GUIDELINES FOR THE DEVELOPMENT OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS IN UNIVERSITY LIBRARIES IN NIGERIA

BY

Victor Chukwuma Igwilo

B.L.S.(Hons.), Ahmadu Bello University, Zaria, Nigeria, 1974

Graduate Certificate in Education, Ahmadu Bello University,

Zaria, Nigeria, 1974

Submitted to the Faculty of the

School of Library and Information Science

in Partial Fulfillment of the Requirements

for the Degree of Doctor of Philosophy

University of Pittsburgh

1980

DISSERTATION DEFENSE

Name of Student VICTOR IGWILO

Title Guidelines for the Development of Computer-Based Circulation Control Systems in University Libraries in Nigeria

Committee:

Name	Accept	Department
Jay Daily	x	DLS
Ellen Detlefsen	x	DLS
Blanche Woolls	x	DLS
K. Leon Montgomery	✓	IDIS

Major Advisor Allen Kent
Allen Kent - IDIS

Date Aug 18, 1980

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The overall purpose of this study was to provide guidelines for the development of computer-based circulation control systems for the university libraries in Nigeria. It was the thesis of the study that systems approach methodology and its related integrated systems concept in a distributive computing environment could be used in satisfying this purpose.

Designed to answer five basic research questions, the study included a review of the literature, questionnaire surveys, and interviews. The research instruments - three written questionnaires and three interview schedules - were developed, refined and pretested. The population sample for this study consisted of 1,104 librarians, systems specialists, and university faculty, staff and students from two universities, the Ahmadu Bello University and the University of Ibadan.

Sixty-seven percent of mailed questionnaires were returned. The results were tabulated and analyzed as they relate to the specific areas the study addressed. The Chi square test and T-test statistics were used first, to determine if differences existed in the way different groups and institutions involved in the study responded to similar questions. The analysis of the questionnaire and interview responses served mainly to provide the framework for the formulation of the guidelines. Expert opinion, recorded in the literature, served to fill in gaps, elaborate and provide rationale where needed.

Set against the needs of the libraries and the constraints in the Nigerian university environment, the opinion of the professional librarians and systems specialists, as well as drawing on the experience of experts expressed in the literature, the following conclusions were reached as guidelines for the development of computer-based circulation control systems in the university libraries in Nigeria:

a. In the development of computer-based systems in the university libraries in Nigeria the best approach is a logical process where possible applications are identified by looking at all library activities which are mostly labour intensive, and install them with the detailed perspective needed to assure that each separate unit can be linked with the other.

b. The development approach for computer-based circulation control systems would be based on an integrated systems concept with a machine-readable data base designed from the bibliographic record (catalog).

c. An integrated data base would be supplemented by the concept of distributed computing or processing. The idea is that both the mini and the mainframe computers should be used, with each processing need handled by the computer system best suited to it.

d. The development of computer-based circulation control systems should not be based on computing power supplied by commercial bureaux; rather the university computer center facilities would be used with a dedicated minicomputer installed within the library.

e. Given the present infrastructure in the country, a completely on-line real-time system will not be feasible immediately. Rather, an intermediate solution to the off-line/on-line provided by the hybrid concept would be adopted as a short range approach. In the long range approach, both the mini and mainframe computers would operate in an on-line mode based on the principles of "80% - 20%" rule. This suggests that approximately 20% of the circulation files (the highly active files) are retained in the library for processing with the dedicated minicomputer which would transact about 80% of the circulation data processing and information requirements. This means that although the mainframe computer has 100% of the files, it would only function when the minicomputer fails to satisfy a request or an action required.

ACKNOWLEDGEMENTS

Financial support for my graduate studies from the Ahmadu Bello University, Zaria, Nigeria, and the Federal Government of Nigeria is gratefully acknowledged.

I am gratefully indebted to my major advisor and chairman of my doctoral committee, Distinguished Service Professor Allen Kent for his guidance, dedicated support, patience, sympathetic understanding and constructive suggestions during the course of this investigation.

I am grateful to Dr. Ellen Gay Detlefsen, my academic advisor for her valuable guidance, optimistic encouragement and many helpful suggestions.

Special thanks to Drs. E. Blanche Woolls, Jay Daily and K. Leon Montgomery for their critical evaluation and helpful suggestions in all aspects of this work. The comaraderie which Dr. Woolls has promoted among the doctoral group has been a most rewarding aspect of my years in the school.

I wish to express my deep appreciation and sincere gratitude to the individuals and institutions who have contributed immensely to make this research a reality by granting me interviews or responding promptly to the questionnaires.

I wish to thank Mrs. Jan F. Buehler of the office of measurement and evaluation for generous cooperation in the data processing aspect of this work, and Mrs. Carol G. Kambic for her assistance in preparing the manuscript.

I wish to thank my wife, Agnes, and my children, Victor (jr.) and Ifeanyi whose moral support, patience, endurance and unselfish sacrifice were essential to the completion of this work.

Victor C. Igwilo

July, 1980

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CHAPTER I

INTRODUCTION

A. Automation and Library

> Technology presents us with a maze of paths and possibilities that could be tried. Yet there is not time, no money, not people enough to follow even a fraction of these paths to the end. Already the discussions seem endless: remote versus local processing, distributed versus centralized storage, large versus small system integration, processing versus storage, storage versus transmission, and so on. The trade-offs are dizzying, but until choices are made and paths selected, this abundance of possibilities cannot be turned into a wealth of realities ... Matthews (1)

Current trends in the practice of librarianship emphasize interest in automation activities in the library environment. The pace with which this interest is mounting is due to the increasing complexity of modern civilization and added significance of technological development. The question of computer usage in libraries is one that continues to occupy a great deal of attention. "It points to the pattern of change in library methods and trends. It is a change which has come to stay because it promises benefits which are considerable."(2) Young in an overview of automation outlined these benefits when he wrote that "the computer provides accuracy, consistency, reduction of duplicated efforts, speed, control, cost reductions, increased accountability, and more efficient use of human skill."(3) Boss has illustrated how indispensible computer technology is to libraries when he wrote as follows:

> Libraries are labour intensive organizations caught in a period of rising labour costs and diminishing income growth. Their situation is made even more complex by a rapid increase in the price of books, serials, and other library materials. The utilization of technology is the most promising option available. (4)

Consequently, "libraries turn to automation to reduce time-consuming clerical routines, to provide better service, new services and greater control over the collection."(5) A similar view was expressed by McDowell:

> The digital computer offers the librarian a means of storing and rapidly manipulating, sorting, collecting, editing, selecting, searching, amending and printing large volumes of data. It is fast, automatic and, if fed correctly very accurate ... it offers the chance to do analyses and provides services hitherto impossible. (6)

It is apparent then that the dimensions added to a library function by automation are speed of access, control of the operator over the path or course of search, and access to several computer capabilities. But as with all change, the application of the digital computer to library operations and the transition from manual to computerized systems can be either exciting and rewarding or it can be a nightmare.(7)

B. Context of the Study

In Nigeria, the university library occupies an important position in the university, providing a service of information and instruction. It is also "a necessary part of the researcher's tools without which he cannot make the most efficient use of his talent."(8)

The university library conceives its mission to be an essential component of the university, fostering the free interplay of ideas by functioning as an active and creative force for the

interaction of library services and resources with the campus community. "All evidence points to the fact that the Nigerian university faculty and student have no alternative to relying heavily on the university library resources at all times."(9) Funds limitations notwithstanding, book markets are few, and very often, wanted books are not readily available in the book stores. The problem of the Nigerian university student or faculty has been put succinctly by Osundina:

> The problem ... is not the question of wanting or not wanting to use the library. The question is whether or not the university library can provide for his needs in the first place, and secondly, whether or not he has access to what are provided. Because he has no funds to buy text books, or because the books are not even on sale in book stores, accessibility becomes, to him, a paramount factor in the achievement of his educational objectives.(10)

The circulation section of a university library is in a sense a control system, which provides access to and regulates the flow of books and other circulatable items in a fashion which responds to the needs of the university community, and maintains a continuous record of the library activities.(11) In this regard,

> circulation, as with most of the library functions, but with circulation in particular, needed the ability to meet expanded enrollments, larger book collections and changes, if not expansion, and the amount of materials used by the students and faculty.(12)

A diagnosis of the current Nigerian university library circulation control system shows that a crisis situation exists. While demand for materials is increasing, access to these materials is diminishing. Part of a report by the circulation section submitted to the university library management at the Ahmadu Bello University, Zaria in 1976 reads as follows:

> the circulation section offers lending services to the senior staff and students of the entire university. In doing this it uses a form of Brown Charging system. With growing number of readers, this had become inadequate because:
> 1. the operation is slow;
> 2. individual reader's holding is not easily known when desired;
> 3. the issue is too bulky;
> 4. searches for recall and reservation are laborious and frustrating;
> 5. error rate in filing is high.
>
> This is why all the members of the circulation staff wish to have something smoother since increase in staff does not necessarily result in increased efficiency.(13)

Soyinka reporting on the situation at Ibadan University library stated:

> ... it is recognized that the present manual system can hardly cope any longer with an increasing work-load without a corresponding growth in circulation staff. Yet, increasing staff strength is neither presently feasible ... nor desirable on account of the greater administrative overhead involved ... (14)

Another report by Olaosun (15) on the situation at the University of Ife library which said that "the manual issue used ... has proved to be problematic" summarizes the situation that exists at most of the university libraries in the country.

C. Need for Study

> Librarians have almost never been satisfied with circulation operations; users are perhaps even less happy. The reason is readily apparent. As more and more flexability was allowed, as collections and systems grew, management almost inevitably failed to allocate commensurate resources. Thus our goals of security, accuracy, and reliability of inventory control and speed of service were not achievable by available resources ... In a real sense, then, automated circulation systems are the first circulation systems that begin to meet the unrealized goals we aspired to at a price we can begin to afford. (16)

The present state of library circulation in the Nigerian universities already described shows clearly that the existing

systems are not adequate for the needs of the universities. The university library in Nigeria is overwhelmed by the volume and complexities of its circulation control systems. It is not uncommon for a patron to be denied the opportunity to use library material due to simple clerical error or a breakdown in communication between the circulation, bindery and cataloging departments. The massive volumes of data that result from library circulation are in many instances handled by outdated manual or semi-mechanized procedures resulting in duplication of work and data record, error in processing data, and problems with keeping files current. These difficulties create delays and inefficiencies in the operation of the total library system.

It is apparent that the situation is not just a question of more staff, more files or more books. It is a matter of changing archaic library and circulation procedures that shackle the libraries and instituting new management techniques to control library materials.

Several university librarians are exploring the possibility of developing computer-based systems.(17) Unfortunately, few of these librarians have sufficient skills or funding to do so. Yet librarians have a serious responsibility to be fully cognizant of the potential applications of computers in library work and to obtain the designs and systems best suited to Nigerian needs.

The circulation control system of the library involves a complex set of files. Foil (18) has observed that the increased capacity of file storage and sorting, and the increased speed of processing have made the computer a valuable tool for file processing applications of the type used in the circulation process.

One reason for the need to formulate guidelines for the development of computer-based circulation systems in the university libraries in the Nigerian environment is a public relations factor. The circulation system of a library is its most active public service point. The importance of a well designed and efficient circulation system cannot be over-stated.

Another reason concerns technological transfer.

> Until a few years ago, it was generally assumed that the most advanced technology used in the highly developed countries could and should be transferred to less developed countries ... an assumption which was shared by experts from both East and West ... (19)

Little or no regard was given to the conditions in these less developed countries. It is not uncommon to meet experts who still insist on the transfer of technology regardless of its inappropriateness and the difficulties such transfer would cause. It is the investigator's belief that any computer-based system to be developed must be based on its applicability in the environment in which it is to operate. "The fact that such a project may seem unsophisticated or uninteresting to Western experts is irrelevant. In the final analysis, the priorities of those who must operate and eventually pay for the project will prevail."(20)

The design and development of computer-based systems is another issue. In recent years, systems which control and monitor the circulation process in libraries have received widespread attention, but despite the best efforts of librarians and researchers, no guidelines have emerged for the development of computer-based circulation control systems in an environment that is technologically underdeveloped. Moreover, "there are hundreds of automated circulation

systems, but despite their common objectives, most of them are not transferrable to a different library environment."(21) While Miller and Coleridge have expressed that "the need is apparent for an off-the-shelf circulation control system which can be installed in any library and easily adapted to that library's requirement,"(22) a committee set up to look into the automation of the circulation control system in the Ahmadu Bello University library, Zaria, Nigeria, recommended as follows:

> As far as the house-keeping tasks of the serials and circulation sections are concerned, it is envisaged that computerization would be part of an integrated data system covering other sections of the library such as acquisitions and cataloguing...(23)

One of the implications of the committee's recommendation is that off-the-shelf circulation systems which are operational in libraries in developed countries such as the United States of America are not entirely suitable for the Nigerian environment and cannot be simply adopted for operation in the libraries. The alternative therefore is to design a system that is oriented to Nigeria.

Another reason to formulate guidelines for the development of computer-based circulation control system is the existence of a favourable climate for creating computer-based systems in the university libraries in the country. As a result of this, the need exists for methodology to analyze and design information processing systems that are relevant to university libraries "if we are to keep from getting further behind."(24) Furthermore, the prime objection of cost which has discouraged the use of computers in the past is now less significant. At present most universities in the country have some form of computer systems which can considerably reduce the

cost of development and reduce the delays that might otherwise be encountered.(25)

D. Statement of the Problem

. Several reports made at the workshop on library automation held in Nigeria in 1977 (26) present overviews of different plans and projects in the university libraries in Nigeria. Before this the process of automation development in these libraries was guided largely by intuition, with most of the projected automation systems being performed on ad hoc bases. Each library defined its own design, standard and procedures.

The past few years have seen many library automation projects fall by the wayside. Certainly, lack of funds was a factor, but this loss of library automation project also could be interpreted to indicate that these developments are without the theoretical framework which would provide the basis for useful applications. Yet it has been realized that Nigerian university libraries will have to resort to automation if they are to cope adequately with present day demands on their services.(27)

Although progress has been made in techniques to aid in formalizing computer-based circulation control system design, and various of such design activities have appeared in the literature, the adoption of computerized techniques in university libraries in Nigeria has been very slow and limited because of limitations imposed by environmental constraints.

The present ad hoc approach to automation prevalent in university libraries in Nigeria could result in effective or less

expensive services but there is no assurance as suggested by Carpenter that:

> 1. the resources required will not overtax the (library);
> 2. other changes could not have been made along with changes of primary interest; and
> 3. the designer has not overlooked more desirable combinations of techniques, operating procedures, personnel, material and equipment.(28)

It is not the intention of this study to ask whether or not to automate since it has been established through various reports made by the university libraries during the Ibadan Workshop on Library Automation in Nigeria that automation is feasible at university level, but to ask HOW?

E. Environmental Constraints[1]

No system operates with unlimited resources.(29) In order to develop a viable computer-based circulation control system, it is necessary to understand the structure of the system and the forces of the environment to which it is subjected. The environment of a system has been defined by Samuelson as "that which not only lies outside the system's control but which also determines in some way how the system performs."(30) He also defined environmental constraint as "the limiting conditions which are outside the organization and thus beyond the control of its management."(31) In this context, environmental constraints which are common to the Nigerian university libraries, and which may be applicable to other libraries in

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[1]Although much of the information are derived from data developed during the study and reported at the appropriate parts in this study, it appeared important to summarize the findings regarding environmental constraints very early in this work in order to provide context with the reader.

developing countries of the world with close similarities are:

1. The present computer configurations in the universities in Nigeria are designed to perform highly complex assignments. They are therefore most suitable for science, mathematics and engineering.(32)
2. Minicomputers capable of performing simple and fewer functions are not available in the computer centers.
3. Most of the computer centers cannot at present handle data processing in the library on-line.
4. On the average, most of the computer systems' up-time is 60%.
5. There is the problem of continuous instability in electric power supply for the proper functioning of the computer systems.
6. There is no guarantee that the library system would be given any priority when operational. In other words, not enough hours of dedicated computer time would be made available for the library operations.
7. There is the problem of availability of spare parts and maintenance crew.
8. There is shortage of skilled, well-trained system personnel within the library and the problem of staff turnover in the university computer centers.
9. There is the question of inadequacy of funds to support library automation programmes.
10. There is no historical information concerning computer-based circulation control systems projects that have been completed by any of the computer centers in Nigeria.

11. There is the question of adaptation rather than development based on local situation and resources.

In any system development exercise, it is necessary to identify both key and link elements which connect the library system under development to the fabric of the environment in which it is embedded.(33) The environmental element is of great importance to the functional ability of the library system which this research effort is aimed at developing. It is a determinant factor to the type of design structure which will emerge from this study.

F. Value of the Study

The value of this study is fourfold. It is:

1. A working tool to provide policy makers in the Nigerian universities with detailed enough guidelines to help them in making decisions necessary for setting up computer-based circulation control systems in the libraries.
2. A guide for librarians, systems analysts/designers, and all those interested in the area to understand the choices, decisions, priorities, advantages and interfaces that are possible and necessary in determining how best to deploy computer technology in their particular environment to make library automation a rewarding reality.
3. A guideline to reduce the disparities that have grown up among the various university libraries in Nigeria. It should serve to promote a consistent approach among these university libraries in their initial stages of computer-based circulation control system development.

4. A fundamental system development methodology which may be generalized and applied to other real libraries in developing countries of the world with close similarities.

References

(1) W. D. Mathews. "The Impact of Technology on the Governance of Library Networks." The Structure and Governance of Library Networks. Edited by Allen Kent and Thomas J. Galvin. New York: Marcel Dekker, 1979.

(2) Basil Amaeshi. "Mechanization of Cataloguing Services" Nigerian Libraries. 11 (April, August, 1975) 96

(3) Jo Micki Young et al. Introduction to Minicomputers in Federal Libraries. Library of Congress, Washington, D.C., 1978. (ED 168588) p. 17

(4) Richard W. Boss. "Circulation Systems: the Options" Library Technology Reports. 15 (January-February, 1979) 10

(5) Alice Harrison Bahr. Automated Library Circulation Systems, 1979-1980. 2nd ed. White Plains, N.Y.: Knowledge Industry Publications, 1979, p. 6

(6) B. A. J. McDowell et al. Circulation Control System. Southampton: University of Southampton, 1970. (Southampton University Library: Automation Project Report No. 1) p. 1

(7) Allan M. Rees. "Libraries and Information Centers" College & Research Libraries. 25 (May, 1964) 200

(8) S. M. Lawani. "An Assessment of the Holdings of Tropical Agricultural Periodicals in Nigerian Libraries" Nigerian Libraries. 10 (April, 1974) 1

(9) Oyeniyi Osundina. "The Relationship Between Accessibility and the Use Made of the Academic Library by Undergraduate Students" Nigerian Libraries. 10 (April, 1974) 41

(10) Ibid.

(11) B. J. Olufeagba. Computer and Circulation Control: an Introduction. Paper Presented at the Workshop on Library Automation in the Nigerian Libraries, March 7-9, 1977, Ibadan University Library, Ibadan, Nigeria. p. 7 (unpublished)

(12) Hugh C. Atkinson. "The Evolution of an Automated Circulation System" An Automated On-line Circulation System. Edited by Irene Braden Hoadley and A. Robert Thorson. Columbus, Ohio: Ohio State University Libraries, 1973. p. 3

(13) J. A. Fab Akhidime. Circulation Section Report to the University Librarian. Zaria, Nigeria: Kashim Ibrahim Library, 1976. (mimeo.)

(14) O. Soyinka. Preliminary Report on the Installation of a Computer-Based Circulation Control System at the Ibadan University Library. April, 1979. p. 8 (mineo.)

(15) Adebayo Olaosun. "Computer-Based Circulation Control for University Libraries in Nigeria" Zambia Library Association Journal. 9 (December, 1977) 90-98

(16) Barbara Evans Markuson. "Granting Amnesty and Other Facinating Aspects of Automated Circulation: a Review of Recent Developments for Non-Experts" American Libraries. 9 (April, 1978) 205

(17) Progress Reports. Papers Presented at the Workshop on Library Automation in the Nigerian Libraries, March 7-9, 1977, Ibadan University Library, Ibadan, Nigeria. (unpublished)

(18) Patti Sue Foil. "Survey of Data Collection Systems for Computer-Based Library Circulation Processes" Journal of Library Automation. 9 (September, 1976) 222

(19) Robert F. Mann. "Appropriate Technology and Information Services in Developing Countries" International Library Review. 10 (January, 1978) 23

(20) Ibid. p. 26

(21) G. Miller and F. A. Coleridge. "A Conceptual Model for Circulation Control Systems" ASIS. 28 (July, 1977) 196

(22) Ibid.

(23) J. A. Fab Akhidime et al. Computer Applications to the Circulation and Periodicals Sections. A Report Submitted to the Kashim Ibrahim Library, Ahmadu Bello University, Zaria, Nigeria. May 11, 1976. (mimeo.)

(24) J. F. Nunamaker. "A Methodology for the Design and Optimization of Information Processing Systems" System Analysis Techniques. Edited by J. Daniel Couger and Robert W. Knapp. New York: John Wiley, 1974. p. 359

(25) B. J. Olufeagba. op. cit., p. 21

(26) Progress Reports. op. cit.

(27) Adetunji Akinyotu. Library Automation, a State of the Art Review. Paper Presented at the Workshop on Library Automation in the Nigerian Libraries, March 7-9, 1977, Ibadan University Library, Ibadan, Nigeria. p. 29 (unpublished)

(28) Polly Carpenter. An Overview of Modia: a Method of Designing Instructional Alternative for Air Force Project Rand. 1972. p. 2

(29) K. Samuelson et al. Information Systems and Networks. New York: North-Holland, 1977. p. 18

(30) Ibid. p. 133

(31) Ibid. p. 18

(32) C. C. Ifebuzor et al. Automation and Library Co-operation for Nigerian Libraries. Paper Presented at the Workshop on Library Automation in Nigerian Libraries, Ibadan, March 7-9, 1977. p. 9

(33) Brian Rothery et al. eds. The Art of Systems Analysis. Englewood Cliffs, N.J.: Prentice-Hall, 1971, pp. 158-159

CHAPTER II

REVIEW OF RELATED LITERATURE

A. Introduction

> To say that technology is changing and developing rapidly is by now a platitude - but it is a major factor behind the indecision of (library) administrators when it comes to choosing specific approaches to automation. (1)

Automated circulation systems have become a major concern of libraries seeking more efficient ways of carrying out their activities and serving patrons. The literature on computer-based circulation control systems is extensive and varied in both content and quality. An examination of the literature shows that the application is world-wide involving public, academic, special and school libraries. The literature also records that automation activities have shifted from the simple unit record systems to more complex on-line systems, with emphasis shifting to networks and consortia.

The problem of development of computer-based circulation systems cannot be separated completely from the problem of systems development in general and data processing (information) systems development in particular. Therefore, this review will begin by scanning the relevant literature on systems concepts and terminologies. Then, computer-based circulation control systems in the university library environment will be reviewed under the following headings:

the Historical Perspective; Overview of Computer-Based Circulation Control Systems; Trends in Practical Operations and Technology in the United States of America; and Progress and Trends in Nigeria.

The review will be limited to the United States of America and Nigeria, and so does not include any information about activities in other countries. However, the investigator recognizes and acknowledges the fact that the development of computer-based circulation systems has reached its highest point in most developed countries of the world.

B. Systems Concepts and Terminologies

1. General

> Managing a large organization is fundamentally a matter of coping with complex systems (as) the organization itself constitutes a system ... (2)

In order to gain a real understanding of the planning and control process within an organization, one must first understand the concept of a system.(3) Bertalanffy defines a system as "a set of elements in interrelation among themselves and with the environment."(4) Ackoff (5) and Alexander (6) give a similar definition. This means that there are at least two elements or components in an entity called a system, each of which is connected to every other element or component directly or indirectly. Emery has said that "the parts of a system are themselves composed of subparts;"(7) and Ackoff has also stated that "every system can be conceptualized as part of another and larger system,"(8) *suggesting that each element or component of the* system may itself be composed of other elements or components thus comprising a system within the original system. The smaller system

may be considered as a subsystem of the original larger system.

"The essential characteristic of a system is that it is composed of interacting parts, each of which has interest in its own right,"(9) but linked through interfaces which takes the form of inputs and outputs.

Jishi has summarized Ackoff's (11) classification of systems according to the following criteria:

1. By the nature of their elements; abstract systems have conceptual elements, concrete systems contain at least two objects.
2. By the system's relation to its environment; a closed system has no environment, an open system does.
3. By the number of states which a system may have over time; a static system has only one state, a dynamic system has multistates.
4. By the behavior of the system with respect to its output; it may be "state-maintaining," a "goal-seeking," a "multi-goal-seeking," a "purposive," or a "purposeful" system.
5. By the effect of the relationship of the elements on the system; there are "variety increasing" and "variety reducing" systems, the first enhances the properties of the elements (allowing for the establishment of higher order systems), the second reduces the effectiveness of the elements when combined into the system. (There are also "separable" and "unseparable" systems depending on the effect the performance measure of a component may have on the state of the other components.)
6. By the nature of their adaptability (the ability to modify itself or its environment) ... (10)

Hassell has also brought together related system concepts which include such classifications as:

1. Natural versus mechanized systems.
2. Closed versus open-loop systems.
3. Adaptive versus non-adaptive systems.
4. Manual versus automatic systems.
5. Open versus closed systems. (12)

In spite of these classifications of systems, "different terms are used to refer to the same thing and the same term is used to refer

to different things."(13) Nonetheless, Jishi(14) has emphasized the importance of these classifications and concepts when he suggested that the common characteristics which certain types of system have, can be made use of in the study of the properties of a system which otherwise might not be clear; and that the determination of the type of system based on these classifications would help in the study of such a system. One must, of course, be aware that not all entities are systems, "the differentiating feature of systems is that they can be separated into parts and that the parts work together for the sake of the whole."(15)

2. University Library Circulation Systems

In the United States, the genesis of the concept of systems in the library parlance started with the public library's goal of bringing library services to all.(16) Library services were organized into large units with the regional units of service developed into a public library system.(17) Two basic elements of a system were important to the development of these public library systems in accordance with the ALA standards:

1. the provision of accessibility of service;
2. a pool of resources and services in depth and variety used in common by all the outlets.(18)

The concept of system was further expanded as years went by and seen less as public library units serving larger areas and more as library units involving libraries of various types in inter-organizational or intergovernmental relationships.(19) Lambert takes a further step by formalizing the library as an information system when he defined a library as:

> ... an organized whole with a definite organizational structure and objective and which consists of a set of parts and elements that have definite characteristics and that are in specific relations to each other. The individual parts and elements together with their characteristics and relations form the internal organizational structure of an information system.(20)

Other views that are similar to that of Lambert are those of Baker (21) and Hassell (22) where the emphasis was on total system view point portraying the library as a tripartite, closed-loop, information service system involving users, funders, and servicers; Debons and Montgomery who view the library as "a conglomerate of information systems as well as being an information system iteslf."(23) Their point of departure was "the library (as) ... an information environment largely focussing on document transfer operations;"(24) and Taylor (25) who views the library as a document transfer and data access system.

Emery(26) has distinguished between two types of systems; one whose primary transformation deals with physical input and output, with information serving as a means of coordination, and the second which deals only with information, as in management information system, or information service system.(27) Sparks (28) defines an information service system as one which operates in an environment including both the information to be processed and the population of users who require various portions of this information. This definition reflects the operations of the circulation unit of a university library, in which case, the library circulation unit can be classed as a management information system according to Emery's systems classification. Also, the elements or components identified by Baker and Hassell respectively, namely, users, funders, and

servicers, are the same as those of the circulation unit. In this case, the circulation unit can be referred to as an information service system. The only limitation in Baker's and Hassell's system concept of the library is that the data element is totally ignored.

Based on this background, the circulation system of the university library can further be conceptualized as:

1. A dynamic (multi-state) system because an event occurs, and its state changes over time.
2. A multi-goal-seeking and purposive system because it collects information as it occurs in the environment, and distributes to its users only that information which they need. In other words, the circulation system is set to perform more than one function in an attempt to achieve different goals and ovjectives set by the management. What functions it performs is not a matter of its choice, it is also determined by the management.
3. An open system because of its interaction with the environment in which it exists. Hall (29) shares this view when he says that many systems are open in that they exchange materials, energies or information with their environments. Patrons' data provide a typical example of exogenous input to the circulation system since it is typically obtained from users in the environment.

4. A concrete system because at least two of its elements or components are objects.
5. A mechanized system as libraries are in every respect considered as such, even though the entities which form them and the environments in which they exist may contain many natural systems also.(30)
6. An adaptive system because it could react or respond to a change in its environmental and/or internal state which reduces its efficiency in pursuing one or more of the goals that define its function(s).

Another important classification which Folley (31) has successfully dealt with is that of manual versus automatic concept. Under this classification, some circulation systems are semi-automatic systems which indicate that some of their functions are performed by humans and some by machines. Large, completely or partially automatic systems currently offer an alternative concept because they are technically feasible at the present. But large, manual systems are rapidly becoming extinct because they are too inefficient (32) and so do not provide an alternative library system concept in the university library context.

These concepts of the library circulation systems are important from a system development view point since the data processing and information functions which must be performed are defined and emphasized on them.

C. Library Automation: the Historical Perspective

The term "automation" became part of the librarians' vocabulary starting in the 1960s, and has been used since then with library functions such as book ordering, fund accounting, serials processing, cataloging, circulation and information retrieval. Heiliger and Henderson (33) have suggested that:

> the introduction of improved process capabilities and of random-access storage in the early 1960s marked the beginning of a decade of intensive mechanization efforts and the prelude to automation ...

This phenomenon also brought the possibilities of substantial mechanization to the attention of librarians. In general, the rationale that explains why librarians become involved in automation was summarized by the conclusion of a study made in 1962 of the potential of applying advanced data processing in a university library which stated that:

> the speed of computers and the wide range of routine that they can handle offer possibilities for alleviating the pressures of personnel shortages and turnover, of increased volumes of inventory and user activity, and of demand for more up-to-date records.(34)

Alper (35) in his review article identifies three stages of historical development of computer application to libraries. These are:

1. the stage of intellectual endeavour (research);
2. the stage of development; and
3. the practical operational stage.

There are, however, no clear distinctions between one stage and another, in fact, there are overlaps.

The intellectual endeavour (research) stage was characterized, as De Gennaro (36) puts it, by either visionary papers written by

information scientists or librarians speculating on how computer technology would or would not change libraries in the future; or detailed technical papers written by systems librarians describing how and where to apply computer technology in the library systems. Notable contributors at this stage are Shaffer,(37) Quenzel,(38) Stein,(39) Culbertson,(40) Hayes(41) and Hammer.(42) Some of the articles written by these authors describe the changes that automation was going to bring, usually giving limited predictions concerned with technological advances and possible uses. Some saw automation as the answer to all library problems; others saw automation as merely doing the same thing libraries were doing but faster, more efficiently and more or less expensively. As the technology became more functional most of these predictions became irrelevant as new potentials were revealed and some old assumptions abandoned.

The developmental stage presumably started with the appointment of a team by the Council on Library Resources to survey the possibilities of automation in large research libraries in the United States. Among the conclusions of this committee were that:

1. automation can within the next decade augment and accelerate a library's services;
2. automation will facilitate the development of national library system;
3. automation of book processing, catalog searching and document retrieval are technically feasible;
4. automation will reduce the cost-to-performance ratio ...(43)

During this period, a series of important conferences and seminars which brought together librarians and information scientists with engineers and computer specialists were held at many library centers such as Washington, D.C.(44) Illinois,(45,46) and Massachusetts. (47) A series of projects were described. The LC MARC and the MIT INTREX

programs were among the important projects discussed. Other projects of note were those described by the Palo Alto Office of Computer Usage Company,(48) Jahoda's report on 25 projects utilizing data processing equipment in library record maintenance,(49) the Markuson review of automation development in the Library of Congress(50) and the project at Harvard discussed by Palmer.(51) According to Veaner, "with these, library automation passed from fantasies and dreaming to experimentation, research and development projects."(52)

The practical operational stage in the historical development of library automation is the massive application of computer technology to library operations with variations according to computer technology and configuration. Salmon (53) reported that there was a fairly widespread use of punched card data processing equipment up to 1960. Lancaster and Fayen (54) have also stated that during 1960-69, more general application of digital computer techniques to technical processes in an off-line, batch processing mode was widespread. From 1970 to the present, definite trends toward the design of on-line systems and conversion of batch systems to on-line mode predominate. De Gennaro,(55) Martin(56) and Salmon(57) have written outstanding papers on this subject.

