TOWARDS SOFT SYSTEM MODEL OF A COMPUTER-BASED CIRCULATION CONTROL SYSTEM: A CASE STUDY OF USMANU DAN FODIYO UNIVERSITY LIBRARY, SOKOTO, NIGERIA.

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ABSTRACT

Traditional systems analysis prescribes the definition of problems in terms of a 'means-end' schema, which assumes that the problem can be perceived as a search for an efficient means of achieving declared objectives or meeting pre-defined goals. This is a framework which is generally associated with 'hard' systems thinking. The approach, thus, involves clearly defining the need to be met, and developing models of alternative systems which could meet the defined need. The concern of 'hard' systems approach is therefore basically 'how-to-do-it', because 'what-to-do' has already been taken care of.

However, ill-defined, unstructured problem situations as found in many organizations today require a more broad-minded approach that could lead to decisions on attempts to improve both the 'what' and 'how'. This, in principle calls for a switch to 'soft' systems thinking which should serve to free the analyst from the traditional restriction mentioned above. This is the main course taken in this research which is conducted on a university library's circulation control system, where the management has expressed the wish to employ the use of modern information technology, but was not certain whether and how that could lead to improved efficiency.

Using the 'soft' systems methodology as an intervention tool, the circulation department's information requirements have been addressed, raising a number of issues regarding the far-reaching implications of developing a computer-based information system by the inclusion of a data modelling technique at the 'other systems thinking' stage.
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THE RESEARCH OUTLINE

The research has been divided into ten chapters. Each chapter is divided into sections, beginning with a short description of the purpose which it is meant to serve.

The first section of chapter one introduces the situation in which there is thought to be problems; section two is an attempt to justify the need for the research, while the third and the fourth sections discuss the purpose of the research and the environmental constraints within which the Nigerian university libraries operate respectively.

The second chapter, which is a review of the related literature is divided into two main sections. Section one is a state-of-the art review in the field of information systems methodologies, while the second section touches on the literature as it affects librarianship and information studies.

Chapter three discusses in detail the research methods used and the justification for selecting to use the "Soft Systems Methodology" in the form of an action research. This follows a thorough discussion of the differences between the "hard" and the "soft" approaches to problem tackling.

Chapter four marks the beginning of the actual systems study, and it is referred to as the finding-out stage. It begins with an unstructured, descriptive analysis of the problem-situation at the Usmanu Dan Fodiyo University Library’s circulation control department. The fifth chapter presents and analyzes the data gathered in the process of the research through distributed questionnaires and interviews. Data collated and analyzed in this section of the work was later used as an aid to the comparison process.
Chapter six is mainly an attempt to combine soft systems thinking with principles and
techniques from computer systems analysis to form an "intervention" tool within the soft
systems approach.

The seventh chapter compares parts of the problem situation analyzed in chapter four with
the derived conceptual models in order to use any mismatches found in discussing changes
to improve the problem-situation.

The differences identified in chapter seven, along with their implications are examined more
carefully in chapter eight to see if and how they could bring about feasible and desirable
changes. Particular attention is paid to the role of modern information technology in the
developing world.

The ninth chapter is concerned with implementing the changes which are thought to be
culturally feasible and systemically desirable, taking into consideration the problem-situation
identified and analyzed.

Chapter ten summarizes the results of the work, paying attention to their implications on the
discipline of computer systems analysis.
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CHAPTER 1

1. INTRODUCTION

There is, today, a new generation of methods to assist in the analysis of decision problems. These methods are, yet, less widely known, practised, and understood than their predecessors — the algorithmic and optimizing tools of operational research (Rosenhead, 1989). Common features of these novel approaches include ..."an aim of partial structuring of previously unstructured situations (rather than the solution of well-structured problems), and a process involving participation as a key component" (Rosenhead, ibid, p1). This research effort is a move in the direction of one of the new generation of methodologies mentioned above, (in this case, the 'Soft Systems Methodology' developed at the University of Lancaster). An attempt is made to combine soft (not well-structured) problems with appropriate methods and techniques from computer systems analysis in order to introduce some elements of structure that will enable a panoramic identification of questions and factors that should make up the agenda for more debate and study.

In the late 1960's a type of library study emerged, oriented toward library effectiveness and involving models and measures of performance found in systems engineering (SE), operations research, and related fields.

Studies of library performance are rooted in and related to both present and anticipated problems. The studies by themselves do not provide solutions. They do, however, provide background information and a basis for rational decision and policy and thus for better library performance.
Academic library managers, university administrators and academic library users in Nigeria are becoming increasingly concerned about the lack of a reliable way to:

(i) determine the effectiveness of their libraries, and

(ii) coordinate and utilize their scarce resources so as to meet the challenges of the overall objectives of their rapidly changing environments.

Effectiveness in this context refers to the systemic evaluation or analysis of the extent to which the library produces the desired beneficial results in satisfying its primary intended users, and contributing in meeting the stated mission or objectives of the wider system within which it operates.

It is generally the case that academic libraries have some basic characteristics in common. Nevertheless, each library has some distinctive and contextual characteristics, specially tailored for and controlled by its individual environment. It follows therefore, that each individual library must be responsive and adaptive to the changing legitimate needs and requirements of its own particular environment and user-characteristics.

