher presents four systems that have reports available in all modules and these can usually be divided into:

1) Acquisitions (concerned with expenditure and financial control. Some reports concerned with everyday management such as chasing orders, others influence management decisions such as chasing of suppliers);
2) Cataloguing (reports on OPAC to monitor the use of library stock);

3) Circulation control (can generate a large number of different kinds of reports); and
4) Serials (reports might emanate from any of the serials functions, including acquisitions, cataloguing and circulation control (Fisher, 1994, p111, 112).

Clients` Needs Approach: Lakos in the 2nd Northumbria Conference, Longhirst Hall, held on September 10,1997, pointed out that librarians assume that the library has to be prepared to respond to the need of its clients. Academic libraries, as complex organizations, have to focus on the value they add to the educational process. It is imperative that they establish and institutionalise planning processes in order to foster an environment of assessment. So libraries should base their services on the expressed needs and requirements of their clients to deliver high quality services.

Lakos puts forward some points as components that will make the assessment environment. These components are: emphasizing the role of clients` needs across the organization; incorporating assessment analysis and following up into the cycle of work; promoting an evaluation or assessment attitude for all staff at all levels across the library; promoting an environment of cooperation in the library; encouraging co-operation with other entities on campus such as faculty and computer department; and establishing a management information system to realize an environment of assessment. This evaluation should reflect the mission and policies supported by library managers and integrated into library services and make assessment tools available to all staff. This means that continued learning will be a prerequisite for being able to deliver quality services.

Lakos emphasized client needs and outcomes as four values to direct the relationship towards the development of an environment of assessment: **c**lient needs is primary- the authority and accountability of the library is driven by the educational needs of its clients; equitable Access- all community should have equitable access to the resources and services in the library; assessment is the responsibility of all staff- inculcates an attitude towards assessment and evaluation at all staff levels; and continuous improvement- working to make all services and processes more effective.

Lakos identified the MIS/DSS as a computer-based tool designed to improve management decisions which provide managers and staff with: internal and external data and tools for analysis of that data- software-based systems or environments which use input measures and with the right analysis tools, provide information to managers; assistance in the decision-making process- the assumption is that the library wishes to make rational decisions, based on empirical data; support tools- they do not replace managerial judgment, they do not replace humans- they are helping tool; and improvement in the effectiveness of decisions as their main objective- they are process improvement tools: information tools that help improve outcomes (Lakos, 1997).

Benefits and Difficulties of MIS:

There are three factors that determine the value or quality of MIS. These are:

i. The content of information - it must be meaningful, relevant and new to the receiver.
ii. The form or presentation of the information - that can create value. The information producer should form an idea of the perception level of the manager to produce understandable information capable of being used and recalled.

iii. The timing of its presentation - delays in data gathering, processing or communication can transform potential vital information into worthless waste paper.

Fulweiler states that in a world in which too many people believe that "everything is available on the Internet for free," academic libraries can no longer depend upon increased, annual funding—they must prove they provide value. MIS can provide information to argue positively for increased budgets by proving that the library is spending wisely and in ways that are in accordance with users needs. To be accountable, academic libraries need planning and evaluation processes with measurable objectives including the means to assess operations and outcomes of student learning. MIS can be a mission-critical component of these processes (Fulweiler, 2001, p388).

Lakos addresses the benefits of MIS in the library as: assisting managers and staff in their daily decision-making processes (increased quality of available information), maintaining better accountability and control on resources, monitoring and controlling resource allocations (an equitable allocation of budgets), improving overall library effectiveness (better outcomes mean improved quality of work and services, better analysis of client needs, better allocations of resources and services, better management decisions should improve effectiveness over time). Also, improving long term planning, and facilitating performance measures activities.

However, there are certain difficulties also in introducing MIS into an established library environment. This is due to some personal and cultural obstacles which include the following: lack of executive leadership, few library-based MIS, lack of technical skills, lack of technical support, hierarchical management, routine work or workload, insufficient planning, lack of buy-in staff, resistance to change, lack of investment in infrastructure, and lack of systems thinking.

Lakos observed that one of the common reasons for the scarcity of any MIS infrastructure in libraries is the lack of resources allocated for achieving this goal. It became clear that assessment activities are fragmented, duplicated and done in isolation. Most assessment such as surveys and data gathering are done either on a project basis or are not centralized, which means that the information analysis is either non-existent or out of context. To overcome this problem they established a professional position that would be responsible for coordinating many of these assessment activities in the library as a resource for data and analysis. An MIS was based on a program capable of receiving systems data from a variety of internal and external sources to the process units, a report writer for reports and an attached module that would deliver data and analysis to senior management in the library (Lakos, 1997).