While library automation has become a common phenomenon, "a small but strident minority continues to delude itself with the belief that it is useless to apply computer to bibliographic problems."(58) Mason,(59) and Melcher(60) among others are still skeptical of computer applications to library operations.

D. Overview of Computer-Based Circulation Systems

1. General Overview

Three reports have been made available in the Library Technology Reports. Markuson (61) produced the first full report on computer-based library circulation control systems in 1975. This report gives a detailed description of development and technical characteristics of various systems available, their vendors and the functions of a computer-based circulation control system. This report was updated by Scholz (62) in 1977. Scholz categorizes computer-based circulation control systems into two, absence systems and inventory systems. Inventory systems are those which contain a computer-readable record for all copies of titles held by a library which is using the system, while the absence systems are set up in such a way that the record for an item which is in circulation is created only when that item actually circulates. He further states that computer-based circulation systems can also be divided into those which are on-line and batch systems. The evaluative aspect of this report is useful, but the emphasis on commercially developed systems with little or no attention to systems otherwise developed is a limitation.

The third report in this series by Boss (63) published in 1979 describes extensively the general criteria and desirable features for accessing a computer-based circulation system. It is an excellent presentation of development and technical characteristics of circulation control systems currently available under manual, photocharging, batch processing, stand-alone, distributed, and front-end systems respectively. The main limitation of Boss's paper is that no critical evaluation of the systems described are made. It does not,

therefore, offer much help to someone whose aim is to examine the existing systems in order to develop one. However, the eight functional criteria for an ideal circulation system are helpful contributions.

Another article by Markuson (64), Granting Amnesty and Other Fascinating Aspects of Automation, provides a comprehensive overview of some general developments in library circulation technology, vendor and network approaches to circulation, problem areas, and some hints on system procurement. Markuson says that the minicomputer is the technical development most basic to wide-scale automation of circulation systems while bar-coded and optical character recognition(OCR) inventory control systems are recent technological developments which eliminated the host of problems associated with the error-prone keying of each transaction or the use of the punched card for item identification. According to her, the trend seems to be towards the use of commercially available generalized data management and operating systems with Gaylord, CLSI, ULISYS, Systems Control, Data Phase, Cincinnati Electronics, Universal Library Systems and 3M predominant. The local (in-house) developments which are good and cost-effective remain an important component of automated circulation systems with Northwestern University, Ohio State University and University of Chicago libraries as good examples. Furthermore, there has been interest in the development of automation of library circulation in a network environment. OCLC Inc. has included circulation control functions as a planned future service, and the University of Toronto library automation system which has expanded across Canada to British Columbia has announced its CIRC system, which it describes as an

on-line catalog and circulation control system in a network environment.

Dranov (65) traces the origin of computer-based circulation systems from the in-house developed, off-line systems to the on-line, minicomputer-based inventory control systems. She discusses the rational for computer-based circulation control systems development, the process involved in the process of transfering from manual to automated system and cost. She then goes on to discuss the available systems, their capabilities, the software, conversion requirements, maintenance and cost. Dranov points out that large academic libraries prefer home-grown or in-house systems structured by library systems personnel around the existing campus computer center. These libraries require more capabilities than the packaged systems offer. As for the packaged systems, they give the library just about everything it needs, except that they are designed with the needs of all libraries in mind, not the needs of specific library.

In her work on automated circulation systems, 1979-80, Bahr(66) clarifies the terminology and the issues involved in the automation of circulation systems. Such terminologies like home-grown, packaged, absence, inventory, off-line, on-line; and issues like call number versus access number, OCR label versus bar-coded label, conversion, electronic security system, interface, and cost are extensively discussed, pointing out problems and prospects of each in automation process. She discusses the criteria for system acquisition including decision process and organizational factors influencing the decisions. She points out that the final decision with regards to system acquisition rarely depends on price alone, for while cost is important, system

capability and options for future enhancements are vital considerations. According to her, the real innovation in system design is already available: increased flexibility. It is possible for a library whose institution has hardware available to purchase system software and terminals to operate its circulation system on the existing computer.

Grosch (67) in her Minicomputers in Libraries, published in 1979, provides an excellent survey of the minicomputer systems developed for library use and their capabilities. Three minicomputer configurations are identified as most popular with the libraries: the dedicated stand-alone system which handles an individual library's processing; the front-end minicomputer linked to a host computer as a communication device linking the main computer to various terminals, as well as performing both transaction verification and capturing transaction functions; and the multiple minicomputer network systems which can enable a large library with many branches to build its own internal networks.

2. Application Development

(i) System Configurations. According to Elchesen,(68) typically, under an arrangement where an automated data processing service center (the computer center) is used for library operations, a user library has little direct control of the computer operations. If there are a large number of other users, computer time may be at a premium and may be allocated on a priority basis. Quite often, under such circumstances, libraries are at a disadvantage because their overall worth to the parent organization is not perceived as being high enough to warrant sufficiently large computer-time

allocation. Elchesen elaborates the above view as follows:

> ... Many large general-purpose time-sharing systems support a large number of interactive daytime users. The peak periods of on-line computing often coincide with the hours of greatest activity at the library circulation ... Therefore, on-line library housekeeping ... might be forced to compete for processing time with many users during the least desirable periods of the day.(69)

Elchesen reporting on the Lawrence Livermore Laboratory experience noted that:

> operating within the framework (where the library relies completely on the services provided by the computer center) reduced the quality of the library services. Scheduling conflicts with other user groups were encountered and work often became backlogged ...(70)

However, Grosch has noted that:

> Design advances and manufacturing techniques have brought about more flexible, more powerful computer packaged in physically smaller cabinets. These designs, together with improvements in the languages needed to program computer systems, have produced a family of relatively low cost, powerful computers that present the computer user with many alternatives to the conventional large scale computer system usually shared by many users.(71)

The above factor has resulted in a significant move toward providing computer users with their own systems. Grosch has identified two concepts applicable in the development of computer-based circulation control systems, namely, modular and distributive computing.

> The modular computer system is one in which the user initially acquires sufficient computing resources for his or her immediate or short term future needs, but has the option of easily adding computing resources to the system for long term future growth, without a major or significant redesign or programming of the system. In this sense ... minicomputer system represents modular system when compared to conventional computer systems designed around a large central computer system shared by many users.(72)

On the other hand, distributive computing concept is based on the philosophy of placing as much computing power as is needed for a user's task directly within the user's physical environment.(73)

(ii) *Centralized and Decentralized Processing Versus Distributed Processing (Distributive Computing).* Wu (74) and Spangle (75) have both observed that it is generally recognized that data processing should be centralized to achieve economy of scale. Wu (76) said that this recognition is based on the assumption that if an organization has committed much of its funds to the mainframe computer it will certainly attempt to maximize its utilization, and the centralized concept is logically consistent with the goal of utility - maximization. Another issue that led to centralized approach was that the overall goal of an information system is to provide controlled access and sharing of data within an organization, recognizing a need for coordination, security, integrity, synchronization, consistency, timeliness, and availability.(77) The centralists also argue that a good amount of program and data incompatibility still exist. So the best steps to take in such instances, is first to get things under control and then to remove the incompatibilities by putting all applications on a central system.(78)

According to Wu,(79) this trend has changed, and it is arqued now that centralization tends to disregard peoples' feelings and needs. The systems people decide how and what information is to be produced. The user simply accepts what is given. Ziegler (80) says that centralized data processing system has the effect of adding greater effort on maintaining satisfactory availability, large

up-front planning, management of acceptable response time, responsiveness to users' application requirements, and maintenance of privacy. Another argument against centralized processing is that of vulnerability.(81) On the other hand, Burch and Strater (82) have argued that decentralization of processing offers greater redundancy in files, duplication of efforts, and permits lack of standardization in an organization.

These problems naturally lead to the concept of distributing the information processing resources across two or more geographically separated locations within an organization. The distributed system is the latest fashion in computer system technology which permits hardware and software and data files to be located in different physical locations. They can be separated according to optimum need, and yet interconnected when necessary so that their physical distance is not apparent.(83)

Distributive computing also known as distributed processing has been defined by Spangle as "two or more processors altering or managing data in a cooperative manner."(84) According to Spangle,

> this definition implies much more than just communicating data between sites. It involves the possibility of putting advanced data processing power where it is most needed in an organization, as well as providing top management with central control of the total enterprise. ... (He further observed that) computing systems of the 1980s will satisfy both central and local users requirements by putting processing power where the application need exists, and tying the sites together in a total system environment.(85)

Ziegler (86) said that the intent of a distributed system is to provide a logically integrated information system while providing for physical distribution of data over two or more computing facilities.

Ziegler further defines a distributed system as one that:

> interconnects multiple homogeneous and heterogeneous nodes to exchange data, share resources, and execute multiple well-defined and interrelated software components {program} in one or more nodes ... Distribution of control involves the allocation, finding and accessing of network resources and the synchronization of such services as update and maintenance.(87)

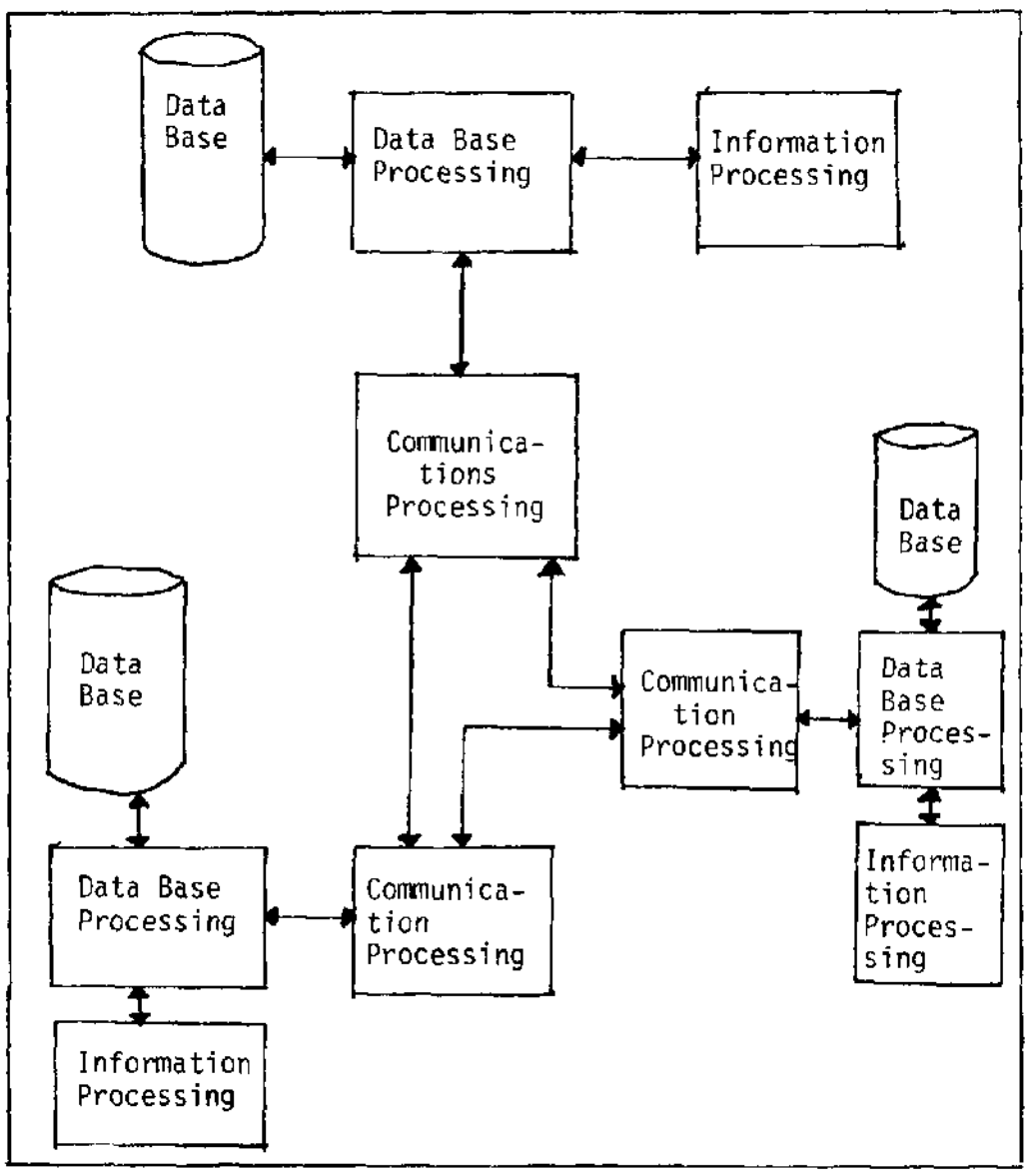
Wu pointed out that:

> to allow the distribution of information processing, multiple CPUs must be used, with each location having its own local CPU, Each local CPU, called a node, can process local data to satisfy the needs of the local management. If there is a central node with a greater processing capability, any job that the local node cannot handle will be assigned to the central node. Each local node is linked to its data base, which may be a copy of the central data base ...(88)

Figure 1 shows a distributed processing system environment.

Figure 1

Completely Distributed System*



* Source: Frederick H. Wu. "Distributed DP Provides for Local Data Needs" Computerworld. July 30, 1979. Special Report/3

Distributed data processing systems take many forms of which three are outstanding in the library environment. Grosch categorizes them as follows:

> In one type, a large scale computer acts as the host or central computer (which) supports communication, accessing and updating of files ... of potential use to a local minicomputer ... The local minicomputer performs data entry, data verification, message formating ... maintaining frequently accessed file information and indexes to the host processor's files. In the second type, a minicomputer with sufficient disk drives and on-line terminals are used to support a variety of application performed on a local data base. A third type involves separate dedicated minicomputer systems to serve separate functions within a library ...(89)

The distributed concept has dramatically and suddenly changed the system design philosophy. No longer is it necessary that data processing facilities be centralized.(90) A distributed information system allows flexibility by reducing implementation constraints of traditional centralized or decentralized information processing systems. It allows for maximizing isolation while providing a high level of sharing of costly resources, such as high-speed computing and mass storage. Also it makes it possible to reduce response time and communication costs, and provide higher availability.(91)

Compared with the centralized systems, distributed systems have the following advantages:

1. Under local direction, the system is flexible.
2. The system is more responsive to the user.
3. Systems analysts are more responsive to user problems, personnel and requirements.
4. Some claim that, once installed, distributed systems using minicomputers have lower operating costs, particularly for on-line and real-time systems in which a large CPU bears all overhead costs.
5. Distributed systems are ideal for implementing real-time applications.
6. Since a system failure in one node does not affect the others, the system as a whole is more reliable.

On the other hand, there are disadvantages:

1. The initial cost of a distributed system's software and hardware may be too high for the approach to be considered viable by the management...
2. Because there is a smaller DP staff at (the local node), personnel turnover can make the local system vulnerable.
3. Friction between the local DP staff and the central headquarter's staff may arise when the latter attempts to enforce the policy of uniformity in system design.(92)

The attraction and versatility of the distributed processing system approach have been summarized by Spangle when he wrote as follows:

> I'm very excited about some of these new possibilities, and by the benefits that are now in sight for our users. First, there will be balanced growth of central sites, with corresponding growth around them. I should add that the minicomputer is the ideal tool for off-loading selected, time-consuming functions from the central processor and distributing those functions to the appropriate work units, with a resulting extension of the functionality and a more rational way to expand the system. Second, since many elements of the computer can be working on different portions of the same task, the work may be done faster. Third, there's the benefit of more economical back-up in case one element of the system should go down.(93)

(iii) Integrated System Approach Versus Single Application Approach. Grosch,(94) in her Minicomputers in Libraries, 1979-80, said that the basic premise of single application development is to define a set of procedures, both human and computer-related, to achieve a desired result. Thus libraries have developed procedures to fulfill the acquisition, cataloging or other departmental responsibilities in a library. Most of the turnkey systems are designed, marketed and maintained by vendors, which supply a complete system of software and hardware to perform a defined application.

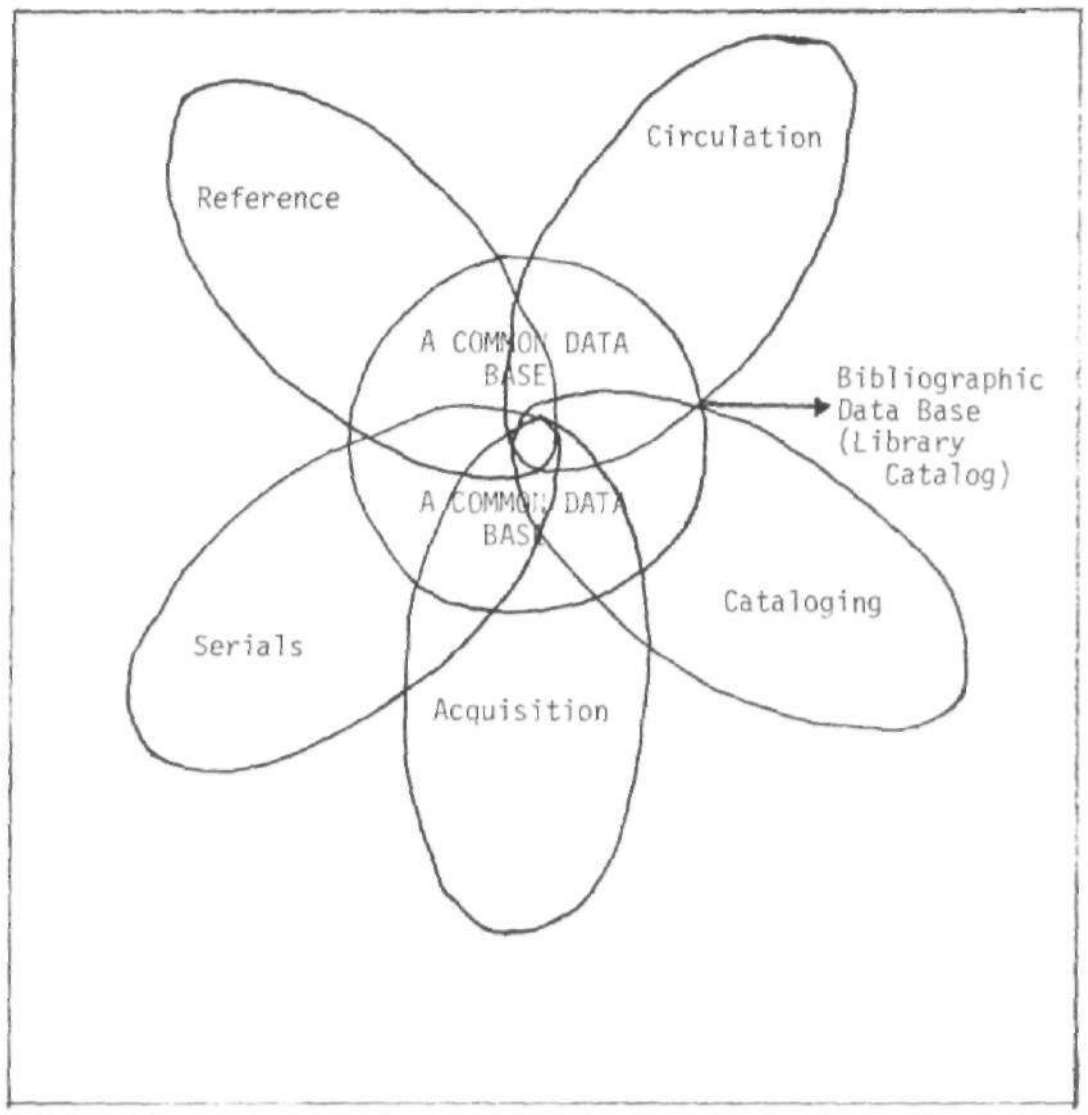
With librarians recognizing that there is overlap and possibility of shared data in each of the systems, they have started to require a system which integrates these tasks through the development of an integrated data base. Most of in-house developed systems are based on an integrated data base system approach.

Breslin and Tashenberg have defined an integrated data base as the organization of information in a file structure which represents the total information requirements of the user.(95) The basic principle is that different applications and transactions from the same organizational units can be processed simultaneously.(96) Thus, the circulation transactions, bibliographic information for cataloging and acquisitions may be overlapped and processed concurrently. McGee(97) has also said that the term integrated system usually implies a system in which centralized, minimally-redundant files undergo shared processing by different library functions. Figure 2, which is adapted from Libaw's (98) Cognitive Systems' Imbricated Model of Information Transfer, shows an overlapping pattern of processing in a library environment. The core of the system is a machine-readable record. From that core, any library system other than the circulation system can be initiated. It actually shows an interrelationship among the units and accentuates the labour and time-saving aspects of having multiprocessing capabilities from one machine-readable record or records.

Burch and Strater said that the progression towards integrated system approach was due to dissatisfaction with hierarchical approach because of fragmentation and non-coordination of information function.(99) They further identified the basic characteristics

Figure 2

An Integrated Data Base System: Library System*



* Source: Frieda B. Libaw. "A New Generalized Model for Information Transfer" American Documentation (October, 1969) 383

of an integrated system as:

> 1. fast response time to queries via remote terminal;
> 2. on-line mass storage;
> 3. instantaneous and simultaneous updating of files; and
> 4. centralized batch processing in addition to on-line processing ...
>
> even though remote terminal and remote processing are listed as characteristics of integrated system, it is possible to design such a system without these characteristics, depending upon the accessing requirements ... it is conceivable, for example, that all activities could be handled in batch mode.(100)

On the bright side, the existence of this organization of information prevents duplication of data, provides standardization, reduces processing and maintenance costs, and provides faster and more meaningful access to, and reporting of, data.(101) On the other hand, this approach is very expensive to implement, may be difficult to maintain, and takes longer time to implement. Fallback and recovery are more complicated with machine failure.(102)

(iv) Mode of Operation. "Computer-based systems for (library) circulation can ... be divided into those which are on-line and batch."(103) Boss (104) has said that,

> batch processing is the periodic computer processing of data after a number of similar data input item have been accumulated. Initially the data was gathered on punched card. Later magnetic tapes or disks were used, but in each case processing on a computer would take place only periodically.

Buckland and Gallivan (105) wrote that the commonest approach to computer-aided circulation control is to operate in the off-line (batch) mode. Such systems can perform the basic operations of issuing and discharging books in an economical manner but because they operate in an off-line manner they cannot easily update files or

detect delinquent readers at the point of issue. Boss (106) has further said that the present state of technology makes a strictly batch operation not economical.

In an on-line processing mode "transactions are recorded, files are instantly updated and the most current information is immediately available to library staff."(107) While this mode of operation has been acknowledged as the best, it has also been said to be the most expensive to operate.

"An intermediate solution to the off-line (batch)/on-line dilemma is provided by the hybrid approach..."(108) This approach follows the principle of the distributed processing concept. According to Buckland and Gallivan,(109) the gaps in an off-line system could be plugged effectively, with flexibility and relatively cheaply by using a dedicated on-line minicomputer in the library backed up by a mainframe computer employed in batch mode.

E. Trends in Practical Operationg and Technology in the United States of America

The literature search revealed that library automation has moved through four generations of systems development. According to Grosch (110) the initial generation is composed of the unit record equipment systems. The general purpose computer that became widely available in the 1960s made possible a second era of library automation which involved the move to digital computer in batch processing environment. The on-line systems ushered in the third generation, and opened up the possibility of communicating among libraries with centralized facilities and decentralized input. The fourth generation

consists of widely integrated applications systems supported by on-line computer systems operating in either network or stand-alone environment. This latest development depends upon the employment of distributive computing concept through low cost modular computers.

Unit Record Systems (the first generation) use a limited logical capability and deal with a single record at a time in a basically mechanical way. Salmon (111) reported that the common equipment in use includes a keypunch, a sorter, a collator and a tabulator such as the IBM 402 or 407. In this kind of system, there is no memory storage of information. In most cases a deck of punched cards in which required information is recorded is used to provide various types of output. Parker,(112) Salmon,(113) Hirst,(114) Pratt(115) and Birnbaum(116) gave accounts of significant efforts which have been made on the scene of academic library circulation systems.

In off-line batch processing systems (the second generation), the data and the programs are delivered to the computer in machine-readable form, usually generated from punched card, paper tape or magnetic tape input; the computer then process the job, and delivers the desired output. Dunlap,(117) in his state-of-the-art review, reported that punched cards are the most common type of computer input, although some systems use paper tape or magnetic tape produced by a keyed data recorder, thereby eliminating the punched card entirely. According to the review, the obvious advantages of off-line batch processing over the unit record systems are speed, accuracy and the ability to store and manipulate data. Once the data are entered

many more operations could be performed, and more importantly, "the system could remember information regarding book orders in progress, books held or on loan, and so forth, all on magnetic tape."(118)

The literature reveals that the IBM 357 and 1030's data collection devices were basically used in circulation control systems at this stage. These applications produced a computer printed loan record, list of reserves, books on loan and statistical analysis. McCoy (119) and Heiliger (120) have reported that Southern Illinois University in Carbondale and Florida Atlantic University libraries employed the IBM 357 data collection system. It was possible to have a machine-punched book card and a machine-readable borrower's identification card that could be read by the IBM 357, thereby eliminating manual punching. Ruecking (121) described the Rice University system which used IBM 357 devices for data collection, but unit record equipment for processing. Salmon (122) describes the system in Washington University in St. Louis which implemented the first computerized IBM 357 system of one-record variety, using punched book-cards produced in already automated cataloging system. A survey by Gull in 1969 (123) shows that over fifty libraries were using IBM 357 system.

By 1966, the trend shifted to the use of IBM 1030 which was faster, quieter and more reliable data collection device. Palmer (124) has reported that the University of British Columbia installed twenty-nine 1030 units, plus a PDP-11 minicomputer to control them and create daily transaction tape. The processing itself is done on a Honeywell 200 and an IBM 370/155. Other popular systems and their users have been discussed by Buckland in his Survey of Automated Library Systems, published in 1973.(125)

The on-line processing systems (the third generation) comprise on-line processing which according to Mader and Hagin (126) is sometimes referred to as direct access or real-time processing. On-line means that a communication line exists connecting the user's site to the computer with data files organized to allow computer access to them directly, or within a matter of seconds. According to Salmon,(127) in on-line systems the status of each item's availability is current at all times, whereas in off-line systems one day's activities are not reflected until the next day.

More on-line systems have been installed for circulation control than for any other purpose basically because the bibliographic information used need not be extensive or complex. Kershner (128) and McGee (129) have reported that typically two types of on-line circulation systems are currently operational. One operates against the active circulation file, and the other against the entire shelflist inventory, requiring conversion of the shelflist.

Veneziano (130) says that the Northwestern University system is an example of the system which operates against the active circulation file, and uses four book-charging stations which consist of an IBM 1031 terminal connected to a 370/135 computer and a 1033 printer, designed for self-service charging. Other circulation functions such as processing renewals and discharging are performed at the circulation desk using an IBM 2740 typewriter terminal. Another example is the University of Chicago JRL circulation terminal system described by McGee.(131) The system utilizes specially designed JRL 1000 circulation terminals whose major components are a 31-column printer, a light-pen that reads bar-coded lables, and an interface which permits

optical use of a CRT.(132) The Ohio State University system, which is an example of the type which operates against the shelflist inventory, has been described in an institute devoted to a study of the Ohio State University library unique on-line, real-time circulation system.(133) The latest development shows that the system utilizes a complete machine-readable shelflist file stored in a 2319 disk on-line. The library control system runs on an IBM 370/168 with 4 meg (million bytes) of core storage. The on-line files are maintained on eight Mod-11 disk drives with 92 CRT and typewriter terminals providing access to the on-line system. The system allows borrowing and information on document status by telephone calls.(134) Foil,(135) Buckland et al.,(136) Kershner(137) and McGee,(138) give accounts of significant efforts which have been made on the scene of circulation at this level.

Cost factors and resource sharing need have been responsible for the development of networks and minicomputers (the fourth generation) configurations. Becker and Olsen, after identifying the varieties of contexts in which the term "networks" is used, note that it is widely applied to the banding together of existing information systems into some type of communication cooperative.(139) Markuson says that,

> Network developments are of interest because of their potential for integration of circulation with other shared network functions; for the possibility of member participation in development of system specifications; and for cost sharing of system development and operation.(140)

Markuson has further pointed out that "a control circulation system provides a mechanism for resource sharing, particularly when cooperating libraries are in geographic proximity."(141) One example

of such a circulation control system is at the State Library of Ohio which uses the circulation functions of LCS (Ohio State University Library Control System). This system "makes possible reciprocal borrowing privileges for the OSU (Ohio State University) and State Library of Ohio patrons."(142) Other planned library automated circulation system networks include OCLC, Inc. and the University of Toronto Library Automated System (UTLAS) which serves 46 libraries and has already expanded across Canada to British Columbia.(143)

The minicomputer was described by Markuson as:

> the technical development most basic to satisfactory, wide-scale automation of circulation. The price, flexibility, and sophistication of the mini made it the first computer satisfactory for library processing that could be purchased at a reasonable cost, operated in a library environment, and run by library staff ... it has been the basis for packaged, vendor-developed system and is now becoming the basis for distributed circulation networks tied into a large bibliographic data base.(144)

Bahr (145) and Grosch (146) have given good directories of installed minicomputer-based circulation control systems and the manufacturers offering them.

F. Progress and Trends in Nigeria

Serious interest in computer application to library processes is a comparatively recent phenomenon in Nigeria. Until a few years ago it was generally assumed that computer technology was not viable in Nigerian libraries, an assumption highlighted by Greeves when she wrote:

> Computers are, as yet, not economically viable in this country (Nigerian library environment). The amount of material processed is rather small and manual labour is still cheap in comparison with that of Europe and America.(147)

This assertion was true for some time, but not for too long. Librarians, especially those in the university libraries, soon realized that Nigerian university libraries would have to resort to automation to cope with the demand on their services.(148) It was not until 1975 that Nigerian librarians started to call for the use of computer technology for data processing and bibliographic control in the university libraries.(149,150,151,152) Olufeagba in his Computer and Circulation Control: an Introduction, observed that:

> Despite diversification and reorganization, the alarming rate of growth of entries and requests requires an exponential growth in staff if a satisfactory level of service is to be achieved in a manual, labour-intensive structure. The increased number of personnel, however creates additional managerial problems and could further aggravate errors in the system due to human factors.(153)

The future appears to be full of prospects for automation of library systems, especially the university library systems in Nigeria. An indication of this is contained in the various reports given at the library automation workshop held in Ibadan in 1977.(154) In a paper presented by Akinyotu at the Ibadan workshop (155) it was stated that only three university libraries had experience with library automation. Others had only expressed intention to undertake some form of automation.

The first use of computer technology was at the Ibadan University library. The serial records from this library were placed on the computer in April 1973.(156) A print-out of 1225 pages of its serials records was delivered to the library by the university's computer center in 1975. Since 1976, the catalogue of serials in the university library is computer-produced. The university library has projected a computer-based union list of serials for all the university

and reserach libraries in Nigeria, the automation of reserve book collection and circulation control, and the production of a machine-readable catalogue. The University of Lagos library analyses its fund slips for book purchases by means of computer, and has plans for an integrated acquisitions, cataloging and circulation system.(157,158)

At the Ahmadu Bello University library, an in-house computer system is being developed. Two terminals have been installed at the circulation desk, while the writing and testing of the programmes by the computer center staff have been going on since 1976. The union list of serials held by the Ahmadu Bello University library complex is computer produced.(159)

The University of Nigeria, Nsukka library (Nnamdi Azikiwe library) is still experimenting on computerizing the serials holdings and the circulation control system with the aid of the computer center in the university.(160) Nothing concrete has emerged yet.