It is in view of the fundamental differences in 'world-view' (Weltanschauung), dictated by conflicting cultural factors that one academic library, The Usmanu Dan Fodiyo University library, Sokoto has been selected for this research. More specifically, the research is concerned with the operations of the circulation control system. "Information System" is used here in the context of Buckingham’s definition, (Buckingham et al. 1987), as:
a system which assembles, stores, processes and delivers information about an organization (or to society), so that the information is accessible and useful to those who wish to use it, including managers, staff, clients and citizens. An information system is a human activity (social) system which may or may not involve the use of computer system.

The following statement by Aguolu (1978) is only an indication of the existing situation under which academic libraries in Nigeria survive:

...Nigeria’s existing information resources could not meet the needs of higher education, and unless immediate, positive and systematic efforts are made to improve the situation, it would be much harder to satisfy the bibliographic and information needs of students, faculty and other researchers.

An added dimension is the fact that, apparently due to the fundamental differences in perceiving the problem and how best to tackle it, many academic libraries in Nigeria resorted to automation of some aspects of their services without fully analyzing the implications. This created a host of other difficulties because computer systems analysts were given the "all-clear" to go into work in the futile hope that the problems would be solved.

Coupled with the factors mentioned above, there is another serious issue which tends to be eluding not only the field of library and information services, but organization research in general i.e, the issue of measuring and evaluating service effectiveness.

These studies, well documented by Lancaster (1977) and Chen (1978), although necessary, are not sufficient. This is especially so in organizations whose total service outcomes are "intangible" or difficult to measure. It must be acknowledged, therefore, that some reasonable grounds have been covered in this direction regarding library and information fields, and more work is being done as indicated by the literature review, but results are still varied, incomplete and there is, (to the best of this researcher’s knowledge) no wholly acceptable or
conclusive standard. Kantor (1976) acknowledged this kind of problem, where he argues that viewed in the abstract, libraries deal with information in the service of knowledge; the contrast between information and knowledge — the one barely measurable in simple situations, and the other challenging the profoundest minds — is an indication of the difficulty we encounter in defining performance measures for libraries (p101). He goes on to write:

We would like, were it possible, to define the contribution which a particular library makes to the transmission and growth of knowledge during each day (or year) of its operation. Since knowledge itself is not measured, this is clearly impossible. We are always restricted to the observation and measurement of concrete elements, concentrating our attention on those which we believe to be strongly correlated with the transmission and growth of knowledge.

Lack of such clearly defined parameters, which a practicable information system can provide is a major set-back for effectiveness measurement for the purposes of resource budgeting and allocation.

Academic libraries spend several man-hours collecting and compiling all sorts of statistics about the library. Most of the data generated by the libraries, however, are those that have little or no contribution toward the efficient and effective operation of libraries. This problem has led Olson (1972) while looking at libraries from the total systems view to state that what is actually needed ..."is research which focuses on the goals and functions of library and information systems and on their user-service outputs".

Also, brooding over the lack of adequate means of assessing and evaluating service effectiveness in the library system, Griffen and Hall (1972) wrote:
We do not now have any parameters that will enable us to evaluate the effectiveness of library services, much less changes for better or worse. Beyond intuition, all we have are a few library statistics that are collected and not standardized, nor do we know how to manipulate this data for purposes of informed policy planning, much less for evaluation.

Worried about the same difficulty, the United States National Library of Medicine commissioned Evans, Borko, and Ferguson (1972) to conduct research which would address the problem of difficulties in evaluating library performance with particular reference to effectiveness. One of their major findings was that:

...most of the present evaluation techniques do not seem to be sufficiently sensitive to both quantitative and evaluative factors of library service and are, therefore, not completely acceptable to either librarians or non-librarians.

The authors then suggested that:

...research should be directed to the development of a technique to aid in establishing for each individual library a list of its services, ascribing to each service its relative importance to the total library program...

Without an effective information system the library is like a surveyor without a pair of compasses. It lacks means of knowing which of its service dimensions are performing up to the goals and aspirations of its primary intended users and which are not.

Lack of crystal, clear understanding of the performance of the library regarding its various service components, hinders successful planning. This is one of the bedevilments of academic libraries in Nigeria and many so-called developing countries, where planning and decision-making are based on guesswork or trial and error. An example of this is the example cited earlier, of libraries taking a decision to automate apparently without systematically analyzing and monitoring the situation.
Consequently, most of those libraries that had hitherto automated, have abandoned the idea and reverted to the discarded manual system — a waste of valuable scarce resources. As a result of this costly miscalculation, other service dimensions have had to suffer.

Nigeria, and indeed many countries in virtually every part of the world are in a state of acute financial squeeze. The implication of this on the academic library is that the annual subvention that the library would receive shall depend almost entirely on the library manager's ability to report needs and impact of his services convincingly to the funding body. He needs to be able not only to demonstrate meaningfully the needs and successes of the library, but also its contribution, or relative value, to the larger institution in accomplishing the latter's immediate academic goals of teaching and research. This point is adequately driven home to the academic librarian by a report prepared by the National Centre for Higher Education Management Systems of the United States, thus:

In the past, assumptions about the need for, and the value of, library services sufficed as justification of library operations and demonstration of library effectiveness. These assumptions are no longer valid foundations for funding decisions and accountability.