1.11 Decision Support Systems (DSS)

Adams lists some important issues facing libraries when applying MIS. These issues cause the following problems:

1) output is indiscriminating,
2) the information is not analyzed for a purpose,
3) the data lacks integration,
4) the system in not user-friendly,
5) The information, which is given by MIS, may not be acceptable.

To overcome these problems, libraries could introduce decision support systems (Adams, 1991, p8-9). Gumilar and Johnson state that DSS are capable of solving the

major problems of MIS, which are because of poor communication between the systems, users and library managers.

The main interface outputs in DSS are: regular reports which provide information on parts of the system, which are predetermined by the system's users; event-centered reports in which a report is generated only when a predetermined event has occurred; Ad hoc reports, which are generated in response to a stimulus by the system user to report on a condition, which is not normally monitored; a language query, which enables the user to interface directly with the system and to test, changes in conditions experimentally. DSS also provides the report formats, from simple one-off designs to sophisticated presentations for senior managers. These are: standard reports, tailored reports, tabulations, spreadsheet, and graphics. The information can be obtained on three levels: information from the library's operations; information from the parent organization; and information at the national and regional level (Gumilar and Johnson, 1995, p69).

The differences between an MIS and a DSS are that the former tends to be used by lower and middle management due to their ability in making decisions. In contrast, the latter tends to be used by the top management because it can help with decisions on unstructured issues or at the strategic management level (Gumilar and Johnson, 1995, p69, 70). Fisher believes that DSS supplements rather than replace MIS (Fisher, 1994, p114).

Boekhorst defines DSS as an "interactive computer-based information system containing databases and sets of rules". It is designed to help the library management in its process of decision-making by controlling the flood of operational data, providing topical performance data, controlling the quality of library services, improving the affectivity and efficiency of the library. EQLIPSE (Evaluation and Quality in Library Performance: System for Europe) is one of four projects funded by the European commission as part of its library programme that aims at developing DSS (Boekhorst, 1995,p281). According to Fisher, DSS are more refined types of MIS. They offer information to managers from which they can make judgments and decisions concerning various situations (Fisher, 1994, p110).

1.12 The future of MIS in Academic Libraries:

Many academic libraries have, at a minimum, a simple and informal MIS. Academic libraries gather, compile, and analyze financial, collection, and services information so as to make decisions, and plan, control, and operate the library as effectively and efficiently as they can. The MIS activities outlined in this section are those used by some advanced libraries in the developed world; other libraries have simpler, more informal or fewer processes, whereas others have more complex or different activities. The entire process may be automated in some libraries; in others parts of the process require human intervention to create and maintain forms, and to enter data. Library staff members are still developing templates to ensure consistent compilation and reporting of data year to year. Automation, either through the integrated library system or microcomputer spreadsheets, is a tool that makes this process faster and more accurate, thereby increasing productivity as measured by the availability of the results. Most academic libraries have formally or informally implemented varying modules of a simple or complex MIS; it is important that this implementation be recognized as such and further developed.

Academic libraries need MIS for accountability to definitively illustrate the accurate management of financial resources and the resulting provision of services. Librarians must be able to prove to administrators that decisions are based upon a

formal process that applies plans and measurable data, and does not rely on whim or intuition. Thus, libraries can justify the expense of acquiring and maintaining integrated library systems by effectively using the report generating power to create and improve management information systems. Most libraries already have the basics of a MIS; it would be nearly impossible to manage an academic library in the 21st century without one (Fulweiler, 2001, p390).

1.13 Conclusion

Academic libraries are presently witnessing a high rise in costs of EJs and at the same time drastic reductions in their budget. This situation has made it imperative for them to introduce systems, which help in increasing their effectiveness at minimum costs. Thus, in the 80s libraries began to experiment with management approaches which include new concepts of ‘quality management’, and ‘knowledge management’ till they finally were able to adapt and integrate MIS or DSS procedures into the library organizational system. Moreover in recent years library managers are not only required to produce more management reports but also under more pressure to justify their activities and manage an effective library, which has made them resort to the Stakeholder’s approach and Transformation processing systems of management.

In order to begin applying these sophisticated management approaches libraries need to begin with an evaluation of performance which draws upon the databases already available in their automated systems. This will help library managers in effective decision-making.

Academic library managers also need to use a more formal planning process to focus their services on meeting users` needs that should be processed as: establishing overall objectives, allocating library resources to programs, and evaluating attainment of objectives.

Accountability is a major issue where library managers can use MIS as part of their strategic planning and evaluation processes to demonstrate and prove effectiveness (doing the right things) and efficiency (doing things right).

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