The University of Benin library established a research group in 1975 "to determine the best method of producing a computer generated serials list for the university library and harmonizing the list with such lists in other university libraries in Nigeria to facilitate interlibrary cooperation."(161) This group has come up with a design showing the specifications for a computer-generated list of periodicals. Later in 1976, another group, the Library Automation Group, was established at Benin which will work in close cooperation with the Research Group towards the complete automation of acquisitions, cataloging and circulation units of the library.(162)

The state-of-the-art shows that only the Ahmadu Bello University library (Kashim Ibrahim Library) has demonstrated its

ability to install a computer-based circulation control system, although it is not yet fully operational. An important and outstanding contribution in the field of library circulation in Nigeria is a paper titled Computer and Circulation Control: an Introduction, presented by Olufeagba during the library automation workshop at Ibadan in 1977.(163) The paper discusses the use of the digital computer as a circulation control device, and presents some aspects of design of a computer-based circulation control system. Among the conclusions of the paper is that:

> It is clear that the computer as a circulation control tool can simplify implementation of daily transactions in a library and offers advantages that recommend it in most instances over the usual manual circulation control system. The prime objection of cost ... is now of less significance especially since most universities (in Nigeria) now have some form of computer system. Even cheaper solutions combining low-cost with versatility and security, based on recent development in micro-computer systems can be envisaged. The development of software for such systems should however be undertaken by a joint venture by several university libraries utilizing local experts ...(164)

This kind of careful analysis is required as a prelude to the development of a successful automated circulation control system in the Nigerian environment.

References

(1) Susan K. Martin. "Turnkey Systems: How to Avoid Locking Yourself In" American Libraries. (February, 1979) 80

(2) James C. Emery. Organizational Planning and Control System: Theory and Technology. London: Collier-MacMillan, 1969. p. 1

(3) Ibid.

(4) Ludwig Von Bertalanffy. "The History and Status of General Systems Theory" Systems Analysis Techniques. Edited by J. Daniel Couger and Robert W. Knapp. New York: John Wiley, 1974. p. 17

(5) Russell L. Ackoff. "Towards a System of Systems Concepts" Management Science. 17 (July, 1971) 662

(6) M. J. Alexander. Information Systems Analysis: Theory and Applications. U.S.: Science Research Association, 1974. p. 4

(7) James C. Emery. op. cit., p. 3

(8) Russell L. Ackoff. op. cit., p. 663

(9) Russell L. Ackoff. "Systems, Organizations, and Interdisciplinary Research" Systems: Research and Design. Proceedings of the First Systems Symposiun at Case Institute of Technology. Edited by Donald P. Eckman. New York: John Wiley, 1961. p. 28

(10) Jamel Abdulla Jishi. A Systems Approach to the Selection of Industrial Development Projects in the less Developed Countries. A Dissertation Submitted to the Graduate Faculty of School of Engineering in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy. University of Pittsburgh, 1974. pp. 39-40

(11) Russell L. Ackoff. "Towards a System of Systems Concepts" op. cit., 662-669

(12) Horace Paul Hassell. An Analytical Design Framework for Academic Library System Formulation. A Dissertation Submitted to the Graduate School of Library Science. Purdue University, 1968. pp. 17-20

(13) Russell L. Ackoff. "Towards a System of Systems Concepts" op. cit., p. 27

(14) Jamel Abdulla Jishi. op. cit., p. 39

(15) C. West Churchman. The Design of Inquiring Systems. New York: Basic Books, 1971. p. 49

(16) Robert R. McClarren. "State Legislation Relating to Library Systems" Library Trends. 19 (October, 1970) 235-236

(17) Barbara Olsen Slanker. Administrative Structure of Public Library Systems and Its Relationship to the Level of Service Offered by Member Libraries. Illinois: University of Illinois, 1970. p. 8

(18) American Library Association. Standards for Public Library Service. Chicago: ALA, 1956.

(19) Robert R. McClarren. op. cit., p. 236.

(20) J. Lambert. "Systems Design in Library and Information Services: the Czechoslovak Experience" International Library Review. 7 (October, 1975) 461-467

(21) Norman R. Baker. "A Descriptive Model of Library/User/Funder Behavior in a University Library Environment" The Library College: A Method of Learning. Graduate School of Library Science, Drexel Institute, Philadelphia: December 18-21, 1966. US Clearing House, Report PB-174-439.

(22) Horace Paul Hassell. op. cit.

(23) A. Debons and K. L. Montgomery. "Design and Evaluation of Information Systems" Annual Review of Information Science and Technology. Edited by A. C. Caudra et al. Washington, D.C.: ASIS, 1974. Vol. 9. p. 49

(24) Ibid, p. 27

(25) Ibid., p. 32

(26) James C. Emergy. op. cit., p. 3

(27) Horace Paul Hassell. op. cit., p. 25

(28) David E. Sparks et al. A Methodology for the Analysis of Information Systems. Wakefield, Mass.: Information Dynamics Corporation, 1965

(29) A. D. Hall. A Methodology for Systems Engineering. New York: D. Von Nostrand Company, 1962

(30) Horace Paul Hassell. op. cit., p. 18

(31) John D. Folley ed. Human Factors Methods for System Design. Pittsburgh:The American Institute for Research, 1960.

(32) Robert E. Machol et al. eds. System Engineering Handbook. New York:McGraw-Hill, 1965

(33) Edward M.Heiliger and Paul B. Henderson. Library Automation: Experience,Methodology,and Technology of the Library as an Information System. New York:McGraw-Hill,1971. p. 7

(34) Louis A.Schultheim et al. Advanced Data Processing in the University Library. New York: Scarcrow,1962.p. 20

(35) Bruce H. Alper. "Library Automation" Annual Review of Information Science and Technology. Edited by C. A. Caudra et al. Washington, D.C.: ASIS, 1975. Vol. 10. p. 199

(36) Richard De Gennaro. "Library Automation: Changing Patterns and New Trends" Library Journal. 101 (January, 1976) p. 175

(37) Kenneth R. Shaffer et al. "Push Button Bibliography, Today and Tomorrow" Bulletin of Bibliography. 24 (1974) 73-78, 86-88

(38) Carral H. Quenzel. "Some Proposals for Handling the Information Problem: a Brief Bibliographical Essay" American Documentation. 14 (1963) 145-148

(39) Theodore Stein. "Automation and Library System" Library Journal. 89 (1964) 145-148

(40) Don S. Culbertson. "The New Library Science: a Man-Machine Parternship" PNLA Quarterly. 29 (1964) 25-31
"Another Tower of Babel?" Library Journal. 88 (1963) 940-943

(41) Robert M. Hayes. "Automation and the Library of Congress: Three Views" Library Quarterly. 34 (1964) 229-239

(42) Donald P. Hammer. "Automation Operations in a University Library: a Summary" College & Research Libraries. 26 (1965) 19-29, 44

(43) "Automation and the Library of Congress" College & Research Libraries. 25 (1964) 120

(44) Libraries and Automation. Proceedings of the Conference ... Held ... Under the Sponsorship of the Library of Congress, National Science Foundation, Council on Library Resources, Inc. Washington, D.C.: Library Science, 1964.

(45) Clinic on Library Application of Data Processing. 2nd, Urbana Campus, University of Illinois, 26-29 April, 1964. Proceedings. Edited by Herbert Goldhor. Champaign, Ill.: University of Illinois Graduate School of Library Science, 1965. p. 117.

(46) Ralph H. Parker. Automation in the Library of Congress: Yesterday, Today and Tomorrow. Seminar on Library Automation in Libraries. Illinois: Dept. of Library Science, Rosary College, 1966. pp. 12-26

(47) Planning Conference on Information Transfer Experiments (INTREX), Wood Holes, Mass., 2 August-3 September, 1965. Report. Edited by Carl F. J. Overhage and R. Joyce Harman. Massachusetts: MIT, 1965. 276 p.

(48) Computer Usage Company, Inc. Specifications for an Automated Library System. Prepared for the University of California at Santa Cruz, Calif. Palo Alto, 1965. 122 p. (unpublished)

(49) Gerard Jahoda and Ferrol A. Accola. "Library Records Prepared with the Aid of Data Processing Equipment." College & Research Libraries. 26 (1965) 129-137

(50) Barbara E. Markuson. "A System Development Study for the Library of Congress Automation Program" Library Quarterly. 36 (1966) 197-233

(51) Foster M. Palmer. "Conversion of Existing Records in Large Libraries, with Special Reference to the Widener Library Shelflist" The Brasenose Conference on the Automation of Libraries, Oxford, England, 30 June-3 July, 1966. Proceedings. London, 1967

(52) Allen Veaner. "Perspective: Review of 1968-1973 in Library Automation" Library Automation, the State of the Art II. Edited by K. Martin and B. Brett. Chicago: ALA, 1975. p. 6

(53) Stephen R. Salmon. "Library Automation" Encyclopedia of Library & Information Science. Edited by Allen Kent, et al. New York: Marcel Dekker, 1975. pp. 338-339

(54) F. W. Lancaster and E. G. Fayen. Information Retrieval On-Line. Los Angeles, Calif.: Melville, 1973. p. 2

(55) Richard De Gennaro. op. cit., pp. 175-183

(56) Susan K. Martin. "Tools for the Information Community" Library Journal. 101 (January, 1976) 163-168

(57) Stephen R. Salmon. op. cit., pp. 338-445

(58) Allen B. Veaner. op. cit., p. 6

(59) Ellsworth Mason. "The Great Gas Bubble Prick't or, Computers Revealed by a Gentleman of Quality" College & Research Libraries. 32 (1971) 183-196
_____ "Along the Academic Way" Library Journal. 96 (1971) 1671-1676

(60) Daniel Melcher. "Cataloging Processing and Automation" American Libraries. 2 (1971) 701-713

(61) Barbara Evans Markuson. "Automated Circulation Control Systems: an Overview of Commercially Vended Systems" Library Technology Reports. 1 (1975)

(62) W. H. Scholz. "Computer-Based Circulation Systems: a Current Review and Evaluation" Library Technology Reports. 13 (May, 1977) 231-325

(63) Richard W. Boss. "Circulation Systems: the Options" Library Technology Reports. 15 (1979) 108 p.

(64) Barbara Evans Markuson. "Granting Amnesty and Other Fascinating Aspects of Automated Circulation" American Libraries. 9 (April, 1978) 205-211

(65) Paula Dranov. Automated Library Circulation System, 1977-78. White Plains, N.Y.: Knowledge Industry Publications, 1977. 102 p.

(66) Alice Harrison Bahr. Automated Library Circulation Systems, 1979-80. 2nd ed. White Plains, N.Y.: Knowledge Industry Publications, 1979. 103 p.

(67) Audrey N. Grosch. Minicomputers in Libraries, 1979-1980. White Plains, N.Y.: Knowledge Industry Publications, 1979. 142 p.

(68) R. Elchesen. "Dedicated Versus Resource Shared Library Computer Systems" Special Libraries. (July, 1976) 301

(69) Ibid. p. 301-302

(70) Ibid. p. 302

(71) Audrey N. Grosch. op. cit., p. 43

(72) Ibid. p. 45

(73) Ibid. p. 44

(74) Frederick H. Wu. "Distributed DP Provides for Local Data Needs" Computerworld. (July 30, 1979) Special Report/3

(75) C. W. Spangle. "Impact of Distributed Systems" Data Management. 16 (January, 1978) 16

(76) Frederick H. Wu. op. cit.

(77) K. Ziegler. "A Distributed Information System Study" IBM System Journal. 18 (1979) 375

(78) Richard G. Canning ed. "The Challenges of Distributed System" EDP Analyzer. 16 (August, 1978) 6

(79) Frederick H. Wu. op. cit.

(80) K. Ziegler. op. cit., p. 375

(81) Judson Breslin and C. Bradley Tashenberg. Distributed Processing Systems: End of Mainframe Era? New York: Amacom, 1978. p. 108-109

(82) John G. Burch and Felix R. Strater. Information Systems: Theory and Practice. New York: John Wiley, 1974. p. 78

(83) Frederick H. Wu. op. cit.

(84) C. W. Spangle. op. cit., p. 17

(85) Ibid.

(86) K. Ziegler. op. cit., p. 375

(87) Ibid. p. 376

(88) Frederick H. Wu. op. cit.

(89) Audrey N. Grosch. op. cit., p. 74-75

(90) Frederick H. Wu. op. cit.

(91) K. Ziegler. op. cit., p. 375

(92) Frederick H. Wu. op. cit.

(93) C. W. Spangle. op. cit., p. 17

(94) Audrey N. Grosch. op. cit., p. 17

(95) Judson Breslin and C. Bradley Tashenberg. op. cit., p. 96

(96) Ibid., p. 24

(97) Rob McGee. "Two Types of Designs for On-line Circulation Systems" Journal of Library Automation. 5 (September, 1972) 157-163

(98) Frieda B. Libaw. "A New, Generalized Model for Information Transfer: a Systems Approach" American Documentation. (October, 1969) 383

(99) John G. Burch and Felix R. Strater. op. cit., p. 80

(100) Ibid., p. 80-81

(101) Judson Breslin and C. Bradley Tashenberg. op. cit., p. 24

(102) John G. Burch and Felix R. Strater. op. cit., p. 86

(103) W. H. Scholz. op. cit., p. 248

(104) Richard W. Boss. op. cit., p. 30

(105) M. K. Buckland and B. Gallivan. "Circulation Control: Off-line, On-line, or Hybrid" Journal of Library Automation. 5 (March, 1972) 31-32

(106) Richard W. Boss. op. cit., p. 30

(107) Alice Harrison Bahr. op. cit., p. 105

(108) R. C. Young. "United Kingdom Computer-Based Loans Systems: a Review" Program. 9 (July, 1975) 105

(109) M. K. Buckland and B. Gallivan. op. cit., p. 34-35

(110) Audrey N. Grosch. "Library Automation" Annual Review of Information Science & Technology. Edited by Martha Williams. Washington, D.C.: ASIS, 1976. Vol. 11. p. 1

(111) Stephen R. Salmon. op. cit., p. 339

(112) Ralph H. Parker. "Development of Automatic Systems at the University of Missouri Library" College & Research Libraries. 23 (1962) 231-232, 264-265

(113) Stephen R. Salmon. "Automation of Library Procedures at Washington University" Missouri Library Association Quarterly. 27 (1966) 11-14
_____ Library Automation Systems. New York: Marcel Dekker, 1975. Chapter 2

(114) Robert I. Hirst. "Adopting the IBM MT/ST for Library Application: a Manual for Planning" Special Libraries. 59 (1968) 626-633

(115) E. Carl Pratt. "International Business Machines' Use in Circulation Department, University of Florida Library" Library Journal. 61 (1942) 302-303

(116) Henry Birnbaum. General Information Manual: IBM Circulation Control at Brooklyn College Library. New York: IBM, 1960

(117) Connie Dunlap. "The Automation of Acquisitions Systems" Library Automation, a State of the Art Review. Edited by Stephen R. Salmon. Chicago: ALA, 1969. p. 39

(118) Stephen R. Salmon. "Library Automation" Encyclopedia of Library & Information Science. op. cit., p. 339

(119) Ralph E. McCoy. "Computerized Circulation Work: a Case Study of the 357 Data Collection System" Library Resources & Technical Services. 9 (Winter, 1965) 59-65

(120) Edward Heiliger. "Florida Atlantic University Library" Proceedings of the 1965 Clinic on Library Application of Data Processing. Champaign, Ill.: I.U.B.S., 1966. pp. 92-111

(121) Frederick Ruecking. Circulation Control at Rice University Using IBM 357 Data Collection System. New York: IBM, 1965.

(122) Stephen R. Salmon. Library Automation Systems. New York: Marcel Dekker, 1975. pp. 192-194

(123) C. D. Gull. "Automated Circulation Systems" Library Automation, a State of the Art Review. Edited by Stephen R. Salmon. Chicago: ALA, 1969. p. 141

(124) Richard Phillips Palmer. Case Studies in Library Computer Systems. New York: Bowker, 1973. p. 33

(125) Lawrence R. Buckland et al. Final Report, Phase XI: Survey of Automated Library Systems. Massachusetts: Inforonics, 1973

(126) Chris Mader and Robert Hagin. Information Systems: Technology, Economics, Applications. Chicago: S.R.A., 1974. p. 33

(127) Stephen R. Salmon. Library Automation Systems. op. cit., pp. 192-194

(128) Lois M. Kershner. "Users Services: 1973 Application Status" Library Automation: a State of the Art II. Edited by K. Martin and Brett Butler. Chicago: ALA, 1975. p. 40

(129) Rob McGee. "Two Types of Designs for On-line Circulation Systems" op. cit., pp. 184-202

(130) Velma Veneziano. "An Interactive Computer-Based Circulation System for Northwestern University; the Library Puts it to Work" Journal of Library Automation. 5 (Summer, 1972) 101-117

(131) Rob McGee. "The University of Chicago Library's JRL 1000 Circulation Terminal and Bar-Coded Labels" Journal of Library Automation. 8 (1975) 5-25

(132) University of Chicago. General Circulation System: Overview. Chicago: University of Chicago Library, 1979. 28 p.

(133) Irene Braden Hoadley and A. R. Thorson eds. An Automated On-line Circulation System: Evaluation, Development, Use. Proceedings and Papers of an Institute Held at the Ohio State University, September 13-14, 1971. Columbus, Ohio: Ohio State University Libraries, 1973. 90 p.

(134) Ohio State University. Library Control System. Columbus, Ohio: Ohio State University Libraries, 1979. 2 p. (mimeo.)

(135) Sue P. Foil. A Comparative Study of Data Collection Systems for Computer-Based Library Circulation Processes. Mississippi: Mississippi State University, 1975. 60 p.

(136) Lawrence R. Buckland et al. op. cit.

(137) Lois Kershner. op. cit., pp. 38-44

(138) Rob McGee. A Literature Survey of Operational and Emerging On-line Library Circulation Systems. ERIC ED 059 752. 1972

(139) Joseph Becker and Wallace C. Olsen. "Information Networks" Annual Review of Information Science & Technology. Edited by C. A. Caudra. Chicago: Britanica, 1968. v. III. pp. 289-327

(140) Barbara Evans Markuson. op. cit., p. 208

(141) Ibid.

(142) Ohio State University. op. cit., p. 1

(143) Barbara Evans Markuson. op. cit., p. 209

(144) Ibid., pp. 205-206

(145) Alice Harrison Bahr. op. cit., pp. 87ff

(146) Audrey N. Grosch. op. cit., pp. 91-127

(147) Monica Greeves. "Trends in Technical Processes" Nigerian Libraries. 8 (1972) 91

(148) Adetunji Akinyotu. Library Automation: a State of the Art Review. Paper Presented at the Workshop on Automation in Nigerian Libraries. Ibadan, Nigeria: University of Ibadan, 1977. p. 29

(149) Ibid.

(150) Basil Amaeshi. "Mechanization of Cataloguing Services" Nigerian Libraries. 11 (April, August, 1975) 96

(151) Adebayo Olaosun. "Computer-Based Circulation Control for University Libraries in Nigeria" Zambia Library Association Journal. 9 (December, 1977) 90-98

(152) Sam Ifidon. Nigerian Libraries and Librarianship in the 80s. A Paper Delivered at the 1976 NLA Conference, Port Harcourt, Nigeria. p. 19

(153) B. J. Olufeagba. Computer and Circulation Control: an Introduction. Paper Presented at the Workshop on Library Automation in Nigerian Libraries, March, 1977. Ibadan, Nigeria: University of Ibadan, 1977. p. 1

(154) Progress Reports. Papers Presented at the Workshop on Library Automation in Nigeria. Ibadan, Nigeria: University of Ibadan, 1977.

(155) Adetunji Akinyotu. op. cit., p. 28

(156) Ibadan University Library. Automation at Ibadan University Library: A State of the Art Report. Presented at the Workshop on Library Automation in Nigeria. Ibadan, Nigeria: University of Ibadan, 1977. 7 p.

(157) Adetunji Akinyotu. op. cit., p. 28

(158) Sam Ifidon. op. cit., p. 19
_____ "New Developments in the Nigerian Library Scene" International Library Review. 11 (January, 1979) 47

(159) H. L. Stephen. Computer Applications to Kashim Ibrahim Library: An Outline of Progress. (4th October, 1979) Zaria, Nigeria: K.I.L., 1979. 5p

(160) University of Nigeria Library. Automation Committee Progress. Prepared by M. W. Anyakoha, Presented at the Workshop on Library Automation in Nigeria. Ibadan, Nigeria: University of Ibadan, 1977. 2p.

(161) University of Benin Library. Progress Report: Automation in Benin University Library. Presented at the Workshop on Library Automation in Nigeria. Ibadan, Nigeria: University of Ibadan, 1977. p. 1

(162) Ibid., 7 p.

(163) B. J. Olufeagba. op. cit., 23 p.

(164) Ibid., p. 21

CHAPTER III

RESEARCH METHODS AND PROCEDURES

A. Objectives of the Study

The objective of this study is to formulate guidelines for the development of computer-based circulation control systems in the university libraries in Nigeria.

The method used in satisfying this objective emphasizes the systems approach viewpoint of design and its related integrated systems concept in a distributive computing environment. The ultimate goal is to develop a framework from which the design structure and systems specifications for computer-based circulation control systems will emerge.

B. Research Questions

In order to formulate guidelines for the development of computer-based circulation control systems in the university libraries in Nigeria, it was necessary to find the answers to the following questions:

1. What is the present state-of-the-art of activities performed and services offered by the circulation control systems in the university libraries in Nigeria?

The task here addresses not only what services are performed, but also the approach and methodology utilized and their deficiencies.

2. What are the goals, objectives, functions, and systems products of a computer-based circulation control system proposed for the Nigerian university libraries?

The task here addresses the throughput expectations for the system both quantitatively and qualitatively, and anticipated activities for a computer-based circulation control system in the Nigerian university library environment.

3. What alternative approaches are preferred for the development of computer-based circulation control systems in the university libraries in Nigeria?

The task here addresses the computer configurations, operating modes, data base structure, important records and basic file processing.

4. What is the design structure of the proposed circulation control system for the university libraries in Nigeria?

The task here addresses not only the "architecture" of the system but also the systems components, their capabilities, and how the system relates to other systems within the library.

5. What are the obstacles to the development of computer-based circulation control systems in the university libraries in Nigeria? What options are available?

The first part addresses the resources capacity, including the technological environment, and other conditions which might impose limitations on the system development. Given the environmental constraints, the second part of the question addresses the options available and the preferred one in the given situation.

C. Definition

In the context of this study, development involves a process whereby all relevant information is utilized to formulate a method of implementation that will achieve a desired objective. Development in this sense involves the determination of goals and objectives; and the preparation of realistic decisions to ensure that the goals and objectives will be reached through the reasonable use of available resources.

D. Assumptions

For this study, the assumptions are as follows:

1. That a well-designed automation system, installed with proper planning and preparation, not only will result in an operation better than the manual system it replaces, but one that will allow the library to deliver good service from its collections.(1)
2. That the best system for a library depends on so many local factors that only detailed analysis can support the ultimate decision.(2)
3. That different methods of approach to computer-based systems development may have different effects on the automation development process in a given library.
4. That by applying the systems approach technique to system development, it is possible to develop guidelines for the development of a computer-based library circulation control system that will have a positive effect on the process of total library automation development in university libraries in the Nigerian environment.

5. That the method of approach to computer-based circulation control system development in the Nigerian context may apply to the automation development process in libraries in developing countries of the world with close similarities.

E. Scope and Limitation of the Study

A computer-based circulation control system development is part of a wider range of information processing activities called systems development. While the purpose here is not so much to review the systems development process itself, but rather to discuss how such development is affected by a library environment, this study considers a computer-based circulation control system in the broader context of systems development.

As Nigeria will provide the major focus, the thirteen university libraries' circulation systems will be studied generally. Two of these libraries and two computer centers at Ahmadu Bello University, Zaria, and University of Ibadan, Ibadan will be analyzed in details as to data, user, capabilities, and system requirements for circulation control systems. Both will be considered in the light of a definition of automation needs derived from the role university libraries in Nigeria are called upon to play, and based on the present technological stage and rate of development.

It is beyond the scope of this study to present estimates of staff, direct cost of the elements of the system and the systems programming requirements. The estimates on direct cost of systems elements and staff may be out of date by the time this study is completed.

F. Methodology

1. System Approach

The systems approach methodology will be used to develop a circulation control system framework. With the systems concepts introduced in chapter II, what remains here is the investigation of the meaning and the rationale in the systems approach methodology for this research. Churchman (3) in his Design of Inquiry Systems, observed that many systems are difficult to study as a unified whole, thus making it necessary to study the system through a study of its components, although the focus of the study must be directed at the result of the system as a whole. This approach has been found useful in systems development and design because its objective is to:

> focus on systems taken as a whole, not on their parts taken separately. Such an approach is concerned with total system performance even when a change in only one or a few of its parts is contemplated because there are some properties of systems that can only be treated adequately from a holistic point of view.(4)

Through this approach also, "the organization is viewed as an interlocking, coordinated assemblage of subsystems whose connections look more like a network than a hierarchy..."(5)

This scientific method approach provides the guidelines for arriving at solutions through planned and systematic collection, analysis and interpretation of data rather than by mere intuition or experience. While this study does not lend itself to the testing of hypotheses in the experimental sense, it is concerned with discovering elements or factors critical in the successful development of computer-based circulation control systems in the Nigerian environment, which also demands systematic collection, analysis and interpretation of data.

2. Data Collection

(i) Sample Size. The population sample which was investigated in this study includes: ninety-one leading librarians or systems specialists who either participated in the workshop on library automation in Nigeria or are deemed experienced in computer-based systems development in Nigerian university libraries; the heads of circulation control systems in the thirteen university libraries in Nigeria; and one thousand selected faculty, staff and students of the Ahmadu Bello University and the University of Ibadan respectively, the two institutions selected for this purpose.

For the interviews conducted for this study, two university libraries in the United States and two university libraries and two computer centers in Nigeria were selected. Although it was planned to interview the heads of these libraries and computer centers respectively, it turned out that persons other than the heads were also interviewed.

(ii) Data Collection Method. Primary techniques used for data collection were: analysis of literature, questionnaire surveys, and interviews.

(a) Analysis of Literature. Personal examination of available literature on systems concepts, planning and development; library circulation control system technology available; and automation activities in the university libraries with particular emphasis on circulation control system was carried out. Major sources consulted include: Annual Review of Information Science and Technology,

LARC Reports, Library Technology Reports, Journal of Library Automation, Journal of the American Society for Information Science, American Libraries, College & Research Libraries, Library Resources & Technical Services, American Documentation, International Library Reviews, Nigerian Libraries, Conference and Workshop proceedings, and monographic series that deal with circulation control systems. These sources provided information relating to the development of operational systems, available technology and related theory and practice of systems planning and development.

(b) Questionnaire Surveys. Three questionnaires were developed for data collection for this study. One was designed for the heads of circulation control units of the thirteen university libraries in Nigeria. Another was for the leading librarians or system specialists who participated in the library automation workshop at Ibadan, Nigeria, and a few selected librarians experienced in library systems development in the Nigerian University libraries, but were not in the workshop. The last was designed for selected faculty, staff and students of two universities selected for the purpose, namely, the Ahmadu Bello University, Zaira and the University of Ibadan, Ibadan.

1. Questionnaire to Heads of Circulation Units. The heads of the circulation units are understandably the chief operators of the circulation systems whose views and cooperation are indispensable if a successful computer-based circulation control system could be developed. It is in recognition of this fact that the questionnaire (Appendix A) was mailed to each of the thirteen university libraries for their respective circulation unit heads.

The questionnaire was designed to obtain an overall picture and understanding of the condition of the present circulation control system; the structure of its organization; and to gather essential information for the determination of the requirements for a computer-based system.

2. Questionnaire to Leading Librarians and Systems Specialists Who Participated in the Library Automation Workshop at Ibadan, Nigeria. The questionnaire (Appendix B) was designed to seek expert opinion on the goals, objectives, functions, systems products and design for computer-based circulation control system in the university libraries in Nigeria. The investigator shares the view expressed by Simon (6) which said that expert opinion as a method of obtaining knowledge can often be useful as a source of objective information that might be more difficult to collect by other techniques. It is also the view of the investigator that information obtained from this source will help towards a better library circulation automation development plan that will meet the needs of the country.

3. Questionnaire to Selected Faculty, Staff and Students of the Ahmadu Bello University, Zaria and the University of Ibadan. Since these groups are the users of the present library systems, the questionnaire (Appendix C) was designed to identify the purpose of using the library, the amount of time spent in getting items located within the library or obtaining information on circulating library materials, and the

present level of performance in terms of information obtained from the circulation desk. The responses obtained will help towards a better understanding of the library circulation department situation from the users point of view, and help to better plan to meet their needs.

(c) Interviews. Interview guides were developed to aid in conducting interviews and soliciting information from the following: computer centers of the Ahmadu Bello University and the University of Ibadan; the management of the Ahmadu Bello University and the University of Ibadan libraries; and two institutions in the United States of America (University of Chicago Library and Ohio State University Library).

The rationale behind the selection of only two out of thirteen universities in Nigeria, and two out of the numerous institutions in the United States, for the purpose of interview was based on the opinion of the investigator. It was the belief of this investigator that it was possible to generalize from this group of institutions because they are the best equipped and could possibly highlight requirements and constraints in the development of computer-based circulation systems. This approach has been reported by McAllister and Bell (7) in the investigation of the success of Project Intrex, a prototype computerized information retrieval system developed at the Massachusetts Institute of Technology in 1971, when the sample population was limited to four users who were exceptionally knowledgeable about the professional literature covered in the Intrex system, and so were best equipped to test the maximum efficiency of the system.

1. Interview with Computer Centers of the Ahmadu Bello University, Zaria and the University of Ibadan. The interview guide (Appendix D) was directed at getting information from the directors of both centers with reference to the scope of the data processing environment. This included the computer hardware and software, their capabilities, interfaces; compatibility of hardware and software; provision of staff; and the success of the present computer configuration for accommodating library data processing. This part of the interview was very important for the development and ultimate implementation of computer-based systems in the university libraries. In fact, it was the determinant factor as to the type of system that would emerge from this exercise.

2. Interview with the Library Administrators of the Ahmadu Bello University and the University of Ibadan Libraries. The interview guide (Appendix E) was directed at getting information from the management of these libraries with reference to their goals, objectives, general organizational structure, staff, budget, strength and nature of collection, and library automation experience of computer-based systems in the library.

3. Interview with the Staff at the University of Chicago and Ohio State University Libraries. The interview guide (Appendix F) was directed at getting information from the Directors of these libraries with reference to the factors and problems involved in planning, development, implementation and

current operations of the circulation systems. The data collected were used mainly as background information.

The choice of the University of Chicago and the Ohio State University libraries was based on the fact that the functions and activities to date of their circulation systems represent a set of characteristics which will be used as a guide for the development of a computer-based circulation control system in the university libraries in Nigeria.

(iii) Development of Research Instruments. The research instruments - three written questionnaires and three interview guides, used in this study were developed by the investigator, based upon a survey of the literature and previous research instruments used for library systems studies.

The questionnaire and interview guides were pretested with students in the University of Pittsburgh, most of whom are working librarians, and senior University employees in Nigeria to ensure clarity and to remove as many imperfections as possible in their designs. The final drafts of the questionnaires and interview guides were given to members of the committee for this study and their valuable suggestions concerning content were incorporated.

(iv) Procedures

(a) Questionnaires. In order to provide a high response rate of this investigator's mail questionnaire, the following steps were taken:

1. On January 2, 1980, copies of both questionnaires A and B were mailed to the respondents. The cover letter described the study and the purpose of the questionnaire, with a request that completed questionnaires should be returned to the Ahmadu Bello University Library, Zaria, where the investigator would collect them.
2. All questionnaires mailed on January 2, 1980, were requested to be returned by January 25, 1980.
3. Between February 24 and March 7, 1980, questionnaire C was personally distributed at Zaria and Ibadan respectively by the investigator. As with questionnaire A and B, the cover letter explained the purpose of the study, and requested that completed questionnaires should be deposited in the mailbox provided for this purpose at the entrance of the library. The investigator personally supervised the collection of the returned questionnaires.
4. As the investigator was physically present in Nigeria, he called on some respondents who were not able to return their questionnaires (A and B) by January 25, 1980.
5. By March 7, 1980, most of the questionnaires were returned to the investigator in Nigeria. A few of them trickled in by mail after the return of the investigator to Pittsburgh.