In view of the nature and repercussion of the problem on academic library management, i.e the inability to assess and efficiently and systemically analyze and relate the so-called "intangible" general and individual dimensions of library services to the overall objectives and aspirations of the wider system, an effective and operationally functional information system is required whereby the library would be addressed in the context of its specific, changing environment. This research views the problem as essentially a 'soft' one which requires a 'soft systems' approach. As Churchman (1968) suggests, "let us accept reason's demand that we must understand the aspects of the entire system before we can create improvement in sectors of the system".
As the review of the relevant literature has revealed,¹ various attempts have been made to model the academic library’s operations with varying degrees of success. Most of these conceptual models are so empirical that operationalization could not be adequately accomplished (Knightly, 1979).

1.2 RELEVANCE OF THE RESEARCH

The academic library in Nigeria occupies a prestigious position in the instructional and extracurricular activities of universities and institutions of higher learning. It is regarded as "a necessary part of the researcher’s tools without which he can not make the most efficient use of his talent" (Lawani, 1974).

It is in recognition of the vital instructional and supportive role of the library in the university that many Nigerian academic librarians opted for and had been granted full Faculty status with all the "privileges" and implications thereof.

Public accountability calls for maximum effectiveness from university libraries which receive public funding. This is a major concern for the governing councils and the general administration of universities all over the federation. In addition, accountability to the primary user also touches on the outcomes or benefits that he can expect within reasonable limits, and which he experiences as being received from the library, relative to the time and effort he expends in getting what he needs from the library. Moreover, regarding the library staff, when no acceptable way of determining and planning for effectiveness exists, a staff morale crisis may soon appear.

¹See chapter 2
The inevitability of the university library to the student in Nigeria can be attributed to the fact that the publishing industry in the country, like that of many developing countries, is still in its infancy. This situation is worsened by acute shortage of foreign exchange that Nigeria currently faces due to the fall in petroleum prices, the country’s number one revenue earner.

Osundina (1974) summarizes the problem of the Nigerian student thus:

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 lacks funds to buy textbooks, or because the books are not on sale in bookstores, accessibility becomes, to him, a paramount factor in the achievement of his educational objectives.

Because circulation is the central function of most libraries, more than any other activity, circulation characterizes the 20th century library. All other functions ___ acquisitions, cataloguing, on-line public access, reference, interlibrary loan, serial control, and so on ___ are all performed with the goal of providing library users with books to be checked out.

The Circulation services departments of many Nigerian university libraries operate under extreme crisis. In this researcher’s experience of heading the Readers’ services division of the Usmanu Dan Fodiyo University library, Sokoto for four years, it can confidently be stated that although that the division provides lending and reference services to the entire staff and students of the university, and despite the rapidly growing number of undergraduate and research students in the university, the current Brown Charging system in operation can not adequately cope with the demands and expectations of the users. This can be substantiated by, among other reasons, complaints regarding the following:

(i) the issue is already too bulky;  
(ii) the operation is frustratingly very slow;  
(iii) it is not easy to know individual reader’s holding as and when desired;
(iv) there is a lot of filing error;
(v) there is also difficulty in recall and reservation searches;
(vi) with no back-up copy of transaction record, a book would be lost forever once
filing tray is tampered with.

The situation in Ibadan university, Nigeria’s premier university is apparently not any better,
where Soyinka (mimeograph, 1979) stated the situation thus:

…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…

Although direct service to the reader constitutes at least the primary, if not the sole, purpose
of most libraries, there has been little attention paid in library literature to quantitative criteria
for choice among services, for assignment of priorities, or for scheduling of service operations
(Hayes and Becker, 1970).

1.3 PURPOSE OF THE RESEARCH

The research emanated from the library management’s desire to find the best approach of
tackling the implementation of a computerized information system without repeating the
costly mistakes made by other libraries which ended up with more problems than they
bargained for. The purpose of the research is, therefore, to contribute toward resolving the
problem by not only revealing where the weaknesses lay, but also to employ the
methodological frameworks of the ‘soft’ systems approach to conduct an investigation into
how best a computer-based information system could alleviate the problem-situation by:
a. Identifying the different groups associated with the circulation services (library staff, students, academic staff, the governing body) so as to establish their views regarding the services of the circulation system.

b. Defining, identifying and analyzing the 'relevant systems' whose properties might help in clarifying, understanding and dealing with the problem-situation (i.e., introducing some form of structure). This is achieved by attempting to demonstrate the role of 'soft' systems thinking as a basis for tackling 'soft’ problems.

c. Introducing techniques and methods from computer systems analysis (an off-shoot of 'hard' systems thinking) into the conceptual model-building stage of soft systems thinking as a basis for developing computer-based information system.

d. Comparing the operations of the circulation system department with the areas of human activity implied by the conceptual models.

e. Evaluating the conceptual as well as the operational models with a view to selecting the appropriate criteria (in the context of 'Soft’ Systems methodology) by which service effectiveness might improve; and finally,

f. Providing an avenue of approach for application of the SSM in a library environment; this is conducted in the spirit of action research and the learning process that it affords.
1.4 ENVIRONMENTAL CONSTRAINTS

We have so far, been discussing the library as a system. However, the library as a system does not exist in a vacuum. To be able to design an appropriate information system we must first understand the structure of the existing system and the forces of the environment to which it is subjected. Wetherbe (1984) defines a systems environment as all entities or factors external to the system. An organization’s environment includes such things as customers, competitors, and government regulations.