(b) Interview.

1. Arrangements to interview at the Ohio State University and Chicago University libraries were initiated by the

investigator's major advisor. Letters were written to the Directors of the two institutions respectively in November 1979. The purpose of the letters was to inform both Directors of the investigator's intended visit. The letter from the investigator described the study and the purpose of the interview. The investigator finally met with the Directors and other library staff responsible for systems development on December 11, 1979, for Chicago and December 18, 1979 for Columbus.

2. This investigator also conducted on-site interviews with Heads of the libraries and Computer Centers at the Ahmadu Bello University and the University of Ibadan respectively between February 24 and March 6, 1980. Some staff members who are responsible for systems development in these Universities were also interviewed. Letters had been sent to these institutions informing them about the investigator's intended visit.
3. During these interview sessions tape recordings of the proceedings were made by kind permission of the various people involved.
4. Before each interview, the investigator discussed the background of the study. Each respondent was alerted to the exploratory nature of the study and assured of anonymity.

3. Data Processing

The Office of Measurement and Evaluation at the University of Pittsburgh gave the investigator assistance in the analysis of data. The investigator, with the aid of a consultant in this office transferred the data from the completed questionnaires to IBM 1230 data sheets. After the transfer had been completed, standard IBM cards were punched from the sheets. The Statistical Package for the Social Sciences (8) was used in the analysis.

References

(1) Barbara Evans Markuson. "Granting Amnesty and Other Fascinating Aspects of Automated Circulation" American Libraries. 9 (April, 1978) 205

(2) Ibid.

(3) C. West Churchman. The Design of Inquiring Systems. New York: Basic Books, 1971. p. 49

(4) J. Daniel Couger and R. W. Snapp. Systems Analysis Techniques. New York: John Wiley, 1974. p. 27

(5) J. Burch and F. R. Strater. Information Systems, Theory and Practice. New York: John Wiley, 1974. p. 79

(6) Julian L. Simon. Basic Research Methods in Social Sciences. New York: Random House, 1969. p. 274

(7) C. McAllister and J. M. Bell. "Human Factors in the Design of an Interactive Library System" Journal of the American Society for Information Science. 22 (1971) 96-104

(8) SPSS. Statistical Package for the Social Sciences. By Norman H. Nie et al. 2nd ed. New York: McGraw-Hill, 1975

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

A. Introduction

In this chapter, data are presented and analyzed as they relate to the specific areas the study addresses. Two types of data were collected for the study: data from the questionnaire surveys and data from the on-site interviews. Where possible the data have been grouped into categories which are reported according to the similarities and differences appearing between and within the specific categories.

The tabulation of the responses and the analysis of the data gathered are organized under the following main headings:

1. Summary of questionnaire response and interview sessions.
2. Questionnaire to heads of circulation units (section II) and questionnaire to selected faculty, staff and students of the Ahmadu Bello University, Zaria, and the University of Ibadan, Ibadan. (Appendices A and C)
3. Questionnaire to heads of circulation units (section III) and questionnaire to leading librarians and systems specialists in Nigeria. (Appendices A and B)
4. Data collected on-site from the research instrument used for the interviews. (Appendices D and E)

To understand tables 3 through 10 and the explanations that follow in this chapter, please refer to the following terms and definitions:

Chi square (χ^2) - a test of compatibility of observed and expected frequencies.

Code - the symbolic representation for data or subject.

Frequency (F) - the number of times the same response has been given.

Mean ($\bar{X}$) - the average response given to answer to a question.

n - the number of respondents.

T-test - a test to determine if there is any difference statistically between the mean of two groups of respondents in answer to a question.

B. Summary of Questionnaire Response and Interview Responses

A total of 1,104 questionnaires were distributed to all participants, from which a total of 742 returns (67.2%) were received. In addition to this method of data collected, a total of 16 interview sessions were conducted out of which 9 were conducted on-site and 7 were conducted at the University of Chicago and the Ohio State University libraries.

The distribution of participating respondents and questionnaire returns is shown in table 1.

Table 1 (Questionnaire Distribution and Returns) shows that six out of thirteen university libraries, representing 46%, responded to the questionnaire designed to find out the condition of the present circulation control systems, and the requirements/approaches to computer-based circulation control systems in a university environment

Table 1

QUESTIONNAIRE DISTRIBUTION AND RETURNS

Respondents	Number Distributed	Number of Returns	Returns %
Heads of Circulation Units	13	6	46.0
Librarians/Systems Specialists	91	73	80.2
Faculty, Staff and Students (A.B.U., Zaria & U.I., Ibadan)	1,000	663	66.3

in Nigeria from the point of view of the operators (circulation staff) of the system. Four out of six respondents are from the six oldest and well established university libraries in Nigeria, namely, the Ahmadu Bello University library, Zaria, Ibadan University library, Ibadan, University of Ife library, Ile-Ife, University of Benin library, Benin City, University of Nigeria Library, Nsukka, and the University of Lagos library, Lagos. The University of Lagos and the University of Nigeria libraries never responded. On the other hand, two out of seven recently established university libraries responded. The poor response in this cadre is quite understandable since the libraries are recently established. It is therefore the investigator's belief that the university libraries which responded to the questionnaire are good representatives of the totality of the university libraries in Nigeria as they now exist.

On the part of leading librarians/systems specialists, most of whom attended the workshop on library automation in Nigeria in 1977, the table shows that seventy-three out of ninety-one respondents (80.2%) returned their questionnaires. Also six hundred and sixty-three out of one thousand (66.3%) faculty, staff and students of both Ahmadu Bello University and University of Ibadan respectively returned their questionnaires. In both cases the responses are very high.

The distribution of participating interviewees and interview sessions is shown in table 2.

Although it was originally planned to interview the heads of various establishments identified for this purpose, it turned out that these heads were not directly responsible for the aspects of their systems which the investigator is interested in. Certain members

Table 2

DISTRIBUTION OF INTERVIEW SESSIONS AT THE
AHMADU BELLO UNIVERSITY, ZARIA & THE
UNIVERSITY OF IBADAN, IBADAN

Institutions	Number of Sessions	Number of People
Ahmadu Bello University (Main) Library	3	4
Ahmadu Bello University Computer Center & Dept. of Electrical Engineering	2	3
University of Ibadan (Main) Library	3	3
University of Ibadan Computer Center	1	2

of staff of these establishments have been given such responsibility and are variously capable to respond effectively to the investigator's questions. Consequently, 12 people instead of 4 originally planned were interviewed. This has actually generated data which will address the research questions, and which otherwise would have been lost. (see table 2)

It was not possible however to follow the interview schedule systematically as the investigator later found out. Consequently, the investigator resorted to a funneled approach similar to that used by Lincoln (1) in his research on the preparation of the white teacher for teaching the black child. By using this approach, a broad question was asked initially and specific questions were progressively posed to secure further insight regarding the respondent's views.

Using the data from both questionnaire responses and interview as a basis, then, the discussion and conclusions offered in this study will represent an appreciably larger group of people and institutions involved in the development and use of computer-based circulation control system in the Nigerian university library environment.

C. Questionnaire to Heads of Circulation Units (Section II) and Questionnaire to Selected Faculty, Staff and Students of the Ahmadu Bello University, Zaria, and the University of Ibadan, Ibadan

Two groups of respondents, the operators of the present circulation systems (circulation staff) and the users of the system (faculty, staff and students) were surveyed. The investigator's objectives were threefold:

1. To find out the condition of the present circulation systems.
2. To identify some of the activities performed, records kept, and information often requested which are relevant to the development of computer-based systems.
3. To identify gaps and deficiencies for the purpose of rectifying them in a computer-based environment.

The questionnaire response addressed in this section of the study has been tabulated under frequency distribution for each question. Where this approach is not feasible, simple data tables have been developed. Numerical codes 1 through 6 are used to denote the individual library to which these questionnaires were sent. The codes are applied consistently where relevant throughout the tabulation exercise to preserve the confidentiality of the responses and the anonymity of respondents.(2)

The data for both questionnaires are tabulated in tables 3 and 4 respectively.

Table 3 (Q. 6 - Q. 8) shows that all of the respondents indicate that the mode of operation in the university libraries' circulation systems is manual. Five out of these six librarians envisage changes from the present mode of operation to another one. Four of the five librarians (from the large, well-established libraries) plan to develop computer-based circulation control systems. However, only two librarians indicate they plan to automate within a period of two years while the other two are not sure of the time frame. As to why the anticipated change is necessary, three librarians

Table 3

DATA FROM THE QUESTIONNAIRES DESIGNED TO FIND OUT THE CONDITION OF THE PRESENT CIRCULATION CONTROL SYSTEMS: RESPONSE FROM THE HEADS OF CIRCULATION UNITS

	Factors	Frequency
Q. 6.	What is the mode of operation in your section? (mark x where appropriate)	
	a. Manual	6
	b. Photocharging	---
	c. Computer-based:	
	Off-line (Batch)	---
	On-line	---
	d. Other (specify)	---
Q. 7.	Do you envisage any changes from the present method to another one? (mark x where appropriate)	
	Yes	5
	No	1
Q. 8.	If the answer to 7 is yes please state which method you hope to adopt.	
	Computer-based	4
	Mechanized	1
	When?	
	0-2 years	2
	Up to 5 years	---
	Unknown	3
	Why?	
	Better/Quicker Service	3
	Prelude to automation	1
	Don't know	1
Q. 9.	How many circulation transactions did your section make during the last academic year?	Responses for questions 9 - 12 are tabulated on page 81.
Q. 10.	What is the number of patrons represented by these transactions?	

Factors	Frequency
Q. 11. Do you expect more, an equal number or fewer transactions and patrons in the current academic year? (mark x where appropriate) a. Transactions: More Equal Fewer b. Patrons: More Equal Fewer	Responses for questions 9 - 12 are tabulated on page 81.
Q. 12. If the answer to question 11 is more or fewer, give estimate % a. Transactions: More Fewer b. Patrons: More Fewer	
Q. 13. What type of records do you keep in your section? (mark x where appropriate)	
a. Patrons record	6
b. Shelflist record	---
c. Bibliographic record (card catalog)	1
d. Daily transactions record	6
e. Reservation record	6
f. Recalled items record	4
g. Bindery record	4
h. Withdrawn items record	3
i. Missing items record	4
j. Delinquent patrons record	5
k. Statistical records	6
l. Other (specify) Book no. record	1
- Items transferred to reserve unit record	1
- Audio visual (software & hardware) record	1
Q. 14. If an item is on order or in process, can any of the records you keep in your section indicate this? (mark x where appropriate)	
Yes	1
No	5

Table 3 contd.

Library Code	Q. 9	Q. 10	Q. 11						Q. 12			
	Circulation Transactions last academic year	No. of Patrons represented by these transactions.	Future Transactions anticipated:			Future Patrons anticipated:			Estimated % increase or decrease on transactions:		Estimated % increase or decrease on patrons:	
			More	Equal	Fewer	More	Equal	Fewer	More%	Fewer%	More%	Fewer%
1	50,807	6,158	x			x			?		?	
2	104,504	8,766	x			x			5		5	
3	?	?	x			x			60		40	
4	243,356	22,839	x			x			10		10	
5	9,120	987	x			x			80		100	
6	7,824	395	x			x			100		100	

Table 3 contd.

Factors	Frequency
Q. 15. Do you experience any problems keeping or having access to the recrods you have identified in question 13? (mark x where appropriate)	
a. Keeping the records:	
Yes	4
No	2
b. Access to the records:	
Yes	2
No	4
Q. 16. What problems are there in keeping and accessing records?	
a. Record is bulky	3
b. Filing (wrong filing)	3
c. Keeping accurate and up-to-date statistics	3
d. Time factor (to get at information)	1
Q. 17. Which of these information are asked of your section by patrons, circulation staff, library management? (mark x where appropriate)	
a. Information as to when items:	
i. charged out are due back	6
ii. reserved could be collected	6
b. Information as to which items are:	
i. available in the library	6
ii. charged out	6
iii. overdue	6
iv. on reserve	6
v. on hold	3
vi. recalled	4
vii. in the bindery	4
viii. withdrawn from the stacks	3
ix. missing	5
x. in high demand	5
c. Information as to what the daily transaction is by:	
i. author/title	2
ii. call number (subject)/book number	5
iii. category of users	2
d. Any other (specify): Information as to:	
i. date due for materials charged out	2
ii. fines for overdue material	1
iii. who the defaulters are	1

Table 3 contd.

Factors		Frequency
Q. 18.	What functions do members of your section presently perform? (mark x where appropriate)	
	a. charging and discharging of library materials	6
	b. reservations	6
	c. renewals	6
	d. any other (specify)	
	i. withdrawals	2
	ii. preparation of circulation statistics	3
	iii. shelfing and shelf reading	5
	iv. preparation of overdue notices	2
Q. 19.	What other functions would you wish to perform which your section cannot presently cope with?	
	a. Identify materials withdrawn and sent to the bindery	1
	b. Identify materials in special areas, withdrawn or missing	1
	c. Locating materials immediately by use of catalog	3
	d. Identify materials on order or in process	1
	e. Keeping statistics up-to-date/updating records regularly	2
Q. 20.	If you are asked about an item, which records will you search in your section?	
	a. Patron's record	2
	b. Daily transaction record	6
	c. Reservation record	4
	d. Bindery record	4
	e. Catalog	3
Q. 21.	How long does such search take you on the average? (mark x where appropriate)	
	a. Less than 1 minute	1
	b. Up to 5 minutes	4
	c. Up to 10 minutes	1
	d. Up to 15 minutes	---
	e. More than 15 minutes	---

Table 3 contd.

Factors		Frequency
Q. 22.	Is the search comprehensive enough to get all the required information?	
	Yes	4
	No	2
Q. 23.	If the answer to question 22 is no, what other records would you wish to have available for search in your section?	
	a. On order record	1
	b. In-process record	1
	c. Withdrawn items record	1
	d. Missing items record	1
	e. Items sent to special area record	2

indicated that it is for better and quicker services. One librarian would simply mechanize its circulation system as a prelude to automation. One librarian is not sure of the reason why it opted for the automation of its circulation system.

Table 3 (Q. 9 - Q. 12) shows that the volume of circulation transactions for the last academic session ranged between 7,824 and 243,356 while the number of patrons represented by these transactions ranged between 387 and 22,839. All the librarians indicated that they expect increase in both number of transactions and patrons. The increase would range between 5% and 100%.

Table 3 (Q. 13 - Q. 16) shows that all of the respondents keep the following records:

patron's record;

daily transaction record;

statistical records; and

reservation record.

Five librarians indicate they keep delinquent patrons record, while four keep recalled items record, bindery record, and missing items record. Three keep withdrawn items record, while one keeps bibliographic (catalog) record, items transferred to reserve unit record, and audio-visual record. As to whether an item which is on-order or in-process could be identified through any of the circulation records mentioned above, only one respondent answered in the affirmative.

Four librarians indicate they have problems keeping the circulation records identified, but four do not experience any problems having access to these records. Three librarians however

acknowledged that the records presently kept are bulky with charges wrongly filed in some cases. They also find it difficult to keep accurate and up-to-date statistics. One librarian indicated that time factor is a problem since it takes much time to go through the records to provide a patron with the required information.

Table 3 (Q. 17) shows that all the six librarians that responded are required by the management, staff or patrons to give information as to:

when items charged out are due back;

when items reserved could be collected;

which items are available in the library;

which items are charged out;

which items are overdue; and

which items are placed on reserve.

Five are required to give information as to:

missing items;

items in high demand; and

what the daily transactions are by call number or book number.

Four are required to give information on:

recalled items; and

items in the bindery.

Three are required to give information on:

items on hold; and

items withdrawn from the stacks.

Two are required to give information as to:

what the daily transactions are by author/title; and

categories of borrowers.

One is required to give information as to:

who the defaulters are; and

how much fine it is for an overdue item.

Table 3 (Q. 18 - Q. 19) shows that all the six librarians that responded, presently perform such functions as:

charging and discharging of library materials;

reservation of library materials on demand; and

renewal of library materials on request.

Between two and five of the respondents variously perform such other functions as:

withdrawal of materials from the stacks;

preparation of circulation statistics;

writing of overdue notices; and

shelving/shelf reading.

As to what other functions these librarians would wish to perform which they could not cope with, the following functions were identified:

locating materials immediately by use of catalog;

keeping statistics up-to-date and updating records regularly;

identification of materials in special areas, withdrawn or missing; and

identification of materials either on order or in-process.

Table 3 (Q. 20 - Q. 23) shows that the records usually searched when asked about any library material include:

daily transaction record;

reservation record;

bindery record; and

library catalog.

Four of the respondents indicate that such a search takes up to 5 minutes, and the same percentage believe that the search is comprehensive. But two of the respondents who believe that the search is not comprehensive identified further records that should be kept in the circulation unit and searched. These include:

on-order record;

in-process record;

missing items record;

withdrawn items record; and

items sent to special area record.

Table 4 (i) shows that a representative sample of the entire university population for the two universities used for this study was selected for the purpose of data collection. The high percentage (44.6) from the undergraduate respondents is proportionate to the number of undergraduates in the Nigerian universities in relation to the entire student population. Since two institutions were used, a chi square (χ^2) test of independence was employed to test if there is significant difference in the way each group in the two institutions responded to the questions asked in the questionnaire. It turned out that there is no difference in the two groups statistically in the way they responded to the questions. In other words, whether a respondent is from the University of Ibadan or from the Ahmadu Bello University makes no difference in the way they responded to the questions.

Table 4 (ii) shows that 456 (68.8%) respondents use the library daily. This is followed by 135 (20.4%) respondents who use the library weekly. Only 72 (10.8%) respondents use the library

Table 4

DATA FROM THE QUESTIONNAIRES DESIGNED TO FIND OUT THE CONDITION OF THE PRESENT CIRCULATION CONTROL SYSTEMS: RESPONSE FROM THE FACULTY, STAFF AND STUDENTS (USERS)

i. Status

Factors	IU* F	ABU** F	CF***	AF%
a. Students of Basic Studies (Pre-Degree Students)	52	59	111	16.7
b. Undergraduate Students	133	163	296	44.6
c. Postgraduate Students	60	52	112	16.9
d. Faculty/Staff/Researchers	63	71	134	20.2
e. Others (not specified)	3	7	10	1.5

Chi square = 2.44239 with 3 degrees of freedom.
Significance = 0.4858.

ii. How often do you use the library? (Pattern of library use)

Factors	IU* F	ABU** F	CF***	AF%
a. Daily	222	234	456	68.8
b. Weekly	61	74	135	20.4
c. Monthly	15	23	38	5.7
d. Several Times a Session	13	21	34	5.1
e. Never	---	---	---	---

Chi square = 2.57248 with 3 degrees of freedom.
Significance = 0.4967

* University of Ibadan
** Ahmadu Bello University
*** Cumulative Frequency

Table 4 contd.

iii. The frequency with which you use the library for the purposes listed under factors.

Factors	n*	NEVER (1) F	NEVER (1) AF%	SELDOM (2) F	SELDOM (2) AF%	AVERAGE (3) F	AVERAGE (3) AF%	OFTEN (4) F	OFTEN (4) AF%	VERY OFTEN (5) F	VERY OFTEN (5) AF%	X̄**
a. To borrow or return library material	660	7	1.1	50	7.6	70	10.6	158	23.9	375	56.8	4.28
b. Consult librarian about library material that is needed	640	77	12.0	60	9.4	91	14.2	200	31.3	212	33.1	3.64
c. Find material for required course	643	19	3.0	54	8.4	79	12.3	140	21.8	351	54.6	4.17
d. Find reference material	639	13	2.0	32	5.0	167	26.1	182	28.5	245	38.3	3.96
e. Study my own books or notes	659	112	17.0	69	10.5	37	5.6	91	13.8	350	53.1	3.76

* The number of respondents.
** Mean.

iv. On the average, how much time do you spend at the circulation desk to either borrow or return library material?

Factors	F	AF%
a. Less than 1 minute	13	2.0
b. Up to 5 minutes	394	60.2
c. Up to 10 minutes	222	33.2
d. Up to 15 minutes	14	2.1
e. More than 15 minutes	11	1.7

n = 654
Mean ($\bar{X}$) = 2.413

v. How much time on the average does it take for the circulation clerk or librarian to inform you whether or not a particular book or material you want is out of the library; if out when it would be due back?

Factors	F	AF%
a. Less than 1 minute	13	2.0
b. Up to 5 minutes	80	12.3
c. Up to 10 minutes	380	58.6
d. Up to 15 minutes	138	21.3
e. More than 15 minutes	38	5.9

n = 649
Mean ($\bar{X}$) = 3.166

Table 4 contd.

vi. How do you rate the services/information given to you at the **circulation desk**?

Factors	n	NEVER (1) F	NEVER (1) AF%	POOR (2) F	POOR (2) AF%	BARELY ADEQUATE (3) F	BARELY ADEQUATE (3) AF%	GOOD (4) F	GOOD (4) AF%	VERY GOOD (5) F	VERY GOOD (5) AF%	$\bar{X}$
a. Information as to whether a given title has been acquired by the library.	644	27	4.2	34	5.3	352	50.5	250	38.8	8	1.2	3.28
b. Information as to the location of a given title within the library.	641	15	2.3	186	29.0	340	53.0	83	12.9	17	2.7	2.85
c. Information as to whether a given title is loaned out, withdrawn, temporarily removed from the stack, missing, etc.	645	27	4.2	288	44.7	262	40.6	52	8.1	16	2.5	2.60
d. Information as to when a title checked out of the library is due back	638	27	4.2	45	7.1	361	56.6	191	29.9	14	2.2	3.19
e. Information as to titles you have requested to be reserved for you.	638	42	6.6	329	52.1	177	28.0	65	10.3	19	3.0	2.50

Table 4 contd.

vi. How do you rate the services/information given to you at the circulation desk?

Factors	n	NEVER (1) F	NEVER (1) AF%	POOR (2) F	POOR (2) AF%	BARELY ADEQUATE (3) F	BARELY ADEQUATE (3) AF%	GOOD (4) F	GOOD (4) AF%	VERY GOOD (5) F	VERY GOOD (5) AF%	$\bar{X}$
f. Obtaining material reserved for you.	632	42	6.6	329	52.1	177	28.0	65	10.3	19	3.0	2.50
g. Getting timely assistance from the circulation staff	643	21	3.3	33	5.1	287	44.6	278	43.2	24	3.7	3.39

either monthly or several times a session. Using the chi square (χ^2) test of independence, there is no significant difference in the pattern of use of the library in both institutions used for this study.

Table 4 (iii) records the responses on the purpose for which the respondents use the library. From the mean ($\bar{X}$) computed for the various reasons why the respondents use the library, two factors, "to borrow or return library material," and "find material for required course" appear outstanding with the mean 4.28 and 4.17 respectively, and which fall between "often" and "very often" categories in the scale. These are closely followed by the three other factors, namely, "find reference material" (3.96), "study my own books or notes" (3.76), and "consult librarian about library material that is needed" (3.64). These three factors fall well above "average" and very close to "often" in the scale designed for this purpose. Additional reasons for using the library which have been suggested by the respondents are:

a. To read newspapers.

b. To read journal articles and government publications.

c. To use the microform collection and equipment.

d. To do some photocopying.

In table 4 (iv), 60.2% of the respondents indicated that they spend up to 5 minutes at the circulation desk to borrow or return library material. 33.2% indicated that they spend up to 10 minutes. On the other hand, table 4 (v) shows that 58.6% of the respondents indicated that on the average, it takes either the circulation clerk or librarian up to 10 minutes to inform a user whether or not a particular book or other library material is out of the library and

when it is due back. 21.3% however felt that up to 15 minutes is spent for this purpose. This contradicts the response given by the heads of circulation units in table 3 (Q. 21) which shows that up to 5 minutes is spent for this purpose.

Table 4 (vi) shows that on the average 75% of the respondents believe that all the services/information given by the libraries investigated and as identified by the investigator are either poor or barely adequate, with mean score ranging from 2.40 to 3.39. This is further discussed in chapter V (1, h).

D. Questionnaire to Heads of Circulation Units (Section III) and Questionnaire to Leading Librarians and Systems Specialists in Nigeria

Two groups are respondents to two sets of questionnaires which are identical in all respects. The investigator's objectives here are:

a. To find out what priorities would be attached to each of the goals[1], objectives[2], functions, systems products; and to identify the preferred approaches from selected automation alternative procedures identified.

b. To see if there would be any relationship in the selection of these priorities and automation alternative procedures between the two groups of respondents.

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[1] Goals - statements concerning something towards which effort is directed.

[2] Objective - statement of what are to be achieved stated in a measurable fashion.

c. To identify any environmental constraints which might impede the development of computer-based circulation system in the university libraries in Nigeria.

The questionnaire responses have been tabulated for each group separately under frequency and adjusted frequency percentage for each factor. The mean for each data category has been computed where applicable. The data from both questionnaire responses are tabulated in tables 5 through 10.

Tables 5 - 8 record the frequency response, adjusted frequency percentage and computed mean of priorities given to each of the main goals, objectives, functions and systems products, in response to the question which reads:

> In developing a computer-based system, goals, objectives, functions and systems products have to be established. Please indicate which priorities you would assign to each of the goals, objectives, functions, and systems products listed below by checking x in appropriate column. (Please check only one column for each item)

Table 5 (a) shows that one goal, "To know the whereabout of any library circulating material at any time with minimum delay" appears outstanding as the first priority (85%). Three other goals specified as first priorities are: "To enable patrons find accurate information on any library circulating material (75%);" "To obtain statistical information about the use of the library and stock (71%);" and "To maximize the availability of all library circulating materials at any time (71%)." One goal, "To maintain control of the stock and circulation of materials by checking that patrons don't take more than is allowed and return them promptly," received the highest percentage of response at second priority level with a score of 33% at that level.

Table 5

PRIORITIES OF GOALS OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS

(a) Leading Librarians/Systems Specialists

Goals	1st F	1st %	2nd F	2nd %	3rd F	3rd %	4th F	4th %	5th F	5th %	X
a. To enable patrons find accurate information on any library circulating material.	53	75	11	15	4	6	3	4	-	--	1.394
b. To maximize the availability of all library circulating materials at any time.	51	71	12	17	2	3	4	6	3	4	1.556
c. To know the whereabout of any library circulating material at any time with minimum delay.	62	85	5	7	2	3	4	5	-	--	1.288
d. To maintain control of the stock and circulation of materials by checking that patrons don't take more than is allowed and return them promptly.	17	23	24	33	19	26	6	8	7	10	2.479
e. To obtain statistical information about the use of the library and stock.	52	71	6	8	5	7	3	4	7	10	1.726

Table 5 contd.

(b) Heads of University Library Circulation Control Systems

Goals	1st		2nd		3rd		4th		5th		$\bar{X}$
	F	%	F	%	F	%	F	%	F	%	
a. To enable patrons find accurate information on any library circulating material.	5	83	1	17	--	--	-	--	-	--	1.167
b. To maximize the availability of all library circulating materials at any time.	3	50	--	--	2	33	1	17	-	--	2.167
c. To know the whereabout of any library circulating material at any time with minimum delay.	6	100	--	--	--	--	-	--	-	--	1.000
d. To maintain control of the stock and circulation of materials by checking that patrons don't take more than is allowed and return them promptly.	2	33	2	33	1	17	1	17	-	--	2.167
e. To obtain statistical information about the use of the library and stock.	2	33	2	33	2	33	-	--	-	--	2.000

Table 5 (b) follows the same pattern as in table 5 (a) except that the goal, "To obtain statistical information about the use of the library" dropped to second priority with a score of 33% at that level.

Additional goals of computer-based circulation control systems which have been suggested by respondents are: "To facilitate speedy, efficient, accurate, and economical circulation transactions;" and "To ensure error free operations."

In table 6 (a & b), the five objectives which received the highest percentage of response, and as first priorities are: "To give accurate information within 1 minute on the status of any library material that circulates (81% and 67%);" "To answer patrons' questions within 1 minute as to charged out library material (78% and 67%);" "To provide direct access to circulation records for enqiuries 15 hours daily, 8:00 am - 11:00 pm (73% and 50%);" "To provide statistical information daily for management reports on the total library circulations by call number (83% and 100%);" and "To provide statistical information daily for management reports on the total library circulations by author/title (69% and 50%);" as shown by leading librarians/systems specialists and the heads of circulation systems respectively. Two objectives, "To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm)" and "To provide statistical information daily for management report by patron category" received very low percentages in both tables 6 (a & b), with scores (33% and 33%) and (20% and 33%) respectively.

An aspect of this report that is contradictory is the response given by the heads of the circulation systems on the question that dealt with statistical information.

Table 6

PRIORITIES OF OBJECTIVES OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS

(a) Leading Librarians/Systems Specialists

Objectives	1st F	1st %	2nd F	2nd %	3rd F	3rd %	4th F	4th %	5th F	5th %	$\bar{X}$
a. To answer patrons' questions within 1 minute as to which library materials are charged out (when due back, etc.)	56	78	9	13	4	6	3	4	--	--	1.361
b. To give accurate information within 1 minute on the status of any library material that circulates	59	81	11	15	3	4	-	--	--	--	1.233
c. To provide direct access to circulation records for enquiries 15 hours daily (8:00 am - 11:00 pm)	53	73	10	14	7	10	3	4	--	--	1.452
d. To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library	21	33	13	20	14	22	7	11	9	14	2.531
e. To provide statistical information daily for management reports on the total library circulation by:											
Author/Title	49	69	14	20	7	10	1	1	--	--	1.437
Call number (subject)	60	83	6	8	3	4	2	3	1	1	1.306
Patron category	14	20	11	15	19	27	9	13	18	25	3.085

Table 6 contd.

(b) Heads of University Library Circulation Control Systems

Objectives	1st F	1st %	2nd F	2nd %	3rd F	3rd %	4th F	4th %	5th F	5th %	$\bar{X}$
a. To answer patrons' questions within 1 minute as to which library materials are charged out (when due back, etc.)	4	67	2	33	--	--	-	--	--	--	1.333
b. To give accurate information within 1 minute on the status of any library material that circulates	4	67	1	17	1	17	-	--	--	--	1.500
c. To provide direct access to circulation records for enquiries 15 hours daily (8:00 am - 11:00 pm)	3	50	2	33	--	--	-	--	1	17	2.000
d. To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library	2	33	--	--	2	33	-	--	2	33	3.000
e. To provide statistical information daily for management reports on the total library circulation by:											
Author/Title	3	50	3	50	--	--	-	--	--	--	1.500
Call number (subject)	6	100	--	--	--	--	-	--	--	--	1.000
Patron category	2	33	3	50	1	17	-	--	--	--	2.833

Under goals, "To obtain statistical information about the use of the library and stock" was given a second priority with 33% score; but under objectives, "To provide statistical information daily for management reports by call number and by author/title" were given first priorities with 100% and 50% scores respectively by the same respondents.

An additional objective of computer-based circulation control systems which has been suggested by respondents is "To make available library circulating materials to patrons who need them and receive those materials brought back 15 hours daily (8:00 am - 11:00 pm)."

In table 7 (a & b) two functions, "Charging (loan) of library materials" and "To maintain currency of information about loans (transaction file)" received the highest percentage of response (92% and 100%) and (87% and 100%), as first priorities. The next four functions which received high percentage of response, also as first priorities are: "Record all items charged to patrons, bindery, reserve collection, etc. (71% and 67%);" "Renewals (67% and 67%);" "Discharge of returned library materials (65% and 67%);" and "Ouery patron/document files (61% and 67%)."

While two functions, "Reservations" and "Recalls and holds" received first priority ratings in table 7 (a), these same functions received second priority ratings in table 7 (b). Two other functions, "Patron/Document search (access to source files having acquisitions, cataloging and circulation information);" and "Identification of delinquent patrons" received second priority ratings in table 7 (b), but in table 7 (a), the former received second priority rating while the latter received fifth priority rating.

Table 7

PRIORITIES OF FUNCTIONS OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS

(a) Leading Librarians/Systems Specialists

Functions	1st		2nd		3rd		4th		5th		$\bar{X}$
	F	%	F	%	F	%	F	%	F	%	
a. Charging (loan) of library materials	66	92	4	6	1	1	-	--	1	1	1.139
b. Discharge of returned library materials	47	67	18	25	7	10	-	--	--	--	1.444
c. Renewals	47	67	15	21	5	7	3	4	--	--	1.486
d. Reservations	45	64	16	23	6	9	1	1	2	3	1.557
e. Recalls and Holds	44	62	16	23	3	4	5	7	3	4	1.690
f. Patron/Document search (access to source files having acquisitions, cataloging and circulation information)	20	31	27	42	12	18	6	9	--	--	2.062
g. Query patron/document files	40	61	14	21	5	8	5	8	2	3	1.712
h. Maintain currency of information about loans (transaction file)	62	87	6	8	2	3	1	1	--	--	1.183
i. Identification of delinquent patrons	10	15	9	14	13	20	7	11	27	41	3.485
j. Record all items charged to patrons, bindery, reserve collection, etc.	50	71	12	17	3	4	2	3	3	4	1.514

Table 7 contd.

(b) Heads of University Library Circulation Control Systems

Functions	1st		2nd		3rd		4th		5th		$\bar{X}$
	F	%	F	%	F	%	F	%	F	%	
a. Charging (loan) of library materials	6	100	--	--	--	--	-	--	--	--	1.000
b. Discharge of returned library materials	4	67	2	33	--	--	-	--	--	--	1.333
c. Renewals	4	67	1	17	1	17	-	--	--	--	1.500
d. Reservations	2	33	3	50	--	--	1	17	--	--	2.000
e. Recalls and Holds	2	33	3	50	--	--	1	17	--	--	2.000
f. Patron/Document search (access to source files having acquisitions, cataloging and circulation information)	3	50	--	--	1	17	-	--	2	33	2.667
g. Query patron/document files	4	67	1	17	--	--	-	--	1	17	1.833
h. Maintain currency of information about loans (transaction file)	6	100	--	--	--	--	-	--	--	--	1.000
i. Identification of delinquent patrons	3	50	1	17	1	17	1	17	--	--	2.000
j. Record all items charged to patrons, bindery, reserve collection, etc.	4	67	1	17	1	17	-	--	--	--	1.500

Additional functions which have been suggested by respondents are:

a. Provide statistical information on the use of library stock.
b. Signal overborrowing.
c. Calculate fines on return of overdue items.
d. Ensure that only legitimate borrowers do borrow material.
e. Update or amend book and borrower information as necessary. Such amendments should cater for situations of change of call numbers, change of address, lost identification cards and issue of new borrower's number, withdrawal from university, etc.
f. Trap library items due for reclassification, binding, reservation, short term loans; detect/trap delinquent patrons at point of issue and give reasons for trapping such.

Table 8 (a) shows that one product, "List of items on loan" appears outstanding as the first priority (90%). Where this major system product is categorized, two out of three categories received first priority ratings. These are: "List of items on loan by call number (63%)" and "List of items on loan by author/title (77%)." Other items that received first priority rating on this table are: "List of items in the reserve book room (70%);" "Notification of availability of reserved items (68%);" "List of all items loaned during the year held on magnetic tape for analysis annually (67%);" and "Printing of recall notices (57%)."

Table 8

PRIORITIES OF SYSTEMS PRODUCTS OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS

(a) Leading Librarians/Systems Specialists

Systems Products	1st		2nd		3rd		4th		5th		
	F	%	F	%	F	%	F	%	F	%	$\bar{X}$
a. List of items on loan	65	90	4	6	2	3	1	1	--	--	1.153
b. Recall notices	40	57	23	33	4	6	2	3	1	1	1.586
c. Notification of availability of reserved items	46	68	14	21	5	7	2	3	1	1	1.500
d. List of items in the reserve book room	50	70	9	13	9	13	3	4	--	--	1.507
e. List of items reserved for patrons	18	28	15	23	10	15	6	9	16	25	2.800
f. List of individuals exceeding borrowing limit	10	14	12	17	12	17	5	7	30	43	3.478
g. List of missing items at set periods	28	43	20	31	8	12	7	11	2	3	2.000
h. List of items in the bindery	38	58	12	18	7	11	6	9	3	5	1.848
i. Record of previous day's transactions	47	71	11	17	2	3	3	5	3	5	1.545
j. List of items on loan by borrower's identification numbers	17	25	13	19	11	16	22	32	5	7	2.779

Table 8 contd.

(a) Leading Librarians/Systems Specialists contd.

Systems Products	1st F	1st %	2nd F	2nd %	3rd F	3rd %	4th F	4th %	5th F	5th %	$\bar{X}$
k. List of items on loan by classification number	41	63	13	20	3	5	5	8	3	5	1.708
l. List of items on loan alphabetically by author/title	55	77	10	14	2	3	2	3	2	3	1.390
m. List of all items loaned during the year, held on magnetic tape for analysis annually	45	67	10	15	3	4	6	9	3	4	1.687

(b) Heads of University Library Circulation Control Systems

Systems Products	1st F	1st %	2nd F	2nd %	3rd F	3rd %	4th F	4th %	5th F	5th %	$\bar{X}$
a. List of items on loan	5	83	1	17	--	--	--	--	--	--	1.167
b. Recall notices	2	33	2	33	--	--	2	33	--	--	2.333
c. Notification of availability of reserved items	4	67	--	--	1	17	1	17	--	--	1.833

Table 8 contd.

(b) Heads of University Library Circulation Control Systems contd.

Systems Products	1st		2nd		3rd		4th		5th		$\bar{X}$
	F	%	F	%	F	%	F	%	F	%	
d. List of items in the reserve book room	3	50	--	--	3	50	--	--	--	--	2.000
e. List of items reserved for patrons	3	50	--	--	3	50	--	--	--	--	2.000
f. List of individuals exceeding borrowing limit	2	33	1	17	2	33	1	17	--	--	2.333
g. List of missing items at set periods	2	33	2	33	1	17	--	--	1	17	2.333
h. List of items in the bindery	2	33	1	17	2	33	1	17	--	--	2.333
i. Record of previous day's transactions	3	50	--	--	2	33	1	17	--	--	2.167
j. List of items on loan by borrower's identification numbers	5	83	--	--	--	--	1	17	--	--	1.500
k. List of items on loan by classification number	5	83	--	--	--	--	1	17	--	--	1.500
l. List of items on loan alphabetically by author/title	4	67	2	33	--	--	--	--	--	--	1.333
m. List of all items loaned during the year, held on magnetic tape for analysis annually	2	33	4	67	--	--	--	--	--	--	1.667

For the second priorities, the products which received the highest percentages of response are: "List of missing items (31%);" "List of items reserved for patrons (23%);" "List of items on loan by borrowers' identification number (19%);" and "List of individuals overborrowing (17%)."

Table 8 (b) shows that the following products received first priority: "List of items on loan by call numbers (83%);" "List of items on loan by borrowers' identification numbers (83%);" "List of items on loan alphabetically by author/title (67%);" "Notification of availability of reserved items (67%);" "Record of previous day's transactions (50%);" "List of items in the reserve book room (50%);" and "List of items reserved for patrons (50%)."

For the second priorities, the products which received the highest percentages of response are: "List of individuals exceeding borrowing limit (33%);" "List of items in the bindery (33%);" "List of missing items at set periods (33%);" and "List of all items loaned during the year held on magnetic tape for analysis annually (67%)."

To compare the response from leading librarians/systems specialists and that of the heads of the circulation units in the Nigerian university libraries, a t-test of significance was employed to test if there is any significant difference between the computed mean for each item under goals, objectives, functions and systems products. The t-test of significance overwhelmingly shows that there is no difference statistically in the two groups in the way they responded to the questions.

There could be explanations for this. Either the heads of the circulation units have the same background with the leading librarians/

systems specialists, most of whom attended the Workshop on Library Automation in Nigeria held at Ibadan, Nigeria, in 1977, or that both groups agree that most of the items identified in the goals, objectives, functions and systems products are relevant to the library situation in the universities in Nigeria.

Table 9 records the frequency response and adjusted frequency percentage to preferred approaches from selected automation alternative procedures, in response to the question which reads:

> Please indicate which approach you would advocate in each of the alternatives listed below in the development of computer-based circulation control system in the university libraries in Nigeria. (mark x to an alternative preferred)

Table 9 shows the responses as follows:

1. A centralized system approach received 86.6% and 100% as against the decentralized system approach with 11.4% and 0% scores.
2. An integrated data base system received 92.4% and 83% as against the single application approach with 7.6% and 17% scores.
3. An inventory (bibliographic) system received 71.6% and 67% as against both inventory (shelflist) system and absence (transaction) systems with 13.4% and 17%, and 14.9% and 17% scores respectively.
4. The bar-coded label system received 67.8% and 50%, as against both optical character recognition (OCR) and punched card systems with 11.9% and 17%, and 20.3% and 33% scores respectively.
5. The hybrid system received 56.3% and 50% as against both on-line and off-line systems with 35.2% and 50%, and 8.5% and 0% scores respectively.
6. Use of existing institutional computer systems received 74.6% and 100%, as against commercially developed system or combination

Table 9

ALTERNATIVE APPROACHES IN THE DEVELOPMENT OF

COMPUTER-BASED CIRCULATION CONTROL SYSTEMS

Alternative Approaches	Librarians/ Systems Specialists		Heads of Circulation Units	
	F	AF%	F	AF%
a. Centralized System	62	88.6	6	100.0
Decentralized System	8	11.4	-	---
b. Integrated Data Base	61	92.4	5	83.0
Single Application	5	7.6	1	17.0
c. Inventory (Shelflist) System	9	13.4	1	17.0
Inventory (Bibliographic) System	48	71.6	4	67.0
Absence (Transaction file) System	10	14.9	1	17.0
d. Bar-coded Label System	40	67.8	3	50.0
Optical Character Recognition (OCR) System	7	11.9	1	17.0
Punched-Card System	12	20.3	2	33.0
e. Off-line (Batch) System	6	8.5	-	---
On-line System	25	35.2	3	50.0
Hybrid System	40	56.3	3	50.0
f. Use of existing institutional Computer Systems	50	74.6	6	100.0
Use of Commercially produced System (Turnkey)	3	4.5	-	---
Combination of the above	14	20.9	-	---
g. Use of Dedicated Minicomputer within the Library	17	23.3	-	---

of the two systems with 4.5% and 0%, and 20.9% and 0% scores respectively.

7. 23.3% of the leading librarians and systems specialists, but none from the heads of the circulation unit, suggested the use of dedicated minicomputer system within the library.

A chi-square test of independence was employed for each of the variables under alternative approaches in the development of computer-based circulation control systems in the university libraries in Nigeria. It turned out that there is no difference statistically in the two groups in the way they responded to the alternative approaches identified.

Table 10 records the response, which have been categorized, to the open-ended question which reads:

> What idea or advice would you give to a person who is intending to start a computer-based circulation control system in a university library in Nigeria?

Table 10 shows the constraints (problems) identified by some of the respondents. These include:

"Irregular electricity power supply (34.2% and 50%);"

"Availability of spare parts and maintenance crew (20.5% and 0%);"

"Shortage of skilled, well-trained systems personnel within the library (19.2% and 33%);"

"Availability of adequate funds (16.4% and 17%);"

"Rate of the existing computer breakdowns (16.4% and 0%);"

"Question of adoption rather than development based on local situation and resources (16.8% and 17%)."

Table 10

CONSTRAINTS*

Factors	Librarians/ Systems Specialists		Heads of Circulation Units	
	n	%	n	%
a. Irregular electricity supply	25	34.2	3	50
b. Availability of spare parts and maintenance crew	15	20.5	-	--
c. Shortage of skilled, well-trained system personnel within the library	14	19.2	2	33
d. Availability of adequate funds	12	16.4	1	17
e. Rate of the existing computer breakdowns	12	16.4	-	--
f. Question of adoption rather than development based on local situation and resources	5	6.8	1	17

* The nature of response had made the investigator classify this table as "Constraints".

E. Data Collected On-Site From the Research Instrument Used for the Interviews

The summary of the interview responses and general comments from some of the respondents in both the Ahmadu Bello University and the University of Ibadan have been made in this section. The first part of this section is the summary of all the responses and comments from the librarians. The second part is the summary of all the responses and comments from the systems specialists in the Computer Centers and Department of Electrical Engineering. Permission was obtained from the interviewees to use parts of their comments that are relevant to the study in the final write up.

1. Summary of Responses and Comments from Librarians

The interviewees at the Ahmadu Bello University library include Mr. K. Mahmud, the University Librarian; Mr. J. A. Fab Akhidime, the head of readers services division and a member of the library automation committee; Mr. A. Ochai, the head of serials division and a member of the library automation committee; and Ms. S. L. Stephens, the head of technical services division and secretary to the library automation committee.

The interviewees at the Ibadan University library include Mrs. T. O. Odeinde, the University Librarian; Mrs. O. Soyinka, research and development librarian and responsible for automation development in the university library; and Mr. F. A. Akinyotu, deputy university librarian and head of readers services division.

The two libraries involved in this interview have centralized administrative systems. Both libraries have members of staff who have

been sent out to Britain to study library automation programs at various times. They also have interest in the development of computer-based systems, especially in serials and circulation systems. Already both libraries have their serials holdings computer produced. While the automation of the circulation system is already in progress (at experimental level) at the Ahmadu Bello University library, the Ibadan University library is contemplating on developing one.

The university policy with regards to the use of computer technology in data processing in these libraries is favourable. There is no policy which stipulates that in the event of the development of computer-based systems within the library that the computer center resources alone would be utilized. However, since the computer center is the nerve center of computing operations in the university, any computer related programme should be referred to it. There is no policy that prevents the libraries from acquiring a system independent of the computer center. In the event that one is to be acquired, the computer center would be well informed of the plan as the center might play a very important role in the acquisitions process.

Formal funds request have not been made by both libraries for the development of computer-based circulation systems. While the Ahmadu Bello University library does not anticipate any financial problem in this regard, the Ibadan University library does.

The main problem identified at the Ibadan University library is funds to support the automation program. Both university libraries might face some technological problems in the sense that the rate of computer breakdown which is high, coupled with constant electricity power failures might affect any automation program in the library.

Both libraries agree that the absence of guidelines for the development of computer-based systems in the library in the Nigerian environment and institutional leadership such as the role being played by the Library of Congress in the United States of America are also setbacks.

The following are some of the interviewees' general comments.[3]

a. Mr. J. A. Fab Akhidime, Head of the Readers Services Division, Kashim Ibrahim Library, Ahmadu Bello University, Zaria, commented as follows:

> The university library is the core of the academic functions of the institution. The university expects us to render good and quick services in the library ... For our services, we rely heavily on the catalog which seems to be the basis of our operations ... Presently, the circulation system requires improvement. Firstly, the cards or issues get bulky and makes searching difficult with resultant untraced charges. Secondly, the readers' time is unduly wasted as they have to wait for a long time to get the information they want. ... We have an integrated system in the back of our mind even though it was not stated. The pilot project which we are running for the circulation system is feeding catalog-card data into the system and this presupposes that materials can be accessed from the cataloging department at an appropriate time. We have opted for on-line system because of the need to give information to the users on demand ...

b. Mr. F. A. Akinyotu, Deputy University Librarian and Head of the Readers Services Division, Ibadan University library, Ibadan, comments as follows:

> I have always believed that an integrated system is the ideal system for the library. When you are automating the library, no matter which aspect you have

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[3] Tape recordings were made with the kind permission of the interviewees with an understanding that the contents of the tape recordings would be used extensively in this study.

in mind, you have to think of the totality of all the areas where automation will be very useful. You will then design your program in such a way that even if you are implementing the systems piecemeal, you always have the kind of mind that other systems are going to come into it later. If you do the various systems in isolation, you will find out that it costs much more and can be almost impossible later to bring them together. In planning for the automation of the library, one should have an integrated system in mind.
... A bibliographic data base is ideal because everything you have in the library will have entries in the data base. That is hoping that you are already setting your mind on some other uses for the data base. Otherwise, a data base comprising of transactions only will be cheaper and quicker to implement.
... Although giving information from the circulation desk on materials still in process as is the case at Ohio State University library at Columbus is good, I shall recommend that it should be left out in our environment since it would complicate things, added to the fact that few users might require such services ...

c. Mr. K. Mahmud, University Librarian, Ahmadu Bello University, Zaria, comments as follows:

We have devised our own automation policy which has already been presented to the library committee, and we have gone ahead with both serials and circulation units ... I have not been directly involved with the planning of the automation program for the Kashim Ibrahim library. But the present plan is to start on experimental basis by inputting some of our Class T materials from LC schedule into the computer and working with that to see what problems will arise before we go further ...
I am not familiar with the turnkey systems but I am not sure how they can be applicable to our own use. There was a plan to have a dedicated system within the library but as I said, we are still at a very experimental stage and the system we are developing is subject to change as we have not actually finalized our plans in this respect ...
The major problem is not staff since we have members of staff who have undergone short courses in Britain on library automation, not even funds, but with unstable electricity power supply. The fluctuations in the current has been responsible for the off and on of the computer center from time to time. When the current is too high or low they cannot operate. Certain information has been input into the computer and has been lost due to current failure, as a result there is a number of technological problems ...

d. Mr. A. Ochai, Head of the Serials Division, Kashim Ibrahim

library, Ahmadu Bello University, Zaria, comments as follows:

> While we are trying to input our catalog data direct to the mainframe in the computer center, we are aware that the center might not be able to cope with our activities as time goes on with the branch libraries coming into the show. We do have the impression that we might have a minicomputer dedicated to the library through which we shall process day to day minor inquiries which readers would want on-line. Then, the bulk of processing could be done in batch in the mainframe which is in the computer center ...
> We do recommend that we don't have to acquire already tailored systems from overseas. We rather design a system which our technicians would have detailed knowledge about, and be able to maintain ...

e. Mrs. T. O. Odeinde, University Librarian, Ibadan University

library, Ibadan, comments as follows:

> ... Obviously there is a relationship between the input into the circulation system and the bibliographic record. Bibliographic records are created by the cataloging unit, so, what goes in cataloging is important to circulation activities. So one has to be conscious of the two activities not as separate entities but a continual one, performed for the achievement of a common goal, the circulation of library material.
> ... I would imagine that a data base for a library circulation or otherwise would purposefully include all the bibliographic data. I would approach it from this angle rather than the shelflist approach which basically represent more or less one fixed access point. The transaction file approach is equally limited. I think it is quite legitimate to use a hybrid system because it will give the library better control over its records and be able to do a number of tasks on the spot than being tied to the mainframe computer all the time.
> Although we have suspended some of our plans in this reagrd (automation of circulation control system), we cannot close our ears and eyes to what is happening in and around us, and we should be prepared to embark on it if and when the time is ripe.

f. Mrs. O. Soyinka, Research and Development librarian, Ibadan

University library, Ibadan, comments as follows:

Our automation procedure here appears to be in piecemeal. The university library does not appear to believe in doing everything at once. We tackle each department independent of each other. So far, we have started with the serials listings and development of machine-readable catalog. There are plans to automate the circulation system.
While I personally believe in automation development through an integrated system approach, there are situations which made it impossible here at Ibadan, especially funds limitation. The ideal would have been to have an integrated system approach in mind at the planning stage.
I believe in a dedicated system for the library whereas the computer center will provide facilities for a back up and major listings ...
We cannot just acquire something because it functions nicely elsewhere, we shall consider what is available locally and what our environment can cope with. We must have to do things through the university computer center which has more resources than the library.

g. Ms. S. L. Stephens, Head of Technical Services Division, Kashim Ibrahim Library, Ahmadu Bello University, Zaria, comments as follows:

The library initiated automation program when it was clear that the circulation system was rather clumsy for the university library. The number of issues and returns each day was becoming too bulky to allow for easy and quick access for the purpose of obtaining information for both the management and the patrons. When the computer center was approached with our requirements specified, we were given to understand that the university computing system has unlimited capacity and that there would never be any problem with storage space and data processing for the library.
The library is at an exploratory stage of automation. The rationale behind our plan to input all our catalog data on-line to the main frame in the computer center is not necessarily to enable readers to borrow and return books, but we wanted a system that can be expandable. We also wanted a system that would enable us to give information on our holdings, especially the circulatables ...
The question of a dedicated minicomputer system for the library has been recommended but the computer center felt that it has such a large capacity that it is not likely to get used up in the foreseeable future. Unfortunately, the computer center has to purge all the files in the system because it needed space. This has raised

the question of a dedicated minicomputer system for the library. It is likely that our major problem will be constant electricity power fluctuation.

2. Summary of Responses and Comments from Systems Specialists

Dr. O. M. Hoffmann, Acting Director; Mr. Okoro, Systems Analyst/Programmer; and Dr. B. J. Olufeagba, Senior lecturer in the Department of Electrical Engineering and specialist in systems engineering; were interviewed by the investigator at the Ahmadu Bello University, Zaria. At the University of Ibadan, Ibadan, Mr. Ogunshua, the Acting Director; and Mrs. A. O. Faparusi, Systems Analyst/ Programmer; were interviewed.

(i) Ahmadu Bello University. According to the interviewees (Dr. Hoffmann and Mr. Okoro), the present computer center with the CDC Cyber 72 model 13 was commission in 1976. The center has analysts, programmers, a statistician, keypunch operators, systems operators, systems engineers. an operation manager, and the administrative personnel. The center has the capacity to engage in further data processing activity.

The report handed over to the investigator shows that the computer center provides service facilities to the entire university community with the biggest users coming from the faculties of science and engineering, the IAR, the bursary, the registry, and the Kashim Ibrahim library.(3)

The library automation projects have been on for more than two years with the serials project completed. The totality of the library was not actually considered or planned as an integrated system. Each

library unit is handled independent of the other. The circulation project is at an exploratory stage and it hopes to receive the processing priority it might need since the circulation system would be completely on-line to the mainframe computer. Whatever computer time that is required for the library circulation operations would be assigned. The present staff strength can handle the library job, in fact, a systems analyst/programmer has been assigned to the library.

In the service field, the electricity power supply continues to be an unpredictable factor. While November, 1979 saw a downtime of 171 hours with a 24-hour operational period, throughout January, 1980 the supply has been very good. This present situation will not change with the library systems fully automated. The only problem will be the instability of electricity power supply. This problem will however be a thing of the past as soon as the university's central generator and 'no-break-set' equipment are fully operational.

Apart from a 512 lineprinter and a 405 card reader, there are two 669 nine-track tape drives, four 884 disk drives, a 905 calcomp graph plotter, and twenty-one CDC display terminals installed at various points in the university. There is also a remote batch terminal in the computer center express room which contains an additional card reader and lineprinter.

The software consists of the network operating system (NOS), four programming languages, and several packages. Table 11 shows details of the computer hardware configuration and software.

The computer center indicated that it could perform all the tasks and functions listed on the interview schedule (see Appendix F). The computer center is of the opinion that it is the responsibility

Table 11

COMPUTER CONFIGURATIONS: AHMADU BELLO UNIVERSITY AND THE UNIVERSITY OF IBADAN

University	Model of Computer	Operating Mode	Hardwares	Programming Languages	Software Packages	Others
Ahmadu Bello University	CDC Cyber 72 Model 13	Batch; On-line; Conversational	4 (844) Disk Drives 2 (669) 9-Track Tape Drives 1 (405) Card Reader 1 (512) Lineprinter 21 Display Terminals 1 (905) Calcomp Graph Plotter Keypunch Machines	Fortran (MNF) Cobol Version 4 (Ansi Compatible) Simula APL Compass	NAG SPSS SPSS On-line Statpack 2 Calcomp graph plotting routines Sort/Merge Trial (Info. retrieval package)	Tape from other computer systems can normally be read at the center. Data transfer between disc and tape possible.
University of Ibadan	IBM 370 Model 135	Batch; On-line*	4 (2311) Disk Drives 3 (2415) Tape Drives 2 (1403) Lineprinters 2 (2540) Card Readers 1 Graph Plotter 1 Console Typewriter Terminal Display Units*	Ansi Cobol Fortran IV (full) PL/1 RPG 2 Assembler	SPSS SSP IBM Utility Programmes Ditto Programme	Tapes from other computer systems can be read at the center

* Available but not fully installed.

of the library to tell it what it wants so that in the design all the features required could be included. As for the flexibility of the system, there would be no problem provided that proper information is given well in advance to the designer on the present and projected future needs of the system (circulation control) being developed.

(ii) University of Ibadan. During the interview, the investigator was made to understand that the computer center which was established in 1963, and formally transferred to the University of Ibadan in 1965, operates an IBM 370 model 135. The system is expected to be upgraded very soon. The center has analysts/programmers, key-punch operators, systems engineers and other administrative staff. Presently the establishment is not properly staffed due to staff turnover.

The computer center provides research facilities for faculties and staff; data processing for the university administration; and instruction on computer use for the entire university community. The computer system is not fully utilized and so can accommodate the university library data processing operations.

The computer center is presently working on the research libraries serials holdings, having completed that of Ibadan University library serials holdings. While the computer center could accommodate library circulation data processing, it would not be able to give it the priority it might require now.

All the tasks and functions identified in the interview schedule (see Appendix F) could be handled by the computer center

when the on-line facilities are installed and become operational. For the meantime only batch processing facilities are available.

The circulation system can be designed in such a way that it can be flexible enough to accommodate future needs of the library without additional cost or major changes if adequate information is given to the designer on the present and future needs of the system.

As for the present rate of computer breakdown in the center, the interviewee intimated it is at the rate of twice a month. The basic problem is the electricity power supply which fluctuates and consequently have some side effects on the computer itself. Any automation program in the library undertaken by the computer center would not worsen the present rate of computer breakdown in the center. This is because breakdowns are neither a function of the load nor a function of the usage. Breakdowns at the center are caused mainly by sudden surge of electric power.

The computer center is solving this major problem with the installation of stabilizer. In addition, a generator with no-break-set will soon be installed to prevent any possible loss of power supply to the system.

The present computer hardware configuration consists of an IBM 370/135, four disk drives, three magnetic tape drives, one graph plotter, two line printers, two card readers, keypunch machines, one console typewriter terminal and several display units. The last two are yet to be installed.

The programming languages available at the center are: Ansi Cobol, Fortran IV full, PL/1, RPG 2, and Assembler. Other software

packages available include SPSS, SSP, IBM Utility Programmes, and Ditto Program. Table 11 shows details of the computer system hardwares and softwares configurations.

The following are some of the interviewees' general comments.

Dr. O. M. Hoffmann, Acting Director of the Computer Center, Ahmadu Bello University, Zaria, made the following comments:

> ... With regards to the question of adoption or adaption of a system commercially developed overseas for use here, I would say that adaption is by far better than adoption. But as you will find, the actual adaption of one of these turnkey systems to the needs of this university could become so expensive, time consuming, and will even mean a big effort to actually implement it ...

Mrs. A. O. Faparusi, Systems Analyst/Programmer, Computer Center, University of Ibadan, Ibadan, had this to say:

> In any automation program for the library, you must think of the whole library system in your plan even though you are not going to implement the whole thing now. So irrespective of whether you want to automate the circulation system now, there is a need to plan for a common data base for all the units of the library. If the whole system is not planned in its entirety for automation purposes, but each unit taken independent of all others, you might eventually have to redesign the whole system. This is because trying to adjust so many pieces might be very costly.

Dr. B. J. Olufeagba, Electrical Engineer (specializing in systems engineering), Ahmadu Bello University, Zaria, commented as follows:

> In this country (Nigeria) ... they all try to use very big systems in a kind of quasi off-line fashion. It is very inefficient and sometimes they run out of disc storage ... You cannot run the library circulation system on such a system, not even on the CDC Cyber system which we have here whose up-time is 40%. You cannot do your charging, queries, etc. efficiently. A way out is to have a dedicated minicomputer which will perform some of the library transactions, while the mainframe computer takes up batch processing activities. The most important determinant in the introduction of any system in any environment is the expected reliability

> and maintainability ... I will advise strongly against acquiring a turnkey system from overseas as the situation where such systems operate nicely do not exist in this country ... Coming to adaption, most systems are not adaptable. Even if you want to adapt you have to make a lot of changes to make sure it works. The best system is the one designed here with suitable parts purchased and assembled by local technical personnel.

References

(1) Eugene A. Lincoln. White Teachers, Black Schools and Inner City: Some Impressions and Concerns. Pittsburgh: Division of Teachers Development, School of Education, University of Pittsburgh, 1975. p. 4

(2) Nathaniel M. Adeyemi. Cooperation Among Libraries in Nigeria: a Pilot Study. A Dissertation Submitted to the Faculty of the Graduate School of Library and Information Sciences for the Degree of Doctor of Philosophy. University of Pittsburgh, 1975. p. 72

(3) O. M. Hoffmann. Ahmadu Bello University, Zaria, Computer Center: (a Report). September, 1979.(mimeo)

CHAPTER V

GUIDELINES FOR THE DEVELOPMENT OF COMPUTER-BASED CIRCULATION CONTROL SYSTEMS IN THE UNIVERSITY LIBRARIES IN NIGERIA

This chapter attempts to investigate the present state of activities performed, services offered and deficiencies, and to propose the goals, objectives, functions, system products, operational requirements, and design structure for computer-based circulation control system in Nigerian university libraries given their environmental constraints. A section on evaluation, testing and validation concludes the chapter.

The questionnaires and interview responses have served mainly to provide a framework for the development of this system. Expert opinion, recorded in the literature or expressed during the investigator's interview sessions have served to fill in gaps, elaborate and provide rationale where needed.

A. Description of the Circulation Control Systems in the Nigerian University Libraries

The data presented in tables 3 and 4, and the analysis that preceded each table in chapter IV, permit the conclusions that follow.

1. The present mode of operation in the circulation systems of the Nigerian university libraries is manual.

2. The present rate of circulation transactions of the circulation system either to borrow/return materials ranges between 7,824 and 243,356 annually, with the number of patrons represented by these transactions ranging between 387 and 22,839. Consultation with the librarians is also very high. There is every evidence that this rate will continue to be high with the continued increase in students entering the universities.
3. The staff is finding it difficult to cope with the demands made of the present circulation systems.
4. Of the records kept in the circulation units: patron record; daily transaction record; reservation record; recalled items record; bindery record; items put on reserve record; withdrawn items record; and statistical records, university librarians have found them useful in the day-to-day discharge of the circulation control systems functions. The responses also show that although the catalog record is not kept within the circulation section, it is very useful in the identification, verification and location of library materials.
5. The information requirements for the circulation systems identified include: Whether items are available in the library; charged out; when due back; if overdue; on reserve; on hold; recalled; in the bindery; withdrawn from the stack; missing; which items are so much in demand; the volume of daily transactions by call number/ author and title/category of users; fines for overdue materials; and defaulters.
6. The responses show that Nigerian University libraries are either developing computer-based circulation systems or have plans to do so.

But these libraries are faced with problems such as: constant fluctuations in electricity power supply, uncertain availability of spare parts and maintenance crew; lack of skilled manpower within the library; inadequate support funds; high rate of computer breakdowns; and uncertainty about adoption of systems produced commercially overseas rather than developing one based on the local situations.

7. Generally, the present manual mode of operation barely copes with the increasing work load and information requirements of the circulation systems. For instance, four of six respondents reported that they spend on the average five minutes to search through the circulation files in order to give information. Three hundred and eighty (58.6%) users respondents indicated that it takes the library staff up to 10 minutes to inform them whether or not a particular item is out of library and when it is due back. One hundred and thirty-eight (21.3%) users felt that it takes up to 15 minutes. Also four hundred and eighty (75%) user respondents believed that all the service/information provided by the circulation units of the libraries investigated were either poor or barely adequate.

This view corroborates with the findings of a recent survey by Alabi and Alegeeleye (1) which puts the satisfaction level of circulation performance at only 48% of the users at the Ibadan University library.

On the same vein, Akhidime, in an interview with the investigator (2) noted that the present circulation system requires improvement as the patrons' time is unduly wasted as they have

to wait for a long time to get the information they want. Stephens (3) pointed out that the number of issues and returns each day was becoming too bulky to allow for easy and quick access for the purpose of obtaining information for management and patrons.

Two other reports from university libraries confirm this trend. Soyinka (4) wrote as follows:

> ... in the case of Ibadan, it is recognized that the present manual system can hardly cope with an increasing workload ... The recently introduced course-system of studies impose a faster response time to demands on the circulation system, and students' frustration with the present manual system is being increasingly articulated ...