Checkland (1981a) on the other hand, refers to environmental constraints as "features of the systems environments and/or wider systems which it has to take as 'given'"(p225).

Every successful systems investigation must, thus, take into consideration the environment within which the system operates before reaching any conclusions. Environmental constraints are, thus, factors and conditions which are outside and beyond the control of the organization’s management.

In the case of the Usmanu Dan Fodiyo university library, which is the focus of this study, environmental constraints include:

(i) The shortage of skilled manpower within the library. This could be attributed to the fact that Sokoto town, where the university is sited is remote from many commercial and administrative sectors of Nigeria. For that reason the university does not attract the adequate number of qualified personnel that it needs in all fields, who prefer to go to more centrally located universities. For example, the nearest neighbouring capital town to Sokoto is located some 450 kilometres away\(^2\).

\(^2\)See map, Appendix D
(ii) There is no guarantee that the university library development plan would continue to enjoy the priority and urgency it requires under the in-coming administration after the tenure of the present Vice-Chancellor, who left office by the end of the 1989/90 academic year.

(iii) There has been the question of inadequacy of financial resources to support library programmes.

(iv) The problem of handling resistance must as well be reckoned with. Of course, resistance is a common phenomenon. In some cases, the resistance is very small and the affected persons quickly adjust to the new system. But in extreme cases, the reaction can be subversive or destructive to the new system.

All the above factors are taken into consideration in deciding the type of information system creation that this research effort is about. To lay a foundation for achieving the above mentioned research goal, the next chapter examines the relevant literature on the subject as well as other related areas so as to form a sound theoretical and conceptual frameworks for a better understanding of systems problems and identifying the best techniques of tackling them.
CHAPTER 2

2. REVIEW OF RELATED LITERATURE (SECTION 1)

2.1 Introduction During the course of the literature reviews, numerous works on systems concepts, system development and planning, management of service organizations in general and libraries in particular, administration of circulation control systems in university libraries, automation of library services, as well as performance measurement techniques were studied. Major sources of information consulted include indexes, abstracts, catalogues of library holdings, and following up references cited in related texts and journal articles.

This chapter attempts to review the large amount of publications, conferences, and other research works devoted to the application of systems studies to the types of problem described in the previous chapter regarding the effectiveness of an academic library's circulation control system, especially in terms of the 'Soft systems' approach to the resolution, or at least restructuring the problem. The other main objective of the chapter is to assist in forming sound theoretical and conceptual frameworks for a better understanding of systems problems, and identifying the best techniques of solving them. This includes considerations of model-building, systems design, methodologies, features, applications, and performance measurement. Consequently, the chapter is divided into two broad sections: section 1 is devoted to the review of the literature in the area of systems study in general as it touches on various organizations and disciplines, while section 2 is specifically devoted to the literature on modelling and measurement of performance as they affect librarianship and information studies.
2.1.1 Definition and Classification of Systems

*Systems Thinking* plays a leading role in a variety of fields ranging from industrial enterprise and government to the military. Similarly, professions and jobs have emerged in the last few decades which, quite unknown a short while ago, now exist under such names as Systems Analysis, Systems Engineering, Systems Design, etc.

In the most general sense, a system is a collection or arrangement of entities, or things related or connected such that they form a unity or a whole. For example, the entities of a library system consist of readers, librarians, books, shelves, buildings, catalogues, etc. The entities of the system interact (e.g., librarians serve the readers, the readers read books, the books are kept on the shelves). This interaction leads to the primary objective of the system: the provision of information.

Fitzgerald and Fitzgerald (1987, p5) define a system as a network of inter-related procedures that are joined together to perform an activity or to accomplish a specific objective. In the same vein, Ogata (1978, p1) refers to a system as a combination of components acting together to perform a specific objective. A component is a single functioning unit of a system.

By no means limited to physical ones, the concept of a system can be extended to abstract dynamic phenomena, such as those encountered in economics, transportation, population growth, and biology. Ogata (1978, ibid) therefore, goes on to make a distinction between dynamic and static systems. A system is said to be dynamic if its present output depends on past input; if its current output depends only on current input, then the system is said to be static.
There are several ways of classifying a system. For the purposes of this study, however, the most relevant classification scheme consists of the categories of closed / stable /mechanistic systems and open /adaptive /organic systems. It suffices, nevertheless, to point out that few systems fall exclusively into one way or the other. Rather, any given system can be defined as sharing characteristics of both categories. This concept is thus illustrated by the following sketch:

2.1.2 Closed/Stable/Mechanistic Systems

This type of system tends to be self-contained. It seldom interacts with its environment to receive input or generate output. Therefore, entities of primary concern in a closed / stable /mechanistic system are those retained in the system. Consequently, the operation of the system tends to be highly structured and routine, because the interactions of the entities are stable and predictable.

An example of a closed / stable / mechanistic system can be a glass container enclosing a garden of small plants. The primary entities in this system include plants, moisture, soil, oxygen, and carbon dioxide. These entities interact with each other in a very stable and predictable fashion.
As mentioned earlier, no known system can continue to operate for prolonged periods of time without interacting with its environment. Systems are subject to decay; they therefore need new entities as inputs in order to survive. In the case of our glass container enclosing small garden plants above, water occasionally needs to be added so that the system can continue to operate.

2.1.3 Open/Adaptive/Organic Systems

An open / adaptive /organic system continually interacts with its environment for replenishment of material, energy, and information. Therefore, in an open /adaptive /organic system, entities internal and external to the system are of concern. The interactions of these entities are probabilistic and changing in nature and are consequently less predictable than those of a close /stable /mechanistic system. A good example of an open / adaptive /organic system is a business organization.

A distinctive feature of an open /adaptive /organic system is that it can adapt to changing and environmental conditions. It can change the entities retained in or transient to the system. It can also change the way the entities interact.

Such a system is self-organizing, and it can change its organization in response to changing conditions. For example, a business organization can change its personnel, equipment, or products; it can also change the way in which they are organized and what they do.
2.2 THE SYSTEMS APPROACH: (foundation and historical origins)

The term 'systems approach' emerged in the 1950's as a label for what was becoming a more analytical orientation to management and problem-solving (Wetherbe, 1984 : 32). Around that era, Kenneth Boulding provided a perspective of the systems approach that is still commonly used today:

The systems approach is the way of thinking about the job of managing. It provides a framework for visualizing internal and external environmental factors as an integrated whole. It allows recognition of the functions of subsystems, as well as the complex supra-systems within which organizations must operate. Systems concept fosters a way of thinking which, on the one hand, helps the manager to recognize the nature of complex problems and thereby to operate within the perceived environment. It is important to recognize the integrated nature of specific systems, including the fact that each system has both inputs and outputs and can be viewed as a self-contained unit. But it is also important to recognize that business systems are a part of larger system --- possibly industry-wide, or including several, may be many, companies and / or industries, or even society as a whole. Further, business systems are in a constant state of change they are created, operated, revised, and often eliminated.

Hicks and Tillin (1977), however, believe that systems approach came into being during the early days of the second World War. They discuss how systems approach was originally developed in designing radar, weapons, combat aircraft, and other hardware when researchers and designers realized that a weapon system has to function as a whole to achieve the performance expected of it.

In designing equipment it also became evident that the importance of the various parts was not in how they operated separately, but how they interacted with other parts to accomplish goal of the whole system.
The success of the systems approach in designing hardware led to its use in designing software.\(^1\) Teams of biologists, mathematicians, physicists, and others were mobilized to use the methodology of the systems approach in proving military tactics and strategies, first in the Battle of Britain and then in many major campaigns to follow.

Nevertheless, it was in the era following the Second World War that the systems approach evolved rapidly. It continued to be applied in solving many different problems of varying degrees of difficulty and complexity in many different fields of endeavour.

Since 1965 it has been used by the U.S. government to evaluate federal projects. The military makes use of it, as do business and industry. Its application is also evident in communications systems, space technology, industrial production, information processing and retrieval, management and logic systems, and many other fields.

The systems approach is based upon General Systems Theory, which is concerned with the development of a systematic theoretical framework for the empirical world. The ultimate goal of systems theory is to define a framework that ties all disciplines together in a meaningful relationship (Wetherbe, 1984, p33).

Implementation of the systems approach draws upon:

(a) systems philosophy

(b) systems analysis and

(c) systems management.

\(^1\) Plans for defense and campaigns, for example.
Systems philosophy is involved with thinking about or conceptualizing phenomena in terms of wholes consisting of entities or sub-systems with emphasis placed on their inter-relationships.

Systems analysis involves methods or techniques of problem-solving or decision-making. Systems analysis is further concerned with becoming aware of the problem, identifying the relevant variables, analyzing and synthesizing the various factors, and determining an optimum or at least satisfactory solution or programme of action.

Systems management is concerned with the application of systems theory to managing organizational systems and / or subsystems. A glance at the literature in this field would enumerate a long array of thinkers who, in one way or another, contributed notions to what nowadays are called "systems theory". From Bertalanffy's work stemmed the Society for General Systems Research, a society devoted to the advancement of systems theory in all fields, with a view to discovering overall principles and developing a common theory to cover all systems.