The report on Ife University library (5) discussed earlier in this study shows the same unsatisfactory situation which exists in all the university libraries in Nigeria.

8. The figures of circulation transactions for the university libraries in Nigeria (table 3, Q. 9) pose initial difficulty as to the rationale for the development and use of computer-based circulation control systems, especially when authorities have indicated that the level at which a computer-based system is feasible and economical is when the monthly transactions is up to 10,000.(6, 7) With the exception of one library, none of the university libraries in Nigeria has reached this level.

Robinson (8) reporting on the situation at Ibadan University library said, "given the current volume of loans in the library, computer-based system cannot be justified on economical ground alone ..." Robinson (9) has however observed in the same report that "there is no doubt that a university library of the size and standing of Ibadan should have a computerized circulation system ..."

On the other hand, Soyinka has argued that even if the circulation transactions are not large, there are other factors, equally important, which can justify the expense of automation in a university library.

> From the user's point of view, a library is only as good as the services which the user receives from its public service points. Additionally, in the case of Ibadan, it is recognized that the present manual system can hardly cope any longer with an increasing work-load without a corresponding growth in circulation staff (which) is neither feasible ... nor desirable on account of the greater administrative overheads involved (but) if for instance, it is recognized that the circulation system of a library is its most active public service point, the importance of a well designed and efficient circulation system cannot be over-rated.(10)

The important consideration in the decision on whether or not to automate should depend on the performance of the system and not merely the volume of transactions. At Ohio State University library, the major reason for the decision to automate the library circulation was that the circulation system had stopped functioning. With about forty drawers of charges, they were unable to cope with the filing of charges and were not able to send out recall or overdue notices. In fact, they had lost control of the circulation system using a manual system.(11) The implication of the above discussion is that automation of the circulation system cannot always be judged on the basis of current volume of transaction. The performance of the circulation system, its survival potential against environmental, organizational and component changes are important.

B. Identification of Goals, Objectives, Functions, and System Products for Computer-Based Circulation Control Systems in the Nigerian University Libraries

The following conclusions may be drawn from the data on the goals, objectives, functions, and system products which a computer-based circulation control system would strive to accomplish in the Nigerian university library environment.

1. Goals

All the goals identified were given first and second priority ratings as shown by the calculated mean for each response. This is an indication that these goals would be considered in the development of computer-based circulation control system in the university libraries in Nigeria.

These goals are:

i. To know the whereabouts of any circulating material at any time with minimum delay.

ii. To enable patrons and other users to find accurate information on any library circulating material.

iii. To maximize the availability of all library circulating materials at any time.

iv. To obtain statistical information on the use of the library and stock.

v. To maintain control of the stock and circulation of materials by checking that patrons don't take more than is allowed and return them promptly.

Additional goals of computer-based circulation control systems which have been suggested by respondents (see p. 99) which would also be considered in the development of computer-based circulation control system in the university libraries in Nigeria are:

i. To facilitate speedy, efficient, accurate, and economical circulation transactions; and

ii. To ensure error free operations.

2. Objectives

According to the priority ratings, five objectives which received first priority ratings would be considered in the development of computer-based circulation control systems in the university libraries in Nigeria. These are:

i. To give accurate information within one minute on the status of any library material that circulates.

ii. To answer patrons' questions within one minute as to which library materials are charged out (when due back, etc.)

iii. To provide direct access to circulation records for inquiries 15 hours daily (8:00 am - 11:00 pm)

iv. To provide statistical information daily for management reports by classification numbers.

v. To provide statistical information at set periods for management reports by author/title.

An additional objective suggested by respondents (see p. 102) which would be considered in the development of computer-based circulation control system in the university libraries in Nigeria

is, "To make available library circulating materials to patrons who need them and receive those materials brought back, 15 hours daily (8:00 am - 11:00 pm)."

One objective, "To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library," which received second and third priority ratings on tables 6 (a) and 6 (b) respectively, was not favoured during the investigator's interview sessions in Nigeria. The only explanation is that Nigerian librarians and systems specialists prefer access to the library through the catalog rather than the shelflist. This preference is also shown in table 9 (c). This objective is therefore dropped in favour of another objective which reads: "To provide access to the library catalog 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library," and which would be considered in the development of computer-based circulation control system in the Nigerian university libraries.

3. Functions

The priority ratings in table 7 (a & b) shows that the functions which would be considered for a computer-based circulation control system in the university libraries in Nigeria are:

i. Charging (loan) of library materials.

ii. Maintain currency of information about loans (transaction record).

iii. Discharging of returned library materials.

iv. Make renewals.

v. Record all items charged to patrons, bindery, reserve collection, etc.

vi. Record library materials on request while out on loan for prospective borrowers, and deal automatically and promptly with such materials on return.

vii. Recall and hold library materials on request while out on loan for prospective borrowers, and deal automatically and promptly with such materials on return.

viii. Query patron/document records rapidly and easily on demand to obtain information on item or patron.

One function, "Patron/Document search including access to source files having acquisitions, cataloging and circulation information," would not be considered because it would not be necessary under the present Nigerian circumstances.(12)

Other functions suggested by respondents (see p. 105) which would be considered in the development of computer-based circulation control system in the university libraries in Nigeria are:

i. Provide statistical information on the use of library stock.

ii. Signal over borrowing.

iii. Calculate fines on return of overdue items.

iv. Ensure that only legitimate borrowers do borrow material.

v. Update or amend book and borrower information when there are changes such as classification numbers, change of address, lost tickets and issue of new patrons number, withdrawal from the university, etc.

vi. Trap library items due for reclassification, binding, reservations, short term loans; and detect/trap delinquent patrons at point of issue, and give reasons for the trapping such as overdue, overborrowing, fines owing, etc.

4. System Products

The priority ratings in table 8 (a & b) show that the system products which would be considered for a computer-based circulation control system in the university libraries in Nigeria are:

i. List of items on loan by classification number.
ii. List of items on loan by author/title.
iii. Notices on availability of reserved items to patrons.
iv. List of items in the reserve book room.
v. Record of the previous day's transactions.
vi. Recall notices.
vii. List of items in the bindery.
viii. List of all items loaned during the year, held on magnetic tape for analysis annually.

These items received first priority ratings in table 8 (a). With the exception of two products, "Recall notices" and "List of items in the reserve book room," which received second priority ratings, all the other products listed above received first priority ratings in table 8 (b).

One product suggested by the respondents which would be considered for the computer-based circulation system in Nigerian university libraries is "Printing of overdue notices."

C. Functional Description

Based on the goals, objectives, functions and system products identified for this study, a computer-based circulation systems' functions can be described in the following groups of segments.

1. Patron and Item Input Functions

The system would be able to provide the method for entering information about a borrower and item into the computer storage files.

2. Item Issue, Renewal and Return Functions

The system would be able to link library items, borrower and date information rapidly and accurately.

Towards this, the delinquent borrowers should be identified automatically by the system. It will also be able to identify the loan period for each library item and report any lost, withdrawn or temporarily withdrawn items, or items overdue.

3. Availability and Item Status Functions

For the availability function, the system would be able to determine if item is available in the library or borrowed by a patron.

On the status function, the system would provide information about a specific copy regarding changes on the status of each item (withdrawn, missing or transferred to special area) or changes in the loan period.

4. Recalls, Holds and Fines Functions

This system function would determine whether an item is available for reserve. It would also allow recall and placing of holds on items.

The fine function will allow for payments, charges and refunds to and from borrowers for fees and fine incurred.

5. Requests and Messages Functions

The system would be able to provide on-line inquiry capability and signal over borrowing or detect problem borrowers at the point of issue.

6. Daily/Periodic Report and Management Information Functions

The system would be able to facilitate collection of statistics on its activities and report same on demand automatically. Such statistics and reports will include: previous days circulation activity; the number of circulations; the number of returns; the number of reserves placed; items holders' report; etc.

D. Computer-Based Circulation Systems Features

The six systems functions developed from the analysis of the goals, objectives, functions, and systems products identified for computer-based circulation control systems in Nigerian university libraries, namely:

Patron and item input functions;

Item issue, renewal and return functions;

Availability and item status functions;

Recalls, holds, overdues and fines functions;

Requests and messages functions; and

Daily/periodic report and management information functions

are proposed to be the basic requirements for computer-based circulation control systems operations in the Nigerian university libraries.

Given these general systems functions, the main features of computer-based circulation control systems for the Nigerian university libraries will be as follows: (13)

1. For Patron and item input functions, the features will include:
   i. immediate updating of the data base;
   ii. ability to increase the item file to one millions without replacement of hardware or software at added cost;
   iii. ability to increase the patron file to 50,000 without replacement of hardware or software at added cost.

2. For Item issue, Renewal and Return functions, the features will include:
   i. ability to set variant-length loan periods and reset when necessary;
   ii. ability to circulate library items for two hourly, overnight, daily, weekly, or other loan period to patrons;
   iii. ability to restrict or block borrowers during charge-out;

vi. ability to produce a list in call number order of all items for which overdue notices are to be sent;

v. response time averaging five seconds or less for charges and discharges.

3. For Availability and Item Status functions, the features will include:

i. ability to sort in call number and Author/title, and display or print in order to ascertain if an item is available;

ii. ability to distinguish multiple volumes and multiple copies of the same call number to determine if an item is available;

iii. ability to indicate which items are on loan, in the bindery, missing, etc.

4. For Recalls, Holds, Fines and Overdues, the features will include:

i. easy, regular preparation of overdues, recall notices, fine notices;

ii. capability of easily posting holds against all circulating items;

iii. ability to place holds on items and notify patrons of their availability, including the capability of producing a list of holds in call number order.

5. For Requests and Messages functions, the features will include:

i. have response time averaging 10 seconds or less for simple inquiries by author/title;

ii. have maximum response time of 15 seconds or less for subject inquiry;

iii. capability of interacting with files in the data base regularly.

6. For Daily/Periodic Report and Management Information Functions, the features will include:

i. capability of producing circulation statistics daily, weekly, monthly or yearly, including ability to cumulate;

ii. ability to produce circulation statistics for the number of times each item was borrowed;

iii. ability to measure collection demand by requests;

iv. ability to identify frequently demanded titles, including both loans and recall requests.

E. Circulation Systems Data Files (14, 15)

The circulation features or capabilities identified above demand that computer-based circulation control system for the university libraries in Nigeria would contain such basic files as "source file and transaction file." (16)

The source file would contain the master record which essentially include the data converted from the catalog record; the patron record which contains the name and address records of all the library patrons; and the log file which would be made up

of copies of circulation transactions which would be used to restore the system in event of crash, and also to generate batch reports in circulation system operations.

The transaction file would include those files created for a variety of transactions that can occur between the library and its patrons during charging and discharging of items, placing reserve or hold on circulating items, settling fines, etc. These transaction files would be used to make the necessary updating at the source records.

Among the files that would make up the transaction file include:

1. Loan File

This would contain an entry for each charged item. It includes patron's identification (ID) number, item identification (ID) number, loan identification (ID) number, due date, and codes to indicate the status of the items (whether the item is in circulation, discharged, on hold, recalled, reserved, etc.). This file is created when an item is charged, and updated immediately when it is discharged or renewed. When it becomes overdue it is updated overnight.

2. Due Date File

This would contain the due date for each item or patron type respectively. Different loans periods may be assigned to any library item/patron each day by reloading the due date file with the appropriate date value.

3. Action File

This would contain information required to perform scheduled batch processing such as overdue processing to be performed on a given loan record if it becomes overdue; also update of patron's identification record especially when the identification number is invalidated. It would prescribe the actions to be taken in each process.

4. Report File

This would contain information sent by the mainframe computer at the computer center to the minicomputer in the library the previous night on the status of circulating items and problem patrons.

F. Circulation Control Systems Parameters and Requirements

This section further discusses various elements or parameters which make up computer-based circulation control system recommended in this study. These elements are based on the systems functions, circulation features (capabilities) and circulation systems data files. The requirements of each parameter or element is identified, and are based to an extent on the responses to two questionnaires, namely, leading librarian/systems specialists and the heads of circulation systems in the university libraries (section III); and the interviews conducted in Nigeria and in the United States (Columbus and Chicago) respectively. Further information was obtained from the analysis of related literature.

This detailed analysis will further identify the type of system components that will emerge from this study. This analysis is presented in table 12.

Table 12

CIRCULATION CONTROL SYSTEMS PARAMETERS AND REQUIREMENTS (17)

Circulation Systems Parameters	Requirements					
	Basic	Files	Terminal	Alpha-numeric Keyboard	Display Screen	Printer
a. Patrons Identification	Badges that have name, status, and identification number (machine-readable)	Names, address, status, ID number. (Source file)	Capability of reading patron badges		X	
b. Document (item) identification	Bar-coded label	Call number, Accession number, Author, Title, edition, copy number, ISBN number i.e. all catalog information	Capability of reading Bar-code.		X	

Table 12 contd.

Circulation Systems Parameters	Requirements					
	Basic	Files	Terminal	Alpha-numeric Keyboard	Display Screen	Printer
c. Charge (Loans)	Input data that identifies borrower/document. Manual input for forgotten ID. Block loans to delinquent patrons. Signal over borrowing or reserved item.	Transaction file	Capability to machine-read patron & document ID; capability to signal and explain the condition that block loans.	X	X	X
d. Discharge	Must identify existing charge record. Update existing charge record. Display message as needed.	Transaction file	Capability to machine-read document ID. Give routing instructions for documents with special destination.	X	X	X
e. Renewal	Must identify existing charge record. Updating existing charge record.	Transaction file	Capability of machine-read document/patron identification as in charging.	X	X	X

Table 12 contd.

Circulation Systems Parameters	Requirements					
	Basic	Files	Terminal	Alpha-numeric Keyboard	Display Screen	Printer
f. Recalls & Hold	Information on the library holdings and accurate circulation status.	Transaction file	Capability to query library holdings & search circulation (transaction) file.	X	X	X
g. Query document and patron files.	Present opportunity for file inquiry, & access to source files: Bibliographic (catalog) and patron.	Bibliographic record, patron record and transaction file	Rapidly display and interact with responses, and capable of displaying personal loans automatically.	X	X	X
h. Currency of information on borrowing	Up-to-date transaction file. Updating source records at least daily.	Transaction file & source file	Record all transactions automatically.	X	X	X

Table 12 contd.

Circulation Systems Parameters	Requirements					
	Basic	Files	Terminal	Alpha-numeric Keyboard	Display Screen	Printer
i. Over borrowing	Information on accurate circulation status	Transaction file	Capable of sorting to borrower sequence, Counts number of documents against borrowers. Stop further borrowing or cause to print recall notice if too many.	X	X	X
j. Statistical Count	Must produce all transactions by call number, etc.	Transaction & source files		X	X	X
k. File Maintenance	Updating all files.	Transaction & source files	Record all transactions automatically (charge or discharge)	X	X	

G. Data Base Structure

The development of computer-based circulation systems consists of the development of a data base designed to handle the systems functions. A data base contains operational data represented as a set of related entities ready to accept required input as well as generate required output.(18) Such data base includes such components as bibliographic data and processing data.(19)

The choice of an integrated system approach as opposed to single application approach, with the resultant common data base (Table 9 (b)) shows that Nigerian leading librarians/systems specialists are conscious of the savings that can be realized by utilizing the same machine-readable data base for different purposes, thus eliminating duplication of data and reduce processing time and costs.(20)

It is recommended that an integrated data base of information for the library as a total entity would be developed for computer-based circulation control system in a distributed processing system environment (see chapter II for distributed processing concept), in the Nigerian university libraries, with the library catalog and patron record as the major input. Surace (21) has noted that a wholly integrated circulation system which is a subsystem of a cataloging imput is within the state of the art. In fact, both Ohio State University library and the University of Chicago library have moved in this direction. The obvious advantages of a catalog based circulation system is the additional information library management will have in determining the circulation usage of its holding, the strength and weaknesses of collection, and additional input for weeding

decision. According to Partridge (22) "until the circulation system is linked to a machine-readable catalog, however, there will be no means of calculating the use of individual book titles." This integration will eventually permit bibliographic queries to be made for the cataloging and acquisitions departments (see figure 2 in chapter II).

De Gennaro proposed an integrated data base system for the university libraries, such that are found in the Nigeria environment when he commented as follows:

> ... university libraries ... which have small book collections and little existing bibliographic apparatus, have taken the seemingly logical course of attempting to design and install integrated computer-based systems for all the library operations. (23)

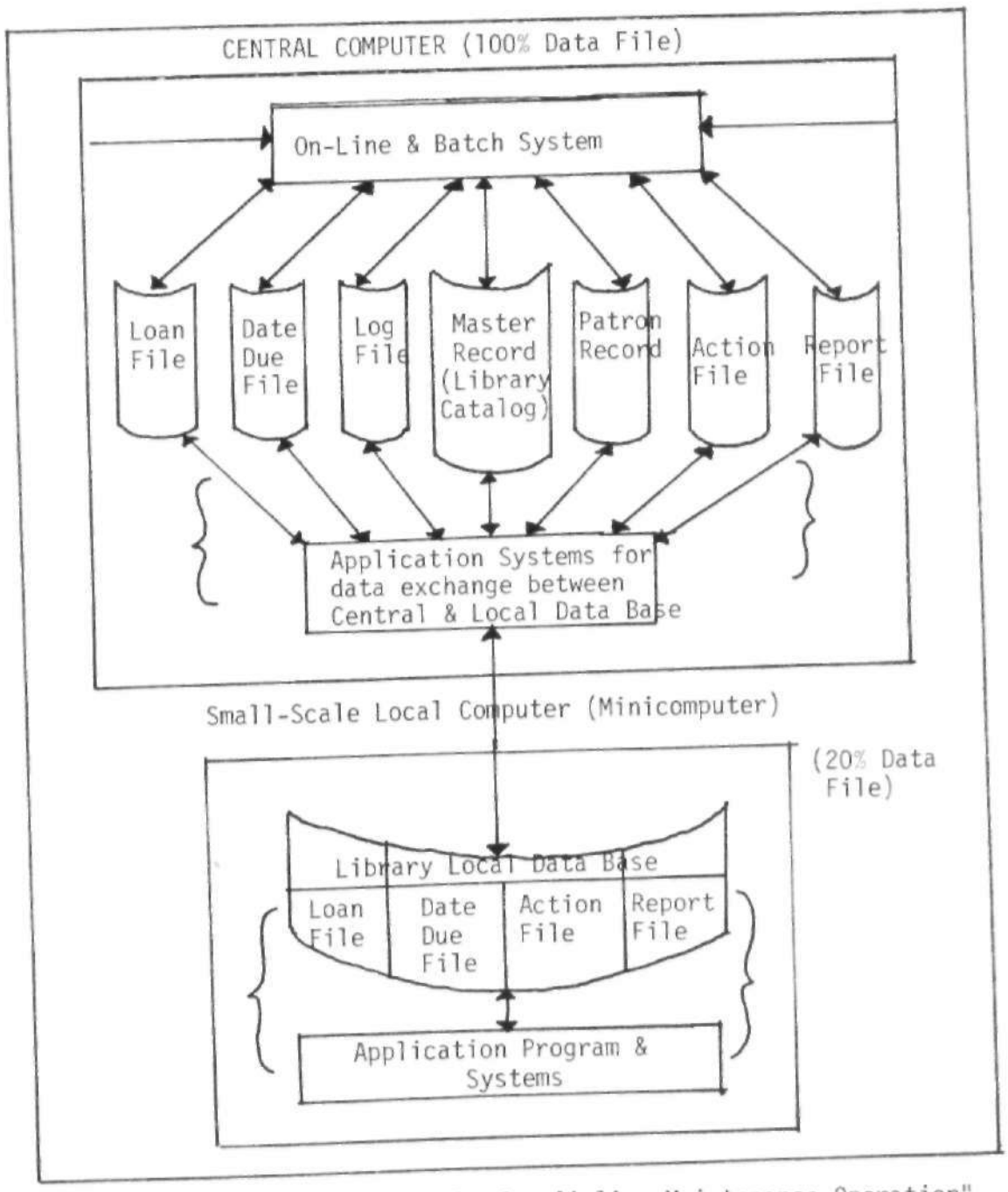
Figure 3 also shows an integrated data base structure in a distributed processing environment with circulation files.

H. Computer Configuration for the Circulation Control Systems in the Nigerian University Environment

A close study of the computer facilities in the Nigerian universities reveals that while the various computer centers would be willing to accept and process data for the library operations, it will not be possible to have a machine-readable catalog on-line 15 hours daily (8:00 am - 11:00 pm), not even the transaction record for the purposes of performing circulation transactions and the necessary queries that might be required. The major reasons are that most of the hardware and communication equipment have not been either installed or upgraded as already approved, added to the problem of hardware downtime which is at the rate of 40% on the average.

Figure 3

AN INTEGRATED DATA BASE STRUCTURE IN A DISTRIBUTED PROCESSING ENVIRONMENT WITH LIBRARY CIRCULATION FILES ON THE FOCUS*



* Source: Keun K. Lee. "DDT Viable for Airline Maintenance Operation" Computerworld. July 30, 1979. Special Report/6

While the computer center at the Ahmadu Bello University could provide the library's circulation control system with on-line capability now, it is not guaranteed that it could cope with the data processing requirements of the library when the library automation program is fully operational. (24)

While the leading Nigerian librarians, systems specialists and heads of the circulation systems in the university libraries are overwhelmingly in support of the use of the computer centers' resources only, in the event of developing computer-based circulation control systems in the university libraries in Nigeria, it is the view of this investigator that the problems already identified on pages 28 and 29 of chapter II, makes this approach very unsuitable for the library circulation functions.

An alternative suggested is the use of minicomputer within the library as a dedicated processor for special application (25) in addition to the use of the mainframe computer in the computer center for major file updating and printing functions. In other words, while the minicomputer is alive and on-line, the mainframe computer is busy elsewhere without actually hurting the library operations.(26)

The rationale behind this approach is fivefold.

1. The functions identified which would be performed by the circulation control system in the Nigerian university environment (pages 134/135) demand an on-line applications, which often require substantial amounts of secondary storage space that must be immediately accessible at random times throughout the day.(27)
2. The library circulation transactions involve highly interactive programs and so well suited to a minicomputer environment.

3. In addition to enabling the library to provide workable on-line library service, the minicomputer provides increased flexibility and reliability (28) which are paramount concerns in the Nigerian university library environment.
4. The minicomputer facility can operate in a temperature range of $20^{O}F$ - $150^{O}F$ and allows rapid temperature fluctuations without failure.(29)
5. The minicomputer facility will allow for distribution of information processing in the distributed processing system environment.

I. Design Structure of the Proposed Computer-Based Circulation Control System in the Nigerian University Libraries

The purpose of this section is to focus on the priorities for general circulation system implementation, their requirements and the resources constraints, and recommend a system structure for the operation of computer-based circulation control system for the university libraries in Nigeria, making maximum utilization of the existing computer facilities in the universities.

Towards this, two systems structures have been developed. Both structures comprise two basic modules respectively. These are the central site hardware/software and the local site hardware/software. Each of these modules performs specific functions.

The basic concept is that of distributed data processing in which the local (library) installations provide some computing power, but a significant portion of storage and computation are performed by a large computer (the host computer) located at the computer center.(30)

In general terms, the central site components are utilized to handle the item and patron data base and control the methodical access to the data. The local site components are utilized for transactions at the circulation desk. The local site design incorporates a minicomputer capable of handling randomly occurring functions at the terminal on a real-time basis.

Both system structures are designed independent of input medium, and are further discussed under short range and long range approach respectively.

1. The Short Range Approach

The short range approach is based on the data collected during the investigator's interview sessions in Nigeria which involved leading librarians and systems specialists.(31,32,33,34) It also agrees with the operating mode which received the highest score in the questionnaire response. This approach combines the attributes of off-line and on-line operating modes, otherwise known as a hybrid system, and it is based on the principle of distributed processing concept.

The minicomputer would provide uninterrupted on-line facilities and perform relatively light but fairly evenly distributed workloads. The day to day transaction activities will be handled by the minicomputer with the necessary transaction files on-line. At night, after the library closes, the host computer also carries out such jobs as printing of overdue and recall notices, as well as sorting, merging and producing lists of all kinds.

The data base structure would be like the one shown in figure 3. The mainframe computer would have all the files in its data base, while the minicomputer would have only the transaction files (active files) in its data base and to be processed on-line.

Figure 4 shows the short range approach schematically which could be implemented with the resources available to the university libraries in Nigeria at present time. The rationale behind this approach is further discussed later in this chapter under constraints.

2. The Long Range Approach

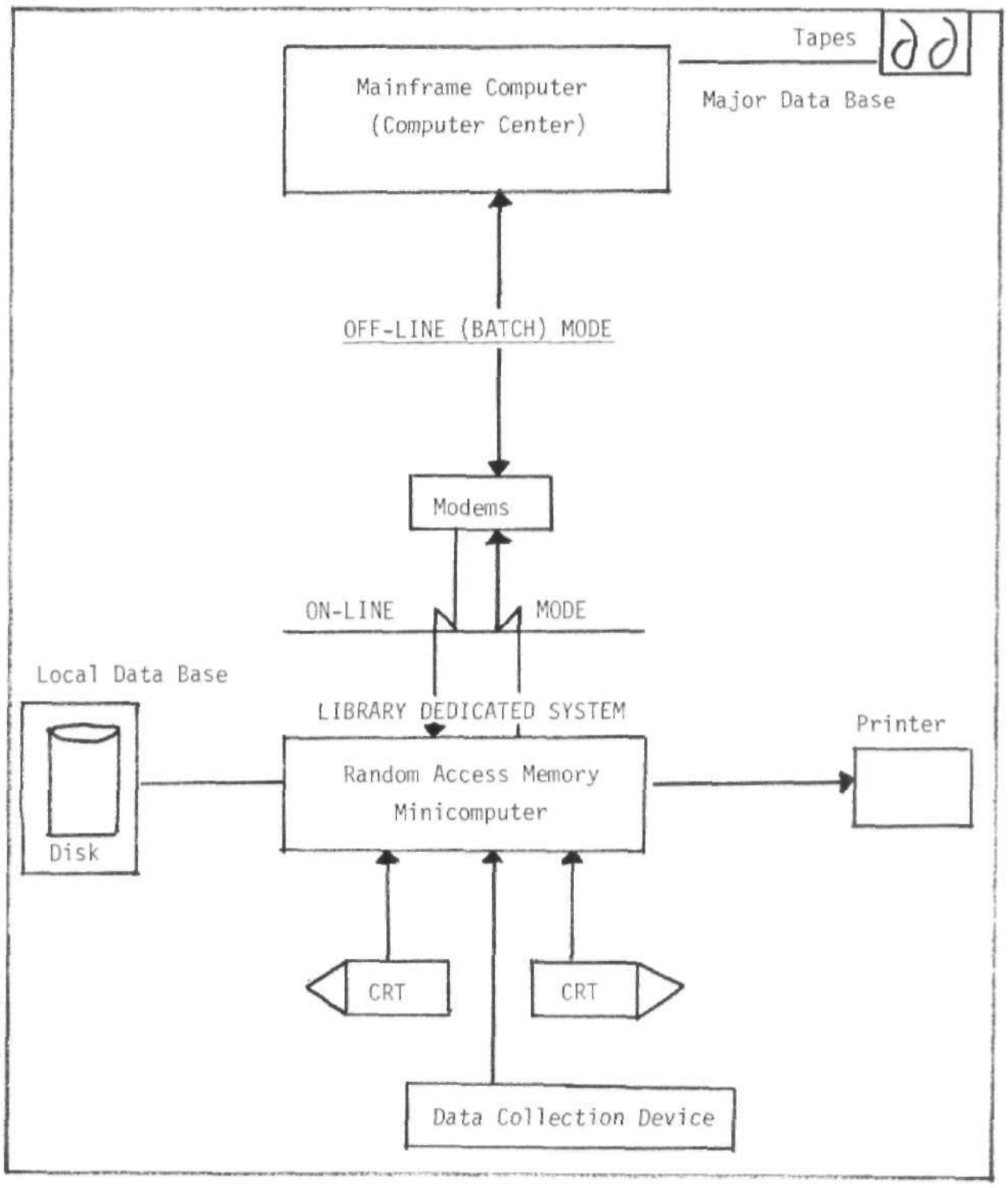
The long range recommendation is not based on data collected but based on the development which will eventually become relevant in the Nigerian university environment.

The basic concept is also the distributed computing based on on-line, real-time operating mode. The idea is to handle each processing need with the computer system best suited to it.

In this case also, the host computer will have 100% of the total systems file stored in its data base on disk but will perform minimal processing functions on-line (see figure 3). The host computer is only operational when the minicomputer in the library cannot give required information from the files available to it. The minicomputer which is installed in the library will have about 20% of the total systems file content, but will process about 80% of the informations required of the system. (35) The basic principle here is the "80% - 20%" rule which is the current state-of-the-art in an automated environment. (36) Handley has reported the extent to which "80% - 20%" rule is influencing SOLINET plans for developing future relationship

Figure 4

PROPOSED COMPUTER-BASED CIRCULATION CONTROL SYSTEM - HYBRID SYSTEM (SHORT RANGE APPROACH)



with central computer facilities such as the OCLC. (37) The "80% - 20%" rule suggests that approximately 20% of a systems file (the highly active file) are retained in the library for processing with local computing, in this case with the minicomputer. It is very important however that the selection of this 20% must be made so that approximately 80% of the processing can be done within the library.

Figure 5 shows the long range approach schematically which could be implemented when the computer resources in the Nigerian universities are fully operational on-line.

The major files updating and the printing/listing functions would be carried out by the host computer off-line during the night.

3. Communication Between the Host Computer and the Minicomputer

For the hybrid system (the short range approach), there would be periodic calling up of data from the minicomputer by the host computer for processing and storage. This has the advantage of eliminating real-time access to the central data base during the day when the host computer time is very critical. (38)

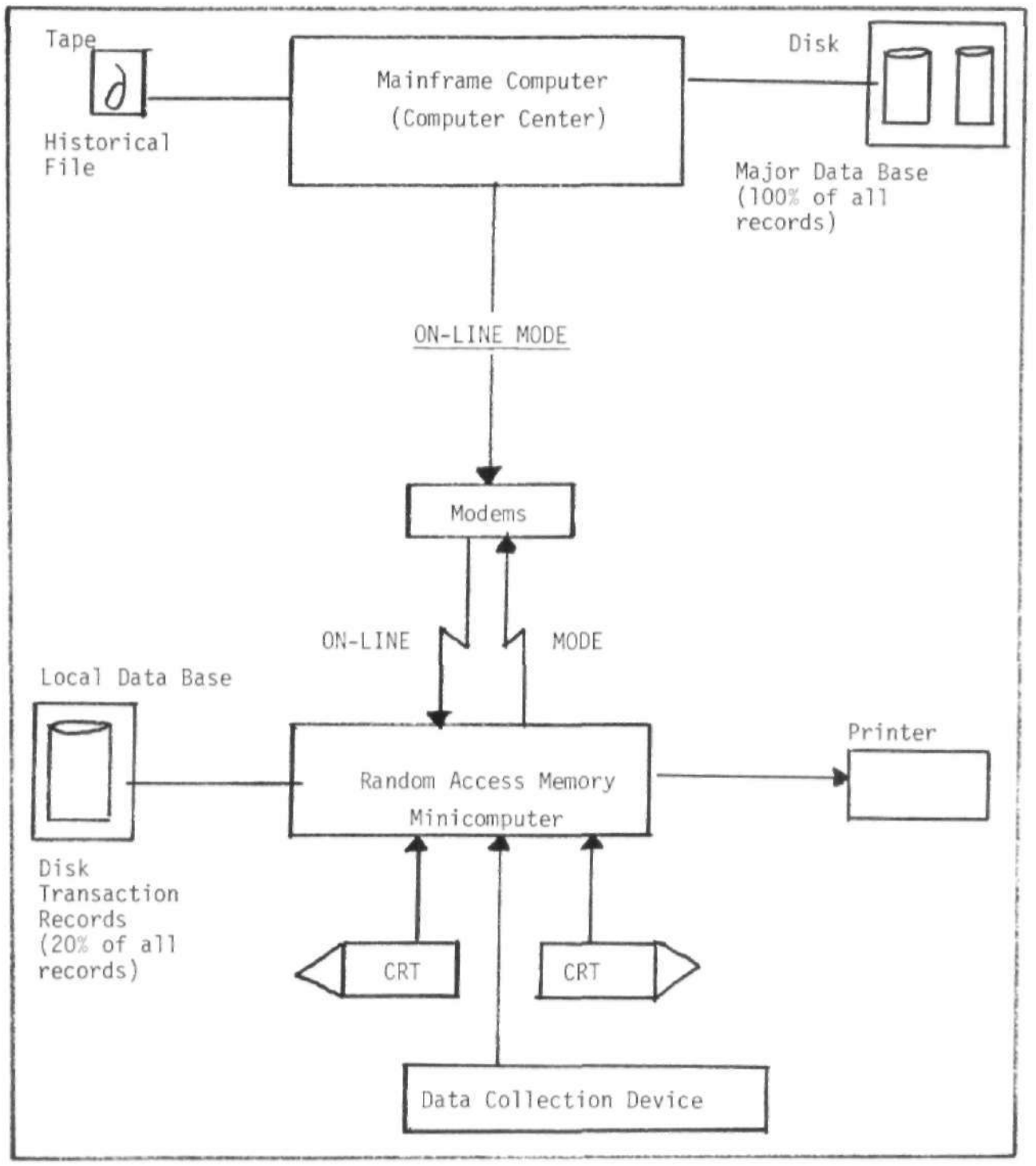
On the other hand, in the long range approach there would be continuous connection of the minicomputer to the host computer with the ability to interrogate the host computer at all times. (39)

4. Data Collection Device

Tedd (40) and Foil (41) have discussed extensively the various data collection devices available in Britain and America respectively. While ALS and Plessey Light Pens are most commonly used in Britain, IBM 357 and Mohawk Data Sciences are popular in the United States of

Figure 5

PROPOSED COMPUTER-BASED CIRCULATION CONTROL SYSTEM: DISTRIBUTED PROCESSING SYSTEM - LONG RANGE APPROACH



America. Soyinka's detailed analysis and recommendations (42) have been found acceptable to this investigator. In this regard, the choice for the circulation control systems in the university libraries in Nigeria would be between the ALS and Plessey Light Pen systems, both manufactured in Britain.