The Social Sciences, too, were known to have taken keen interests in this new approach. Most of the work in this field put emphasis on formal organizations and the interplay between these organizations and the human being, i.e. the cultural inter-relationships that arise as a result of interaction between formal organizations and individuals. They are also concerned with discussing group and individual behaviour in terms of cultural relationships, and then looking at ways in which these behavioral patterns interlock in a miniature social system.
Among prominent researchers in this aspect were Simon (1952) and Morgenstern and von Neumann (1944). Mesarovic (1971) considers systems theory as dealing with the explanations of observed phenomena or conceptual constructs in terms of information-processing and decision concepts, arguing that the field is best delineated by contrast with other scientific disciplines, such as physics, chemistry or biology. Each of these fields has its own primary concepts (e.g. energy, force, quantum, etc., in physics). In systems theory observations are explained in terms of how the information is transmitted and the goals being pursued, or still differently, how these processes are organized without an explicit reference to the nature of the mechanism (physical, biological, social, etc.) involved. The subject of study in Systems Theory is not a physical object or a chemical phenomenon but a "system", a relationship of observed features in the context of information processing and goal-seeking.

Defending the necessity of "systems approach" with regards to the problems of modern organization, Bertalanffy (1971) writes that systems approach as it is applied to organizations can tend to be deterministic: it sees the structure and the functioning of organizations as determined, or at the very least, constrained by internal or external "forces", "tendencies", "factors" and even "laws". Along the same line, Smith (1980) discarded the systems approach as 'merely a piece of status-raising jargon'.

However, the most concrete criticisms of the Systems approach were those offered by Checkland (1981), who writes that if Systems Approach was to be taken seriously it would have to show that within the subject there was a cycle of interaction between the formulation of theory relevant to serious problems or concerns, and the testing of that theory by the application of a methodology appropriate to the subject matter.
He criticizes the General Systems theory, arguing that "its theory [is] highly abstract, and will be difficult to translate into testable propositions," adding that systems thinkers need to be mindful of the distinction between using systems ideas to obtain 'case records' within another discipline, and using that discipline simply as a vehicle for further developing systems ideas themselves.

Referring to the potentialities of applying systems theory in solving complex problems, Checkland (ibid) writes:

> It is not helpful to make claims for an approach unless it is possible to grasp it and use it in tackling problems of their own.

Two main strands of thinking can be identified within the systems movement itself: first, is that which derives from the work of Bertalanffy, which formed the basis of General Systems Theory. The first is that which grew up around the development and subsequent widespread use of computers, and with the application of computers to problems in Technology --Systems Analysis approach. G.S.T's main concern was with obtaining an understanding of the fundamental nature of systems, for which Checkland feels that there would be an immense difficulty in bridging the gap between theory and problem when its concepts are to provide a methodological approach to a practical problem.

The second strand of systems thinking, which Checkland criticizes is the Systems Analysis strand, which he argues, is more concerned with methodology. His major criticism of Systems Analysis is that it lacks guidelines on how to generate alternatives.
Checkland further laments that Systems Analysis methodologies make use of the kind of thinking which is natural to design engineers, whose role is to provide an efficient means of meeting a defined need.

He does not agree to this idea because he feels that the design engineer's situation is one in which what is required has been defined, and must only examine how it can be provided. He writes

Methodologies stemming from engineering thinking inevitably postulate a certain kind of structure in the situation in which the methodology will be used: either a need can be defined, or system's objective can be stated unequivocally, thus enabling the system to be engineered to achieve them.

2.3 Systems Development Methodologies: emergence and definition

Within the last decade alone, several systems analysis and design methodologies had been developed by both individuals and organizations in order to standardize the approach to the exercise of analysis and design. The emergence of methodologies has in itself been a gradual process, building on pre-computer techniques developed as early as the 1920's, and it is still continuing (Brookes et al. 1982). Floyd (1986) points out that with the ever increasing number of System Development Methods available, each using its own conceptual framework, each based on its own philosophy, profoundly affecting systems development, and each making the same promises of general applicability and overall usefulness, it is becoming increasingly necessary to view the subject of methodologies themselves as objects of study.

2.4 Methods or Methodologies? A methodology is the set of procedures by which systems developers document the result of their analysis and design work to assist in both project control and the interchangeability of staff.
Griffiths (1978) defines methodology as "a set of principles which enables an exact model to be built of the trains of events ... and their associated data and the information to be derived from them — expressed in a procedural form capable of being executed by a computer or other reliable means". Griffiths, further attempts to draw a distinction between a method and a methodology, where he views a methodology as having acquired the connotation of dependence on basic principles rather than mere rules of thumb found to work in practice — i.e., a methodology provides, in some measure, reasons for all steps in the design process and reasons further more which may be understood completely without reference to the particular application or to any broad classification, such as real-time, transaction processing or batch update.

An InfoTech report (1978) defines methodology and method as follows:

The term "methodology" is often used to identify the comprehensive approaches to design. The term is used in preference to the term "method" to indicate comprehensiveness; whereas a "method" is a procedure for carrying out a particular task, a methodology will consist of an integrated set of methods, based on a reasoned set of basic principles.

More generally, a design methodology includes management techniques, documentation procedures, tools to aid the designer, standards for specifications that serve as the input to the design process, and standards for the output of the process.