5. Terminals, Display Screen, Printer and Keyboard

The requirements for the above system components have been analyzed under Circulation Control Systems Parameters and Requirements (see table 12).

Tables 13 and 14 show the summaries of the main components of the proposed computer-based circulation control system for the university libraries in Nigeria; and the priorities for the systems implementation respectively. Figure 6 shows the relationship between the circulation system and other library systems with the bibliographic data base.

J. Constraints

The reason for the development of short range and long range approaches is due to the constraints identified in the university environment in Nigeria. These include:

1. Problem with the electricity power supply.
2. Shortage of skilled personnel in both library and computer center.
3. Insufficiency of funds.
4. Limited computing power due to constant systems breakdowns.

Table 13

SUMMARY OF THE MAIN COMPONENTS OF THE PROPOSED COMPUTER-BASED CIRCULATION CONTROL SYSTEM FOR THE NIGERIAN UNIVERSITY LIBRARIES

Components	Requirements
Master Record containing full description and locational data for all library items.	Library catalog to be converted into machine-readable format centrally stored.
Patrons Record with full details in terms of names, address, status and identification number.	Patron record to be converted into machine-readable format.
Items and Patrons identification.	There should be machine-readable items and patrons IDs.
A Central Computer system which will support mechanical interconnection of library circulation control transactor(s) for system-wide access to data representing the aggregate collection of the main library and its branches.	The Central Computer will have batch/on-line and time sharing capabilities.
Circulation Control Transactor within the library which will manage local inventory control, request for materials in the local collection, and queries.	Minicomputer with on-line real-time operating mode; Data Collection Device; Printers; and Terminals/Display Device.
Communication Facilities over which available messages will be transmitted.	Dedicated communication line and Terminals.
Uninterruptible electricity power supply.	Standby generator; and No-break-set batteries.
Personnel	Systems Analysts/Programmers; Operators; Systems Engineers; Technically oriented librarians.
Funds	Capital and Maintenance funds.

Table 14

SUMMARY OF PRIORITIES FOR THE COMPUTER-BASED CIRCULATION CONTROL SYSTEM IMPLEMENTATION

a. Charge/Renewal

i.	Data collection (charge/renewal)	Automated.
ii.	Charge/Renewal in manual backup	Manual.
iii.	Charge/Renewal of unlabelled and reserve items .	Manual.

b. Discharge

i.	CRT/Keyboard discharge	Automated.
ii.	Discharge in manual backup	Manual.
iii.	Discharge of unlabelled and reserve items . . .	Manual.

c. Query

i.	Staff query of loan record	Automated.

d. Saves and Availability Function

i.	Recall	Automated.
ii.	Charge - Block	Automated.
iii.	Renewal - Block	Automated.
iv.	Discharge - Hold	Automated.
v.	Book Availability Notices/Messages	Automated.

e. Update . . . . . Automated.

f. Loan Periods

i.	Loan period in computer file	Automated.
ii.	Loan period in manual backup mode	Manual.

g. Notice Generation . . . . . Automated.

h. Patrons Accounting/Account Statements . . . . . Automated.

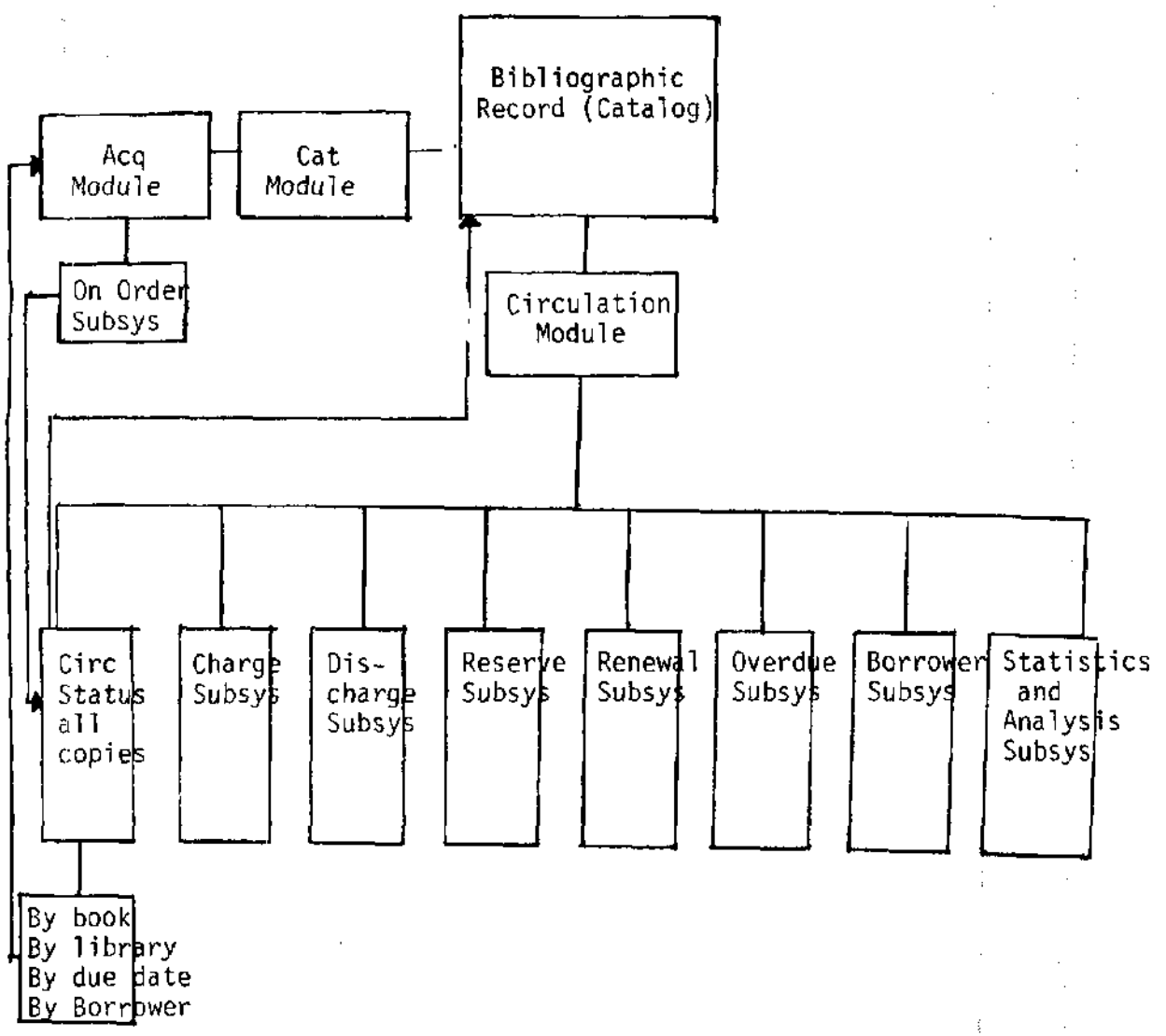
i. List Generation . . . . . Automated.

j. Management Reports . . . . . Automated.

Figure 6

INTEGRATED SYSTEM WITH CIRCULATION SUBSYSTEM

SHOWN IN DETAILS*



* Source: Cecily J. Surace. "Library Circulation Systems: An Overview" Library Automation Handbook. Detroit, Mich.: Management Information Services, (n-d) 5-180 (Reference and Serials Subsystems Omitted.)

5. Computer re sources not fully operational in some university c omputer centers.

Given the above c onstraints it will only be possible at the present to operate on both batch and on-line modes otherwise known as a hybrid system for the library circulation control operations.

At present the prob lems identified above are being tackled by the various institutions. I t is the opinion of this investigator that first and foremost the p roblem of fluctuations in electricity power supply should be contai ned by installing both Standby Generator and No-Break-set Batteries whi ch will keep the computer system running even if there is sudde n power cut from the main power source. Secondly, there is no point pur chasing equipment without having them installed. Efforts should be m ade to install the equipment already purchased by various computer c enters. The Nigerian Federal Govern-ment should be approached to re lax its import policy on computer spare parts so that major repa irs could be carried out without the unnecessary long delays presen tly experienced.

The only way to arrest technical staff turnover is to train more people in the field. Thi s will take some time, but will eventually solve the problem. Also, more students should be offered places in the Department of Co mputer Science already established in some of the universities. The computer centers should offer short courses on the use of computer systems to the university staff including the librarians.

As for funds, proper p lanning and cooperation with the university administration wil l go a long way to solving this problem. It should be realized that the present university financial crisis

will soon be over with the present plan by the Nigerian Federal Government to pump money into the universities. The role the various Vice Chancellors will play as the chairpersons of the library committee in all the universities in this regard will not be underestimated provided adequate plans are put forward by the libraries.

By the time these constraints are contained, it will be possible to implement the long range approach recommended in this study.

The transition from the short range approach to the long range approach will not involve major changes in the data base structure or the basic computing concept. The only thing remaining is a potentially major software development which will involve some additional cost. The communication cost will be high also as both the minicomputer and the host computer will be connected on-line.

Finally, it is very important that there should be full cooperation and consultations between the library and the computer center right from the start since the systems proposed in this study will rely on the computer center to a significant extent.

K. Evaluative Comments, Testing and Validation

1. Evaluative Comments

i. The strongest positive feature of the system proposed in this study is its use of distributed processing concept. One of the results, in theory at least, is that it is possible to implement a computer-based circulation control system for relatively low cost, and at the same time achieving operational efficiency.

ii. The minicomputer-host computer relationship embodied in the system means that networking, automatic interlibrary loan and easier sharing of resources is much simpler to accomplish.

iii. The weak point in the short range approach is that not all the information which relates to both patrons and bibliographic items to be circulated are available on-line. This means that changes to that information are not immediately available to the user. This situation is however rectified in long range approach where both computer systems are on-line.

2. Testing and Validation

System design structures like those proposed in this study can be tested and validated in order to establish their operational viability by the use of any of these methods:

i. by cost-effectiveness analysis;

ii. in a pilot project involving a group of libraries; or

iii. by computer simulation.

(i) Cost-Effectiveness Analysis. The only real criterion for using data processing at all is cost-effectiveness. If tasks can be performed manually in a quick, easy, and accurate manner, an expensive computer is not required.(46) Justification of a capital investment, should always be stated in terms of cost-effectiveness analysis. This analysis weighs the effectiveness derived from the direct benefits of a proposed system against resource constraints which, in this

analysis, equate to cost. This analysis determines if the proposed system produces benefits which outweigh cost, when such analysis is performed on two or more alternative systems.(47) In such a situation the quality or extent of a system's usefulness, generally increases with the following parameters: accuracy; timeliness; reliability; response time; completeness; and relevance.(48)

It is speculated that this methodology has gained wide use because it is based on the motivating force of money.(49) Two examples of such approach are Burkhalter's system analysis in a university library (50) in which the problem investigated was the cost of changing charge-out period; and the analysis of a university library at MIT (51) which investigated the development of a plan for the future operation of the library which would optimally meet certain defined objectives.

One problem identified in this approach is that the constant presence of the estimation of user behavior by quantitative methods seems uniformly to cause difficulty.(52) Also, some authorities believe that cost-effectiveness analysis technique is not suited to the difficult decisions involved in system design.(53)

Despite these limitations, quantification through cost-effectiveness analysis of systems variables is a powerful system test and evaluation tool.(54)

(ii) Pilot Project. The conceptual system design of circulation control system proposed for the university libraries in Nigeria, offer a suitable basis for a pilot study in a real operational situation involving a selected group of libraries. This would be aimed at investigating the practicality of the proposed system and

its performance in relation to goals, objectives and functions on which it is built. In addition, this study can reveal some other unforeseen factors which are likely to influence monitoring tool for validating the system design structure before going into full-scale implementation.(55)

One example of such approach is the MARC Pilot Project which involved 16 selected libraries aimed at eliciting information of the viability of the MARC format designed by the Library of Congress.(56)

(iii) Computer Simulation. Simulation technique enables the use of both real and hypothetical data to supply information on the performance of a system in terms of delays, item processing time, queue contents, and average utilization of each member of staff and each storage facility.(57) Computer simulation therefore can be used to test the proposed circulation system design structures for their internal consistencies, their logical properties and their general behaviors in order to make reasonable judgement about their likeness to reality. It could be used also to assess the suitability of their operational procedures and provide information on systems performance before making final decisions in implementations.

Blount has used simulation techniques to determine a measure of a machine-based information retrieval system's performance.(58) Shaw has also employed simulation technique to evaluate the semester loan policy of the Sears library, as well as various alternative loan policies.(59)

Despite the high cost involved, the use of this test procedure will have particular relevance to the management of library systems such as the one proposed in this study.

References

(1) G. A. Alabi and G. O. Alegbeleye. Frustration Study in an Academic Library: the Case of Ibadan University Library. Ibadan, Nigeria: Ibadan University Library, 1979. (Unpublished Seminar Paper)

(2) J. A. Fab Akhidime. Interview Response. (p. 116, Chap. IV.)

(3) S. L. Stephens. Interview Response. (p. 119, Chap. IV.)

(4) O. Soyinka. Preliminary Report on the Installation of a Computer-Based Circulation Control System at the Ibadan University Library. Ibadan, Nigeria: Ibadan University Library, 1979. p. 8. (Unpublished Report)

(5) Adebayo Olaosun. "Computer-Based Circulation Control System for University Libraries in Nigeria" Zambia Library Association Journal. 9 (December, 1977) 90-98

(6) B. A. J. McDowell and C. M. Phillips. Circulation Control System. Southampton: University of Southampton Library, 1970. (SOUL/Automation Project Report No. 1)

(7) Jane Wainwright. Computer Provision in British Libraries. London: ASLIB, 1975.

(8) M. E. Robinson. Proposed Computer-Based Circulation System: Report. Ibadan, Nigeria: Ibadan University Library, 1979. p. 2 (Unpublished Report)

(9) Ibid., p. 3

(10) O. Soyinka. op. cit., p. 8

(11) Susan Miller. Interview Response. (Ohio State University Library, Columbus, Ohio)

(12) F. A. Akinyotu. Interview Response. (p. 116, Chap. IV)

(13) Richard W. Boss. "Circulation Systems: the Options" Library Technology Reports. 15 (1979) 20-22

(14) University of Chicago. The University of Chicago General Circulation System: Overview. February 28, 1979. pp. 4-7 (Unpublished)

(15) Robert M. Hayes and Joseph Becker. Handbook of Data Processing for Libraries. New York: Becker & Hayes, 1970. pp. 493-503

(16) Rob McGee. "Key Factors of Circulation System Analysis and Design" College & Research Libraries. (March, 1972) 128

(17) Rob McGee. "The University of Chicago Library's JRL 1000 Circulation Terminal and Bar-Coded Labels" Journal of Library Automation. 8 (1975) 5-25

(18) Nathaniel Adeyemi. Computers and Acquisitions. Paper Presented at the Workshop on Library Automation in the Nigerian Libraries ... March 7-9, 1977. p. 1 (Unpublished)

(19) Ibid.

(20) Judson Breslin and C. Bradley Tashenberg. Distributed Processing Systems: End of the Mainframe Era? New York: Amacom, 1978. p. 184

(21) Cecily J. Surace. "Library Circulation Systems: an Overview" Library Automation Handbook. Detroit, Mich.: Management Information Services, (n-d) 5-175

(22) - Partridge. "Conference on Development with United Kingdom Computer-Based Loans Systems: Concluding Discussion" Program. 9 (July, 1975) 143

(23) R. De Gennaro. "Automated Systems in Academic Libraries" Journal of Library Automation. 1 (March, 1968) 76

(24) A. Ochai. Interview Response. (p. 118, Chap. IV)

(25) Judson Breslin and C. Bradley Tashenberg. op. cit., p. 42

(26) Ibid., p. 48

(27) R. Elchesen. "Dedicated Versus Resource Shared Library Computer Systems" Special Libraries. (July, 1976) 302

(28) Judson Breslin and C. Bradley Tashenberg. op. cit., p. 46

(29) Ibid., p. 43

(30) W. H. Scholz. "Computer-Based Circulation Systems: a Current Review and Evaluation" Library Technology Reports. 13 (May, 1977) 253

(31) T. O. Odeinde. Interview Response. (p. 118, Chap. IV)

(32) A. Achai. op. cit.

(33) O. Soyinka. Interview Response. (p. 118-119, Chap. IV)

(34) B. J. Olufeagba. Interview Response. (p. 125, Chap. IV)

(35) Allen Kent. Personal Communication. May 30, 1980

(36) Ibid.

(37) Lee Handley. Talk Given at PRLC Board Meeting. May 23, 1980. Jonestown, Pa.

(38) Richard W. Boss. op. cit., p. 64-65

(39) Ibid.

(40) Lucy Tedd. An Introduction to Computer-Based Library Systems. London: Heyden, 1977. pp. 93-99

(41) Patti Sue Foil. "Survey of Data Collection Systems for Computer-Based Library Circulation Processes" Journal of Library Automation. 9 (September, 1976) 223-233

(42) O. Soyinka. Preliminary Report ... op. cit., pp. 14-16

(43) Judson Breslin and C. Bradley Tashenberg. op. cit., p. 20

(44) John G. Burch and Felix R. Strater. Information Systems: Theory and Practice. New York: John Wiley, 1974. p. 290

(45) Chris Mader and Robert Hagin. Information Systems: Technology, Economics, Applications. Chicago: Science Research Associates, 1974. p. 328

(46) Patricia J. Zimmerman. "Principles of Design for Information Systems" J. Am. Soc. Info. Sc. (July, 1977) 185

(47) B. R. Burkhalter ed. Case Studies in Systems Analysis in a University Library. Metuchen, N.J.: Scarecrow Press, 1968.

(48) J. A. Raffel and R. Shisko. Systematic Analysis of University Libraries: an Application to Cost-Benefit Analysis to M.I.T. Libraries. Cambridge, Mass.: MIT, 1966.

(49) Patricia J. Zimmerman. op. cit., p. 186

(50) Ibid.

(51) Ibid.

(52) Nathaniel M. Adeyemi. Cooperation Among Libraries in Nigeria: a Pilot Study. A Dissertation Submitted to the Faculty of the Graduate School of Library and Information Sciences for the Degree of Doctor of Philosophy. University of Pittsburgh, 1975. p. 110

(53) Stephen R. Salmon. "Library Automation" Encyclopedia of Library and Information Science. Edited by Allen Kent, Harold Lancour and Jay E. Daily. New York: Marcel Dekker, 1975. p. 360

(54) Pauline A. Thomas and Stephen E. Robertson. "A Computer Simulation Model of Library Operations" Journal of Documentation. 31 (March, 1975) 4

(55) Norman R. Baker and Richard E. Nance. "The Use of Simulation in Studying Information Storage and Retrieval Systems" American Documentation. (October, 1968) 364

(56) W. M. Shaw. "Computer Simulation of the Circulation Subsystems of a Library" J. Am. Soc. Info. Sc. (Sept.-Oct., 1975) 271-279

CHAPTER VI

SUMMARY, CONCLUSION, AND RECOMMENDATIONS FOR FUTURE STUDY

This chapter contains a summary of the research study, conclusions, and recommendations for further research.

A. Summary of Research Study

It has been recognized that the University libraries in Nigeria can hardly cope with the increasing work-load that exists. As it is recognized that the circulation system of a library is its most active public service point, the importance of a well-designed and efficient circulation system cannot be over-stated.(1) The present state of the art shows that the university libraries in Nigeria have had varying degrees of experience with library automation. However, the development already undertaken have been achieved without a theoretical framework which would provide the basis for useful applications, yet it has been realised that Nigerian university libraries will have to resort to automation if they must cope adequately with present day demands on their services.(2)

The university libraries in Nigeria are on the threshold of applying modern technology to improve their services. This is illustrated by the development of computer-based systems, to be used in the case of a manual breakdown when there is an increase in quantity of data. It is important however to anticipate this far in advance since the development of computer-based systems takes a long time.

The objective of this study is to formulate guidelines for the development of computer-based circulation control systems in the University libraries in Nigeria. The method taken to satisfy this objective emphasizes the systems approach viewpoint of design and its related integrated systems concept in a distributed processing environment. Specifically, it was hoped that the result might provide a fundamental system development methodology which may be generalized and applied in all the university libraries in Nigeria and other real libraries in developing countries of the world with close similarities.

The methodology utilized for data collection in this study consists of the following three techniques:

1. questionnaire survey
2. interview
3. analysis of literature

The population sample for this study consisted of 1,104 librarians, systems specialists, and university faculty, staff and students from two universities in Nigeria. The questionnaire and interview schedules were pretested to ensure clarity and to remove as much as possible imperfections in the design.

The data from returned questionnaires were coded on IBM 1230 data sheets which were used to produce punched data cards used for subsequent computer analysis. The mean, frequency distribution, Chi Square Test, and T-test of Significance were obtained by use of computer programs in the Statistical Package for the Social Sciences (SPSS) made available through the office of Measurement and Evaluation, University of Pittsburgh.

B. Conclusions

The data which was produced through the study revealed several points:

1. Participants unanimously suggested that the present mode of operation in the university library circulation systems is inadequate.
2. In the development of computer-based systems, the best approach is a logical process where possible applications are identified by looking at all library activities, which are mostly labour intensive, and install them with the detailed perspective needed to assure that each separate unit can be linked with the others.
3. The development approach will be based on an integrated system concept with a machine-readable data base designed from the bibliographic record (catalog).
4. The development of computer-based circulation control system should not be based on computing power supplied by a commercial bureau, rather the computer center facilities of the universities would be used with a dedicated minicomputer installed within the library.
5. Given the present infrastructure in the country, a completely on-line real-time system will not be feasible immediately. Rather, an intermediate solution to the off-line/on-line provided by the hybrid approach should be adopted.
6. An integrated data base will be supplemented by the concept of distributed computing or processing. The idea is that both the mini and the mainframe computers should be used, with each processing need handled by the computer system best suited to it.

Given the present capability of the computer systems available in the Nigerian Universities, both short range and long range system design structures were recommended. In the short range approach, it is recommended that on-line processing should be used for high volume transactions using a minicomputer installed in the library. Whereas the major file updating and printing functions, and back-up security, are left to the mainframe computer which need only be used once every 24 hours.

In the long range approach, both the minicomputer and the mainframe computer would operate in an on-line mode based on the principles of "80% - 20%" rule. This suggests that approximately 20% of the circulation files (the highly active files) are retained in the library for processing with the dedicated minicomputer. The mainframe computer would have 100% of the files in its data base. The minicomputer would transact about 80% of the circulation's data processing and information requirements, while the mainframe computer would transact about 20%. This means that the mainframe computer would only function when the minicomputer fails to satisfy a request or an action. This approach would be feasible in the university library environment in Nigeria, when the various computer centers have been adequately equipped.

C. Recommendation for Future Studies

The information presented in this study identifies four separate but conceptually related directions for future research.

1. Additional work will be needed in the area of cost-benefit analysis of the two proposed circulation systems structure.

2. Studies are needed to find out software and staff requirements for the system.
3. A simulation of the system design structure presented in this study should be carried out to determine:
   i. queuing problems relating to accessing the central and minicomputers;
   ii. the effect of message traffic on the system;
   iii. an optimum transportation structure; and
   iv. the benefit of the design in terms of economic impact, accessibility of information and its effect on library service.(3)
4. A new level of technology as proposed in this study will bring with it a new man-machine relationship incorporating both opportunities and constraints.(4) A study is therefore needed on job satisfaction among Nigerian library staff in an automated environment. This could be expanded to include, how well the combination of technology and tasks would be integrated with the values and needs of the staff so as to produce feelings of job satisfaction.

References

(1) O. Soyinka. Preliminary Report on the Installation of a Computer-Based Circulation Control System at the Ibadan University Library. Ibadan, Nigeria: Ibadan University Library, 1979. p. 8 (Unpublished)

(2) Adetunji Akinyotu. Library Automation: a State of the Art Review. Paper Presented at the Workshop on Automation in Nigerian Libraries. Ibadan, Nigeria: University of Ibadan, 1977. p. 29 (Unpublished)

(3) Nathaniel M. Adeyemi. Cooperation Among Libraries in Nigeria: a Pilot Study. A Dissertation Submitted to the Faculty of the Graduate School of Library and Information Science for the Degree of Doctor of Philosophy. University of Pittsburgh, 1975. p. 121

(4) Enid Mumford. "Values, Technology and Work" Information Systems Methodology: Proceedings. Edited by G. Goos and J. Hartmanis. New York: Springer-Verlag, 1978. p. 154

APPENDIX A

QUESTIONNAIRE TO HEADS OF CIRCULATION UNITS

University of Pittsburgh

SCHOOL OF LIBRARY AND INFORMATION SCIENCE
Program of Doctoral Studies

December 31, 1979

Dear Sir/Ms.

I am writing a dissertation on the topic:
"Guidelines for the Development of Computer-Based Circulation Control Systems in University Libraries in Nigeria."

This is in recognition of growing interest in the development of computer-based systems in the university libraries in the country which is in line with the current trends in the practice of librarianship resulting from the significance of technological development.

Recognizing the potential value of computer technology, my dissertation attempts to formulate guidelines for the development of computer-based circulation control systems in the university libraries in Nigeria. It is hoped that such guidelines will have a positive effect on the process of total library automation development in Nigerian environment.

The attached questionnaire is designed to obtain an overall picture and understanding of the position of the present circulation control system; the structure of its organization; and to gather essential information for the determination of the requirements for a computer-based system. As one of the chief operators of your circulation control systems, your response will help towards a better library circulation automation development plan that will meet the needs of the university libraries in the country.

I will greatly appreciate your cooperation in completing and returning the attached questionnaire at your earliest convenience, but preferably on or before January 25, 1980. I shall acknowledge your help in this study.

Please return the completed questionnaire to the address below:

Victor C. Igwilo,
c/o The University Librarian,
Kashim Ibrahim Library,
Ahmadu Bello University,
Zaria, Kaduna State.

Yours sincerely,

Victor C. Igwilo.

LIBRARY AND INFORMATION SCIENCES BUILDING, PITTSBURGH, PA. 15260

I. Personal Information:

1. Your Name _____

2. Name and Address of your Institution _____

_____

3. Your Position _____

4. How long have you been working in the Circulation Section?

_____ Years(s) _____ Month(s)

5. Which other Section(s) of the Library have you worked?

_____

_____

II. General:

6. What is the mode of operation in your section? (Mark X where appropriate)

a. Manual . . . . . ( )

b. Photocharging . . . . . ( )

c. Computer-Based . . . . . ( )

Batch (Off-line) . . . . . ( )

On-line . . . . . ( )

d. Other (Please specify) _____

7. Do you envisage any changes from the present method to another one? (Mark X where appropriate)

_____ Yes _____ No

8. If the answer to (7) is yes please state which method you hope to adopt: _____

When? _____

Why? _____

9. How many circulation transactions did your section make during the last academic year? _____

10. What is the number of patrons represented by these transactions? _____

11. Do you expect more, an equal number or fewer transactions and patrons in the current academic year? (Mark X where appropriate)

    a. Transactions: More ( ) Equal ( ) Fewer ( )

    b. Patrons: More ( ) Equal ( ) Fewer ( )

12. If the answer to question (11) is more or fewer, give estimate %.

    a. Transactions: More ____% Fewer ____%

    b. Patrons: More ____% Fewer ____%

13. What types of records do you keep in your section? (Mark X where appropriate)

    a. Patrons record . . . . . ( )

    b. Shelflist record . . . . . ( )

    c. Bibliographic record . . . . . ( )

    d. Daily transaction record . . . . . ( )

    e. Reservation record . . . . . ( )

    f. Recalled items record . . . . . ( )

    g. Bindery record . . . . . ( )

    h. Withdrawn items record . . . . . ( )

    i. Missing items record . . . . . ( )

    j. Delinquent patrons record . . . . . ( )

    k. Statistical records . . . . . ( )

    l. Other (specify) _____

14. If an item is on order or in process, can any of the records you keep in your section indicate this? (Mark X)

    ____ Yes ____ No

15. Do you experience any problems keeping or having access to the records you have identified in question (13)? (Mark X)

Keeping the records: _____ Yes _____ No

Access to the records: _____ Yes _____ No

16. What problems are there in keeping and accessing records?

_____

_____

17. Which of these information are asked of your section by patrons, circulation staff, library management? (Mark X)

a. Information as to when items:

i. Charged out are due back . . . . . ( )

ii. Reserved could be collected . . . . . ( )

b. Information as to which items are:

i. Available in the library . . . . . ( )

ii. Charged out . . . . . ( )

iii. Overdue . . . . . ( )

iv. On reserve . . . . . ( )

v. On hold . . . . . ( )

vi. Recalled . . . . . ( )

vii. In the bindery . . . . . ( )

viii. Withdrawn . . . . . ( )

ix. Missing . . . . . ( )

x. So much in demand . . . . . ( )

c. Information as to what the daily transaction is by:

i. Author/Title . . . . . ( )

ii. Call number (subject) . . . . . ( )

iii. Category of users . . . . . ( )

d. Any other (specify) _____

_____

_____

18. What functions do members of your section presently perform? (Mark X where appropriate)

a. Charging and Discharging of materials . . . . . ( )

b. Reservations . . . . . ( )

c. Renewals . . . . . ( )

d. Any other (specify) _____

_____

_____

_____

_____

19. What other functions would you wish to perform which your section cannot presently cope with?

_____

_____

_____

20. If you are asked about an item, which records will you search in your section? _____

_____

_____

21. How long does such search take you on the average? (Mark X where appropriate)

a. Less than 1 minute . . . . . ( )

b. Up to 5 minutes . . . . . ( )

c. Up to 10 minutes . . . . . ( )

d. Up to 15 minutes . . . . . ( )

e. More than 15 minutes . . . . . ( )

22. Is the search comprehensive enough to get all the required information? (Mark X where appropriate)

_____ Yes _____ No

23. If the answer to question (22) is no, what other records would you wish to have available for search in your section? _____

_____

_____

_____

_____

III. Development of Computer-Based Circulation Control Systems:

In developing a computer-based system, goals, objectives, functions and systems products have to be established. Please indicate which priorities you would assign to each of the goals, objectives, functions, and systems products listed below by checking X in appropriate column. (Please check only one column for each item.)