Checkland (1972) defines methodology as 'an explicit, ordered, non-random way of carrying out an activity ... independent of the context of that activity'. This is elaborated upon in his book Systems Thinking, Systems Practice (1981) where he distinguishes between 'method' and 'methodology'. He states a methodology is 'a set of principles of method which in any particular situation has to be reduced to a method uniquely suited to that particular situation'.
Checkland (1981) notes that a 'methodology' can be conceived of as intermediate in status between 'philosophy' and 'technique' (or method). 'Philosophy', in this context, is defined as a 'broad non-specific guideline of action'. For example, the statement 'all science is based on a nomothetic inquiry process' is seen as a 'philosophy'. A technique, on the other hand, is a 'precise specific programme of action which will produce a standard result: if you learn the appropriate technique ... you can ... serve a tennis ball so that it swerves in mid-air'. Checkland states: 'A methodology will lack the precision of a technique but will be a firmer guide to action than a philosophy. Where a technique tells you "how" and a philosophy tells you "what", a methodology will contain elements of both "what" and "how".

Checkland (1981) and Wilson (1984) describe the concept of problem solving in terms of its relation to the extremes of a spectrum ranging from "hard" to "soft", where hard problems are concerned only with questions of 'how' and soft problems are complex mixtures of both 'what' and 'how' types of question.

They both see a problem as any expression of concern about a situation. In this context, a methodology represents a structured set of guidelines which enables an analyst to derive ways of alleviating that concern. Methodology, as opposed to method or technique, in Wilson's opinion is characterized guidelines which are precisely defined, so that if your concern is, say, how to solve a differential equation, techniques are available using either classical or Laplace operators which, if correctly applied, will lead to a solution which any competent analyst will agree is correct (Wilson, 1984, ibid, p49). The application of a methodology, however, may involve the use of techniques, but it is the methodology which determines if a particular technique is appropriate or not. One further argument put forward by Wilson (1984) is that
to be 'technique-oriented' is to introduce the danger that the problem situation will be distorted to fit the technique, pointing out that a more appropriate approach is to be 'problem-oriented' and to allow the situation to distort the way the analysis is being carried out. This orientation demands for flexibility in the approach; hence the emphasis on methodology and not technique. A methodology is more than tools and techniques. It involves recommendations about:

(a) phases, sub-phases and tasks, when to use which, their sequence
(b) what sort of people should perform each task
(c) what documents, products, reports should result from each phase
(d) management, control, evaluation and planning of developments (Maddison, et al. 1983)

Welke (1981) defines a methodology as 'a comprehensive procedural framework directed towards accomplishing a particular change in the object system'. Welke describes the 'object system' as that which one is interested in perceiving (and developing). A person perceives an object system through a filtering apparatus, called a 'perception schema' or simply 'schema'.

The schema acts to identify certain aspects of the object system of interest while rejecting others. Welke also notes that a methodology should support two necessary components of information systems development: change process, and schema perception and representation. The former relates to how the changes to the object system are to be managed; the latter, how the object system is perceived and represented.
Both Checkland’s and Welke’s definitions of ‘methodology’ share a view that sees it as more comprehensive than the term ‘method’ which implies techniques and/or tools. This conception of methodology appears to be widely used and accepted by the information systems community, even though it is not necessarily consistent with the standard dictionary definition where method is seen as a way of doing something and methodology as the study or science of methods (Hirschheim, 1985).

The study of systems development methodologies is quite a controversial issue; a particular methodology may help more with one class of problems and situations than with another. Thus, the most important thing is how to select a methodology that will be appropriate in a given environment, address the problems at hand, and generally enhance productivity.

Indeed, the need for a radically different approach to the development of rapidly growing information processing system (from the early 1970’s) brought about the realization that those practices were inadequate.

However, the introduction of one or more of the "modern" specification and design approaches has met with dismal failure in many instances because the goals and proper use of the method was not fully understood (Connor, 1985).

Techniques are often misapplied due to either a misconception that a single method is best suited for all applications, or fear of change makes the selection of an approach determined by the application from multiple approaches unacceptable.
Having made a distinction between a method and a methodology, it is now safe to state that no unique, standard method exists that can be used universally for a successful information development (Aktas, 1987). All we have are various methodologies — which implies that the success of an information system development process depends largely on the skills, experience and understanding of the analyst.

2.4.1 TOWARDS A CLASSIFICATION OF THE CURRENT APPROACHES TO SYSTEMS ANALYSIS

As mentioned earlier in this chapter, several new approaches or methodologies have emerged over the past few years, and Hammersley et al. (1980) attributed the current turmoil in systems analysis to this fact. These approaches have generally originated as academic ideas and been taken up and modified in the practising world of systems analysis. Thus, there exists a confusing array of approaches.

This section of the chapter examines some of the more fundamental approaches in an attempt to search for an ideal approach that will best suit the kind of issues raised in the previous chapter.

The major approaches to be briefly surveyed are:

(i) General Systems Theory Approach;

(ii) Structured Systems Approach;

(iii) Socio-technical Approach;

(iv) Traditional (NCC) Approach;

(v) Data Analysis Approach; and

(vi) Human Activity Systems Approach.
The chosen methodologies were not chosen on any basis other than that they are well-known to scholars and practitioners alike in the field. Also, although General systems Theory is not normally used in systems analysis, it is nevertheless included here for a general review of its enormous influence on systems thinking and the contribution it has made to almost all the approaches listed above.