	Priorities				
	1st	2nd	3rd	4th	5th
24. Goals.					
a. To enable patrons find accurate information on any library circulating material					
b. To maximize the availability of all library circulating materials at any time					
c. To know the whereabout of any library material that circulates at any time with minimum delay					
d. To maintain control of the stock, and circulation of materials, by checking that patrons don't take more than is allowed and return them promptly					
e. To obtain statistical information about the use of the library and stock					

f. Any other (specify) _____

_____

_____

25. Objectives.

	Priorities				
	1st	2nd	3rd	4th	5th
a. To answer patron's questions within 1 minute as to which library materials are charged out (when due back, etc.)					
b. To give accurate information within 1 minute on the status of any library material that circulates					
c. To provide direct access to circulation records for inquiries 15 hours daily (8:00 am - 11:00 pm)					
d. To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library					
e. To provide statistical information daily for the management reports on the total library circulations by:					
Author/Title					
Call number (subject)					
Patron category					

f. Any other (specify) _____

_____

_____

_____

_____

26. Functions.

	Priorities				
	1st	2nd	3rd	4th	5th
a. Charging (loan) of library materials					
b. Discharging of returned library material					
c. Renewals					
d. Reservations					
e. Recalls and Holds					
f. Patron/Document search (access to source files having acquisitions, cataloging and circulation information)					
g. Query Patron/Document files					
h. Maintain currency of information about loans (transaction file)					
i. Identification of delinquent patrons					
j. Record all items charged to patrons, bindery, reserve collection, etc.					

k. Any other (specify) _____

_____

_____

_____

27. Systems Products.

	Priorities				
	1st	2nd	3rd	4th	5th
a. List of items on loan					
b. Recall notices					
c. Notification of availability of reserved items					
d. List of items in the reserve book room					
e. List of items reserved for patrons					
f. List of individuals over borrowing					
g. List of missing items at set periods					
h. List of items in the bindery					
i. Record of previous day's transactions					
j. List of items on loan by borrowers' identification numbers					
k. List of items on loan by classification number					
l. List of items on loan alphabetically by author					
m. List of all items loaned during the year, held on magnetic tape, for analysis annually					

n. Any other (specify) _____

_____

_____

_____

_____

28. Please indicate which approach you would advocate in each of the alternatives listed below in the development of computer-based circulation control system in the university libraries in Nigeria. (Mark X to an alternative preferred.)

a. _____ Centralized system.
_____ Decentralized system.

b. _____ Integrated data base.
_____ Single Application.

c. _____ Inventory (Shelflist) system.
_____ Inventory (Bibliographic file) system.
_____ Absence (Transaction file) system.

d. _____ Bar-coded label system.
_____ Optical Character Recognition (OCR) system.
_____ Punched Card system.

e. _____ Off-line (Batch) system.
_____ On-line system.
_____ Hybrid system.

f. _____ Use of Institution's existing computer system.
_____ Use of Commercially produced system.
_____ The combination of the two.

g. _____ Any other (specify) _____

_____

_____

_____

29. What ideas or advise would you give to a person who is intending to start a computer-based circulation control system in a university library in Nigeria?
(Please use the back of this sheet of paper for comments.)

APPENDIX B

QUESTIONNAIRE TO LEADING LIBRARIANS AND SYSTEMS SPECIALISTS

MOST OF WHOM PARTICIPATED IN THE LIBRARY AUTOMATION

WORKSHOP AT IBADAN, NIGERIA

University of Pittsburgh

SCHOOL OF LIBRARY AND INFORMATION SCIENCE
Program of Doctoral Studies

December 31, 1979

Dear Sir/Ms.

I am writing a dissertation on the topic:
"Guidelines for the Development of Computer-Based Circulation Control Systems in University Libraries in Nigeria."

This is in recognition of growing interest in the development of computer-based systems in the university libraries in the country which is in line with the current trends in the practice of librarianship resulting from the significance of technological development.

Recognizing the potential value of computer technology, my dissertation attempts to formulate guidelines for the development of computer-based circulation control systems in the university libraries in Nigeria. It is hoped that such guidelines will have a positive effect on the process of total library automation development in Nigerian environment.

The attached questionnaire is designed to elicit your views on the goals, objectives, functions, and systems products and design for computer-based circulation control systems in the university libraries in Nigeria. As one of the leading librarians and or computer specialists in the country, your response will help towards a better library circulation automation development plan that will meet the needs of the country.

I will greatly appreciate your cooperation in completing and returning the attached questionnaire at your earliest convenience, but preferably on or before January 25, 1980. I shall acknowledge your help in this study.

Please return the completed questionnaire to the address below:

Victor C. Igwilo,
c/o The University Librarian,
Kashim Ibrahim Library,
Ahmadu Bello University,
Zaria, Kaduna State.

Yours sincerely,

Victor C. Igwilo.

LIBRARY AND INFORMATION SCIENCES BUILDING, PITTSBURGH, PA. 15260

I. Personal Information

1. Name _____

2. Place of work _____

3. Professional status _____

II. Development of Computer-Based Circulation Control Systems

In developing a computer-based system, goals, objectives, functions, and systems products have to be established. Please indicate which priorities you would assign to each of the goals, objectives, functions, and systems products listed below by checking X in appropriate column. (Please check only one column for each item.)

1. Goals.	Priorities 1st	2nd	3rd	4th	5th
a. To enable patrons find accurate information on any library circulating material					
b. To maximize the availability of all library circulating materials at any time					
c. To know the whereabout of any given library circulating material at any time with minimum delay					
d. To maintain control of the stock, and circulation of materials, by checking that patrons don't take more than is allowed and return them promptly					
e. To obtain statistical information about the use of the library and stock					

f. Any other (specify) _____

_____

_____

_____

2. Objectives.

a. To answer patrons' questions within 1 minute as to which library materials are charged out (when due back, etc.)

b. To give accurate information within 1 minute on the status of any library material that circulates

c. To provide direct access to circulation records for enquiries 15 hours daily (8:00 am - 11:00 pm)

d. To provide access to the library shelflist record 15 hours daily (8:00 am - 11:00 pm) to be able to give information on any title in the library

e. To provide statistical information daily for the management reports on the total library circulations by:

Author/Title

Call number (subject)

Patron category

Priorities

1st	2nd	3rd	4th	5th

f. Any other (specify) _____

_____

_____

3. Functions.

	Priorities				
	1st	2nd	3rd	4th	5th
a. Charging (loan) of library materials					
b. Discharging or returned materials					
c. Renewals					
d. Reservations					
e. Recalls and Holds					
f. Patron/Document search (access to source files having acquisitions, cataloging and circulation information)					
g. Query Patron/Document files					
h. Maintain currency of information about loans (transaction file)					
i. Identification of delinquent patrons					
j. Record all items charged to patrons, bindery, reserve collection, etc.					

k. Any other (specify) _____

_____

_____

4. Systems Products.

	Priorities				
	1st	2nd	3rd	4th	5th
a. List of items on loan					
b. Recall notices					
c. Notification of availability of reserved items					
d. List of items in the reserve book room					
e. List of items reserved for patrons					
f. List of individuals over borrowing					
g. List of missing items at set periods					
h. List of items in the bindery					
i. Record of previous day's transactions					
j. List of items on loan by borrowers identification numbers					
k. List of items on loan alphabetically by author					
l. List of items on loan by classification number					
m. List of all items loaned during the year, held on magnetic tape, for analysis annually					

n. Any other (specify) _____

_____

_____

5. Please indicate which approach you would advocate in each of the alternatives listed below in the development of computer-based circulation control system in the university libraries in Nigeria. (Mark X to an alternative preferred.)

a. _____ Centralized system.
_____ Decentralized system.

b. _____ Integrated data base.
_____ Single Application.

c. _____ Inventory (Shelflist) system.
_____ Inventory (Bibliographic file) system.
_____ Absence (Transaction file) system.

d. _____ Bar-coded label system.
_____ Optical Character Recognition (OCR) system.
_____ Punched Card system.

e. _____ Off-line (Batch) system.
_____ On-line system.
_____ Hybrid system.

f. _____ Use of Institution's existing computer system.
_____ Use of Commercially produced system.
_____ The combination of the two.

g. _____ Any other (specify) _____

_____

_____

_____

6. What ideas or advice would you give to a person who is intending to start a computer-based circulation control system in a university library in Nigeria?
(Please use the back of this sheet of paper for comments.)

APPENDIX C

QUESTIONNAIRE TO SELECTED FACULTY, STAFF AND STUDENTS

OF THE AHMADU BELLO UNIVERSITY AND THE

UNIVERSITY OF IBADAN

January 5, 1980

Dear Sir/Ms.

I am conducting a user analysis as a basis for the development of computer-based circulation system in the university library. I ask for a small effort from you which can be of great assistance in this endeavour.

The attached questionnaire is designed to identify what you think of the university library circulation department. By your response you are helping towards a better understanding of the library circulation department situation, the finding of more adequate solution to identified problems, and to better plan to meet your needs.

Will you help by spending fifteen or so minutes answering the questionnaire? Please select an answer even though you might feel a bit uneasy about it. It is very important that every question be answered.

The questionnaire will be treated with absolute confidentiality and the information given will be used solely for the purpose of this study.

I have attached a self-addressed envelope and request that you drop your response in the mailbox at the main entrance of the library provided mainly for this purpose. Your prompt response will be appreciated.

Yours sincerely,

Victor C. Igwilo.

1. Please mark X where appropriate:

   _____ Student of Basic Studies (Pre-degree).

   _____ Undergraduate student.

   _____ Post-graduate student.

   _____ Researcher.

   _____ Faculty.

   _____ Staff.

   _____ Other (specify) _____

2. How often do you use the main library?

   _____ Daily.

   _____ Weekly.

   _____ Monthly.

   _____ Several times a session.

   _____ Never.

3. Please circle the frequency with which you use the library for the following purposes:

   (1 = Never; 2 = Seldom; 3 = Average; 4 = Often; 5 = Very Often)

   I use the library to:

a.	borrow or return library material	1	2	3	4	5
b.	consult librarian about library material that is needed	1	2	3	4	5
c.	find material for required course	1	2	3	4	5
d.	find reference material	1	2	3	4	5
e.	study my own books or notes	1	2	3	4	5
f.	other (specify)					
	_____	1	2	3	4	5
	_____	1	2	3	4	5

4. On the average, how much time do you spend at the circulation desk to either borrow or return library material? (Please mark X where appropriate.)

   I spend on the average:

   a. less than 1 minute . . . . . ( )

   b. up to 5 minutes . . . . . ( )

   c. up to 10 minutes . . . . . ( )

   d. up to 15 minutes . . . . . ( )

   e. more than 15 minutes . . . . . ( )

5. How much time on the average does it take for the circulation clerk or librarian to inform you whether or not a particular book or material you want is out of the library; if out when it would be due back? (Please mare X where appropriate.)

   On the average it takes:

   a. less than 1 minute . . . . . ( )

   b. up to 5 minutes . . . . . ( )

   c. up to 10 minutes . . . . . ( )

   d. up to 15 minutes . . . . . ( )

   e. more than 15 minutes . . . . . ( )

6. How do you rate the services/information given to you at the circulation desk? (Please circle the number which best designate your success: 1 = Never; 2 = Poor; 3 = Barely adequate; 4 = Good; 5 = Very good.)

   a. Information as to whether a given title has been acquired by the library 1 2 3 4 5

   b. Information as to the location of a given title within the library 1 2 3 4 5

   c. Information as to whether a given title is loaned out, withdrawn, temporarily removed from the stack, missing, etc. . . 1 2 3 4 5

   d. Information as to when a title checked out of the library is due back 1 2 3 4 5

   e. Information as to titles you have requested to be reserved for you 1 2 3 4 5

6. contd.

f. Obtaining material reserved for you . . . 1 2 3 4 5

g. Getting timely assistance from the circulation staff 1 2 3 4 5

7. Is there any other information or service you require from the circulation desk which is poorly provided or not provided at all? (Please mark X where appropriate)

_____ Yes _____ No

If yes please specify _____

_____

_____

APPENDIX D

INTERVIEW WITH COMPUTER CENTERS OF THE AHMADU BELLO UNIVERSITY, ZARIA AND THE UNIVERSITY OF IBADAN

University of Pittsburgh

SCHOOL OF LIBRARY AND INFORMATION SCIENCE
Program of Doctoral Studies

October 10, 1979

Dear Sir,

I am writing a dissertation on the topic "Guidelines for the development of computer-based circulation control system in university libraries in Nigeria."

This is in recognition of growing interest in the development of computer-based systems in the university libraries in the country.

In order to collect the data upon which some of the aspects of this dissertation is based, I would benefit greatly from a brief visit to the computer center of the university to see how the center can be helpful in the development of computer-based systems in the university library.

The main objective of my visit would be to gain insight into the computer technological environment which is very important for the development and ultimate implementation of computer-based systems in the university library.

I will plan to telephone you soon to seek an appointment in January, 1980.

Thank you very much.

Yours sincerely,

Victor C. Igwilo.

LIBRARY AND INFORMATION SCIENCES BUILDING, PITTSBURGH, PA. 15260

THE COMPUTER CENTERS OF AHMADU BELLO UNIVERSITY AND UNIVERSITY OF IBADAN:

INTERVIEW SCHEDULE.

I. GENERAL

1. What is the name of the center?
2. When was the computer established?
3. What is the total number of staff in the center?

   How many are Analysts? Programmers? Operators? Engineers?
4. What functions do you currently perform?
5. How is the computer system utilized presently?

   Under-utilized? Sufficiently utilized? Over utilized?
6. Has your system any experience in library automation?
7. If yes, what aspect of the library have you been involved in?
8. Is the automation program projected, in progress or completed?
9. Can the present computer system accommodate further library processing job?
10. If yes, can you accommodate all the library processing job or part of it?
11. If the library decides to automate, can the present computer system store all data from the library adequately, access these data and at the time required?
12. How much computer time can the library be assigned?
13. Will library job have any priority?
14. Have you the staff to handle the library's functions?
15. Will there be adequate communication between the library and the computer system?
16. What is the present rate of computer break down?
17. With the library fully automated, what will be the rate of the computer system break down?
18. What problems do you envisage with the library automation?

19. How do you intend to solve these problems?

II. COMPUTER CONFIGURATION

20. Model of computer

21. Operating mode:

a. On-line
b. Off-line
c. Batch
d. Remote batch
e. Conversational
f. Other (specify)

22. Hardware: (Indicate type and number)

a. Magnetic tape drive
b. Disk drive
c. Graph plotter
d. Line printer
e. Display unit
f. RJE terminal
g. Console typewriter
h. Key-punch machine
i. Card reader
j. Others

23. Programming language:

a. Basic
b. Cobol
c. Fortran
d. Assembler
e. Others

24. Packages:

a. SPSS
b. SSP
c. IBM Utility Program
d. Ditto program
e. Others

III. TASK

Indicate if the existing computer system can perform any of these tasks:

25. Circulation features:

a. Response time averaging five seconds or less for charges and discharges.

b. Response time of five seconds for simple inquiries by author or title.

c. Ability to sort two classification schemes (LC, DC).

d. Ability to distinguish multiple volumes and copies of the same call number.

e. Identification of restricted or blocked borrowers during charge-out.

f. Immediate updating of the data base including immediate call number access and access to hold.

g. Ability to place holds on items and notify patrons of their availability, including the capability of producing a list of holds in call number order.

h. Capability of easily posting holds against all circulating copies of a multicopy item.

i. Easy, regular preparation of overdue notices, recall notices, fine notices in background or overnight.

j. Ability to produce a list in call-number order of all books for which overdue notices are scheduled to be sent.

k. Access to information concerning materials charged to an individual borrower by the borrower's name.

26. Reserve Functions:

    a. Ability to charge materials to linked course/faculty members.

    b. Ability to generate course/faculty directories.

    c. Circulation statistics for the number of times each item was borrowed, tied to course/faculty member.

27. Management functions:

    a. The production of circulation statistics by time of day, week, month, or year, including the ability to cumulate.

    b. Ability to measure collection demand by classification number, including both loans and recall requests.

    c. Identification of frequently demanded titles.

    d. Identification of frequently circulated titles.

e. Circulation statistics by borrower type.

28. Flexibility of System:

a. Ability to increase the item file to 1,000,000 items without replacement of hardware of software at added cost.

b. Ability to increase the patron file to 50,000 without replacement of hardware or software at added cost.

c. Ability to increase the number of terminals to more than 10 in the library without replacement of hardware or software at added cost.

d. Ability to extend to remote library locations.

e. Ability to "network" with other systems in the country in library environment.

29. Any other comment?

APPENDIX E

INTERVIEW WITH THE LIBRARY ADMINISTRATORS OF THE AHMADU BELLO UNIVERSITY AND THE UNIVERSITY OF IBADAN LIBRARIES

University of Pittsburgh

SCHOOL OF LIBRARY AND INFORMATION SCIENCE
Program of Doctoral Studies

October 10, 1979

Dear Sir,

I am writing a dissertation on the topic "Guidelines for the development of computer-based circulation control system in university libraries in Nigeria."

This is in recognition of growing interest in the development of computer-based systems in the university libraries in the country.

In order to collect the data upon which some of the aspects of this dissertation is to be based, I would benefit greatly from a brief visit to your library to see how the circulation systems operate, and also to interview you on the subject.

The main objective of my visit would be to obtain information on your library mission, goals and objectives; general organizational structure; staff; budget; strength and nature of the collection; library automation experience if any; problems and prospects of developing computer-based systems in the library.

I will plan to telephone you soon to seek an appointment in January, 1980.

Thank you very much.

Yours sincerely,

Victor O. Igwilo

LIBRARY AND INFORMATION SCIENCES BUILDING, PITTSBURGH, PA 15260

AHMADU BELLO UNIVERSITY AND UNIVERSITY OF IBADAN LIBRARIES'

ADMINISTRATIONS:

INTERVIEW SCHEDULE.

Purpose: To obtain information on library mission, goals and objectives; general organizational structure; staff; budget; strength and nature of the collection; library automation experience if any; problems and prospects of developing computer-based systems in the library.

1. How long have you been in this position?

2. What is the main expectation of the university of the library?

3. Could you explain how various sections of the library operate to meet this expectations?

4. If you are asked to give information about a book, where do you have to look?

5. Who are the users of your library?

6. If you take all the possible users how many are they?

7. How many users use your library presently?

8. Do you expect any more next year? Give estimate.

9. How many people are on your staff? How many are professionals?

10. Does your library have a centralized administrative system?

11. Does your library function in more than one geographical or physical location?

12. Does your library have a union catalog of all materials in the system?

13. What is the relationship of the various sections of your library in terms of organization, data flow, information flow?

14. What is the library's annual budget?

15. How much do you spend on books? staff? equipments? others?

16. What is the present strength of your library collection?

17. Do you expect any increase in stock? Give estimate.

18. How much of these are allowed to circulate?

19. What is the total library circulation last year?

20. Do you expect any increase this year? Give estimate.

21. How often do you get information as to the number of materials that circulate by author/title, subject, or patron?

22. What other information would you wish to obtain from the circulation dept?

23. How do you assess your present circulation system performance?

24. Is there any interest in the development of computer-based systems in your library?

25. What is the university's policy as to your use of computer technology for data processing in your library?

26. What automation programs are contemplated, in progress or completed?

27. Is there any policy that stipulates that in the event of the development of computer-based systems in the library that the computer resources at the university computer center alone will be used?

28. If no, what other sources are available to your library?

29. Is it consistent with the university's policy for you to develop a computer-based system in the library independent of the computer center?

30. In the event of automating your library systems, would you adopt an integrated system development with step by step approach or automate each section independent of each other?

31. Would you advocate for centralized or decentralized systems approach in the development of computer-based system in your library?

32. Given the go ahead order to automate, which library section (system) will be your first priority? 2nd? 3rd? Do you have any reason for your choice?

33. Do you consider any of the following as problems which might hinder the development of computer-based systems in your library?

    a. funds to support automation program?

    b. technology to support automation program?

    c. staff to support automation program?

d. institutional policy?

e. absence of institutional leadership in the country (such as LC in the U.S.A.)?

f. absence of systems development guidelines?

g. any other?

34. What ideas or advice would you give to a person who is intending to develop a computer-based circulation system in your library? (Please consider the technology, personnel and funding levels)

APPENDIX F

INTERVIEW WITH THE UNIVERSITY OF CHICAGO AND OHIO STATE UNIVERSITY LIBRARIES

University of Pittsburgh

SCHOOL OF LIBRARY AND INFORMATION SCIENCE
Program of Doctoral Studies

October 10, 1979

Dear Sir,

I am writing a dissertation on the topic "Guidelines for the development of computer-based circulation control system in university libraries in Nigeria."

This is in recognition of growing interest in the development of computer-based systems in the university libraries in my country.

In order to collect the data upon which some of the aspects of this dissertation is to be based, I would benefit greatly from a brief visit to your library to see how the circulation systems operate, and also to interview you on the subject.

The main objective of my visit would be to uncover the factors involved in planning, development, implementation and current operation of the circulation system.

I will plan to telephone you soon to seek an appointment in December, 1979.

Thank you very much.

Yours sincerely,

Victor C. Igwilo.

LIBRARY AND INFORMATION SCIENCES BUILDING, PITTSBURGH, PA. 15260

UNIVERSITY OF CHICAGO AND OHIO STATE UNIVERSITY LIBRARIES:

INTERVIEW SCHEDULE.

Purpose: To uncover the factors involved in planning, development, implementation and current operation of the circulation system.

1. Could you describe the structure of your current circulation control system?

2. Did you develop your own system (in-house) or do you use commercially developed system (packaged system)?

3. Could you give me the background history of the development of the circulation control system emphasizing on why you adopted the present system?

4. What is the relationship between the circulation system and the other library systems in terms of data use, interface, etc.?

5. What is an estimated high library circulation volume?
   What is an estimated low library circulation volume?

6. i. The circulation system is made up of these three components: user, data and system. Could you tell me the goals and objectives of these components?

   ii. How adequately have you satisfied these goals and objectives?

   iii. What are the main factors that contribute to the achievement of these goals and objectives?

   iv. If these goals and objectives have not been adequately satisfied, could you state what factors are responsible?

   v. How do you attempt to solve the problems?

7. i. What functions does the circulation system perform presently?

   ii. Is the circulation system adequate?

   iii. Are there areas that need improvements?

8. i. How many persons have you on the circulation system staff?

   ii. How many are professionals?

   iii. Are there systems specialists on the staff?
   If so, how many? What are their functions?

9. What computer configuration do you use?

10. What is the operating mode?

11. There have been arguments as to which approach to follow in systems development:

    i. Centralized versus Decentralized systems.

    ii. On-line versus Off-line versus Hybrid systems.

    iii. Integrated versus Distributed systems.

    iv. Absence versus Inventory systems.

    v. OCR label versus Bar-coded label.

    Which of these approaches did you adopt and why?

12. At the time of systems planning and development did you consider any of the following as problems which hinder the automation progress?

    i. Human factors.

    ii. Technological factors.

    iii. Finance to support automation program.

    iv. Institutional problem.

    v. Communication factors.

    vi. Shelflist conversion.

    vii. Absence of system development guidelines.

    How did you overcome the problems.

13. What is the cost of developing the present circulation system?

14. What ideas or advice would you give to a person who is intending to start a computer-based circulation control system in a large research library in a developing country? (Please consider the disparity between funding, personnel, and technology levels.)

15. Any other comments?

BIBLIOGRAPHY

Ackoff, Russell L. "Towards a System of Systems Concepts" Management Science. 17 (July, 1971) p. 661-671

Alexander, M. J. Information Systems Analysis, Theory and Application. US: Science Research Association, 1974.

Alper, Bruce H. "Library Automation" Annual Review of Information Science & Technology. Edited by C. A. Caudra et al. Washington, D.C.: ASIS, 1975. vol. 10, 199-236

Amaeshi, Basil. "Mechanization of Cataloguing Services" Nigerian Libraries. 11 (April, August, 1975) 93-99

Atkinson, Hugh C. "The Evolution of an Automated Circulation System" An Automated On-line Circulation System. Edited by Irene B. Hoadley and R. Thorson. Columbus, Ohio: Ohio State University Libraries, 1973.

Bahr, Alice Harrison. Automated Library Circulation Systems, 1979-1980. 2nd ed. White Plains, N.Y.: Knowledge Industry Publications, 1979.

Baker, Norman R. "A Descriptive Model of Library/User/Funder Behavior in a University Library Environment" The Library College: a Method of Learning. Graduate School of Library Science. Drexel Institute, Philadelphia, December 18-21, 1966. US Clearing House, Report PB-174-439.

Bertalanffy, Ludwig von. "The History and Status of General Systems Theory" Systems Analysis Techniques. Edited by J. Daniel Couger and Robert W. Knapp. NY: John Wiley, 1974.

Boss, Richard. "Circulation Systems: the Options" Library Technology Reports. 15 (January-February, 1979) 7-108

Breslin, Judson and C. B. Tashenberg. Distributed Processing Systems, End of Mainframe Era? New York: Amacom, 1978.

Buckland, M. K. and B. Gallivan. "Circulation Control: Off-line, On-line, or Hybrid" Journal of Library Automation. 5 (March, 1972) 30-38

Burch, John G. and Felix R. Strater. Information Systems Theory and Practice. New York: John Wiley, 1974.

Canning, Richard G. ed. "The Challenges of Distributed Systems" EDP Analyzer. 16 (August, 1978)

De Gennaro, Richard. "Library Automation: Changing Patterns and New Trends" Library Journal. 101 (January, 1976) 175-183

Debons, A. and K. Leon Montgomery. "Design and Evaluation of Information Systems" Annual Review of Information Science and Technology. Edited by A. C. Caudra et al. Washington, D.C.: ASIS, 1974. vol. 9, 25-55

Dranov, Paula. Automated Library Circulation System, 1977-1978. White Plains, N.Y.: Knowledge Industry Publications, 1977.

Elchesen, R. "Dedicated Versus Resource Shared Library Computer Systems" Special Libraries. (July, 1976) 299-304

Emery, James C. Organizational Planning and Control System: Theory and Technology. London: Collier-MacMillan, 1969.

Fasana, Paul J. and Allen Veaner ed. Collaborative Library Development. Massachusetts: MIT, 1971.

Foil, Patti Sue. "Survey of Data Collection Systems for Computer-based Library Circulation Process" Journal of Library Automation. 9 (September, 1976) 222-233

Gildersleeve, Thomas R. Successful Data Processing System Analysis. Englewood Cliffs, N.J.: Prentice-Hall, 1978.

Grosch, Audrey N. Minicomputers in Libraries, 1979-1980. White Plains, N.Y.: Knowledge Industry Publications, 1979.

_____. "Library Automation" Annual Review of Information Science and Technology. Edited by Martha Williams. Washington, D.C.: ASIS, 1976. vol. 11, 225-266

Hartman, W. et al. Management Information Systems Handbook. New York: McGraw-Hill, 1972. Irregular paging.

Hassell, Horace Paul. An Analytical Design Framework for Academic Library System Formulation. A Dissertation Submitted to the Faculty of Perdue University in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy, 1968.

Hayes, Robert M. and Joseph Becker. Handbook of Data Processing for Libraries. New York: Becker & Hayes, 1970. 481-544

Heiliger, Edward M. and Paul B. Henderson. Library Automation Experience, Methodology and Technology of the Library as an Information System. New York: McGraw-Hill, 1971.

Hice, G. F. et al. System Development Methodology. New York: Elsevier, 1974.

Hoadley, Irene Braden and A. R. Thorsen. eds. An Automated On-line Circulation System: Evaluation, Development, Use. Proceedings and Papers of an Institute, Held at the Ohio State University, September 13-14, 1971. Columbus: Ohio State University Library, 1973.

Jishi, Jamel A. A Systems Approach to the Selection of Industrial Development Project in the Less Developed Countries. A Dissertation Submitted to the Graduate Faculty of School of Engineering ... University of Pittsburgh, 1974.

Lambert, J. "Systems Design in Library and Information Services: the Czechoslovak Experience" International Library Review. 7 (October, 1975) 461-467

Langefors, Borje and Kjell Samuelson. Information and Data in Systems. New York: Petrocelli, 1976.

Lott, Richard W. Basic Systems Analysis. New York: Canfield Press, 1971.

Lucas, Henry C. Toward Creative Systems Design. New York: Columbia University Press, 1974.

McDowell, B. A. J. et al. Circulation Control System. Southampton: University of Southampton, 1970.

McGee, Rob. "Two Types of Designs for On-line Circulation Systems" Journal of Library Automation. 5 (September, 1972) 157-163.

_____. "The University of Chicago Library's JRL 1000 Circulation Terminal and Bar-Coded Labels" Journal of Library Automation. 8 (1975) 5-25

_____. "Key Factors of Circulation System Analysis and Design" College & Research Libraries. (March, 1972) 127-139

_____. A Literature Survey of Operational and Emerging On-line Circulation Systems. ED 059 752 (ERIC)

Mann, Robert F. "Appropriate Technology and Information Services in Developing Countries" International Library Review. 10 (January, 1978) 23-27

Markuson, Barbara Evans. "Automated Circulation Control Systems: an Overview of Commercially Vended Systems" Library Technology Reports. (1975)

_____. "Granting Amnesty and Other Fascinating Aspects of Automated Circulation: a Review of Recent Developments for Non Experts" American Libraries. 9 (April, 1978) 205-211

Martin, Susan K. "Tools for the Information Community" Library Journal. 101 (January, 1976) 163-168

_____. "Turnkey Systems: How to Avoid Locking Yourself In" American Libraries. (February, 1979) 89-91

Mathews, W. D. "The Impact of Technology on the Governance of Library Networks" The Structure and Governance of Library Networks. Edited by Allen Kent and Thomas J. Galvin. New York: Marcel Dekker, 1979.

Miller, G. and F. A. Coleridge. "A Conceptual Model for Circulation Control Systems" ASIS. 26 (July, 1977)

"News of Computers in Libraries" Program. 9 (July, 1975) 102-170

Nunamaker, J. F. "A Methodology for the Design and Optimization of Information Processing Systems" System Analysis Techniques. Edited by J. Daniel Couger and Robert W. Knapp. New York: John Wiley, 1974.

Olaosun, Adebayo. "Computer-Based Circulation Control for University Libraries in Nigeria" Zambia Library Association Journal. 9 (December, 1977) 90-98

Olufeagba, B. J. Computer and Circulation Control: an Introduction. Paper Presented at the Workshop on Library Automation in Nigerian Libraries, March 7-9, 1977. Ibadan: Ibadan University Library. (Unpublished)

Osundina, Oyeniyi. "The Relationship Between Accessibility and the Use Made of the Academic Library by Undergraduate Students" Nigerian Libraries. 10 (April, 1974) 41-50

Rees, Allan M. "Libraries and Information Centers" College & Research Libraries. 25 (May, 1964) 200-204

Salmon, Stephen. Library Automation Systems. New York: Marcel Dekker, 1975.

_____. "Library Automation" Encyclopedia of Library & Information Science. Edited by Allen Kent et al. New York: Marcel Dekker, 1975. 338ff

Scholz, W. H. "Computer-based Circulation: a Current Review and Evaluation" Library Technology Reports. 13 (May, 1977) 231-325

Schulthein, Louis A. et al. Advanced Data Processing in the University Library. New York: Scarecrow, 1962.

Spangle, C. W. "Impact of Distributed Systems" Data Management. 16 (January, 1978)

Spark, David E. et al. A Methodology for the Analysis of Information Systems. Wakefield, Mass.: Information Dynamic Corporation, 1965.

Surace, Cecily J. "Library Circulation Systems: an Overview" Library Automation Handbook. Detroit, Mich.: Management Information Services, (n-d). 173-180

Veaner, Allen. "Perspective: Review of 1968-1973 in Library Automation" Library Automation, the State of the Art II. Edited by K. Martin and B. Brett. Chicago: ALA, 1975.

Wu, Frederick H. "Distributed DP Provides for Local Data Needs" Computerworld. (July 30, 1979) Special Report/3.

Young, Micki Jo et al. Introduction to Minicomputers in Federal Libraries. Library of Congress, Washington, D.C. ED 168 588

Ziegler, K. "A Distributed Information System Study" IBM System Journal. 18 (1979) 374-401