2.4.2 GENERAL SYSTEMS THEORY APPROACH

General systems theory (GST) deriving from the work of Bertalanffy (1968) has had much influence, but has not really been concerned with practical systems analysis. It is more an attempt to come to terms with and understand the nature of systems. It is theoretical model building for the interpretation of complex and diverse systems (Wood-Harper and Fitzgerald, 1982).

A number of people (notably Klir, 1969) have attempted to apply the theory to the solving of every-day problems without much success — because the breadth of GST makes it difficult to use and to develop a methodological solution; and where a solution is arrived at it is often one which requires a revolution to implement. Perhaps it was partly for this that Popper (1945) has called it ...'Utopian Engineering', i.e implying redesign of the whole fabric of society. A number of people have sought ways to go round this problem and make GST more practical for problem solving. In the words of Wood-Harper and Fitzgerald (1982, ibid):

They have striven to convert GST into a practical methodology by firstly, breaking down the process into a number of defined steps to be followed and secondly, seeking to limit the range of alternative solutions by introducing notions such as the identification of certain value systems within which the problems must be set.
2.4.3 STRUCTURED SYSTEMS ANALYSIS APPROACH

Perhaps the persons most identified with this approach are de Marco (1979) and Gane and Sarson (1979) who described it in more detail than anyone. It is an attempt to solve some of the problems of the traditional approach, such as the departmental/subsystem viewpoint, the problems of coordinating a large team of analysts, and the problems of complexity of a large organization or system. The approach provides new tools for analysis and documentation, such as data flow diagrams, the concepts of data dictionary and structured English. De Marco (1979, ibid) identifies, among others, four major problems of classical systems analysis practice:

1. Communication problems
2. The changing nature of computer system requirements
3. The lack of tools
4. Inadequacy of functional specification

Regarding communication, de Marco argues that faulty communication between users, analysts and designers and implementers often does not enable a precise description of what the new system accomplishes. This fuzzy communication derives partly from Natural Language characteristics including excessive redundancy, ambiguity, and verbosity. As a result, user and analyst interface fails to emphasize logical structure of the current problem and accurate description of the future system. The business of specification is, for most parts, involved in describing procedure. But structured analysis emphasizes that it is far easier to demonstrate procedure than describe it; hence the adoption of the use of graphics. Writes de Marco... "when given a choice (in writing a Target document, for instance between a picture and a thousand words, most analysts would opt unfailingly for the thousand words...)"

Communication problems are exacerbated by lack of a common language between user and
analyst. The analyst is concerned with such things as specifications, data format descriptions, flow-charts, code, disk and core maps — while the user is more concerned with the set of human procedures that are his interface to the system, typically something analysts do not discuss till well after analysis.

Finally, the communication problem is complicated by the fact that what we are describing is usually a system that exists only in our in minds: there is no model for it.

The second set of problems of the classical analysis methodology concerns the changing nature of projects. If a project lasts two years, you ought to expect as many legitimate changes (occasioned by the way business is done) to occur during project as would occur in the first two years after cut-over. In addition to changes of this nature, an equal number of changes may arise from the users’ increase understanding of the system. It was considered normal for an analyst to hold off a change by explaining that implementing it in the Target document would require retyping every page. For this de Marco argues that analysts must change their methods; they must begin by building target documents that are highly maintainable.

Thirdly, systems specification (Target document), as a product of studying current operations often reveals incompleteness and contradictions. In order to be used as a paper, model for future specification should be readable, modular, maintainable and heuristic. Classical specification are often criticized as wordy reports, lack indices and take long time to prepare, read, change and maintain. In view of the above problems, DeMarco advocated new goals for analysis as follows:
(a) that the product of analysis must be highly maintainable. This applies particularly
to the system specification (Target document)
(b) problem of size must be dealt with, using an effective method of partitioning. The
"Victorian" novel specification is out. He writes "we have to stop writing
Victorian novel specifications, enormous documents that can only be read from
start to finish" (p13). He calls for "mini-specifications".
(c) Graphics have to be used wherever possible
(d) We have to differentiate between logical and physical considerations, and allocate
responsibility, based on this differentiation, between the analyst and the user.
(e) We have to build a logical system model so the user can gain familiarity with
system characteristics before implementation.

The above "new goals" are achieved through structured tools: The use of these new 'tools'
enables the clear documentation of existing systems and proposed new ones. It suggests
methods of analysis but none for design. Indeed, when de Marco comes to the issue of the
design of the new system he clearly states that this is not one of his aims. He says "It is at
this time that the Systems Analyst exercises his experience and imagination to come up with
new systems concepts. This is where he 'invents' the new system. I won't tell you how to go
about this I have restricted myself to teaching new tools for analysis, and no tool that
I could think would aid the invention process, when you have come up with your invention,
however, the tools of Structured Systems analysis are exceedingly useful for documenting it
and trying it out".
2.4.4 SOCIO-TECHNICAL (PARTICIPATIVE) APPROACH

This approach is most commonly associated with Mumford, Land and Hawgood (1978). The Socio-technical approach sees any technological intervention as having two components: the technical system involving various job tasks and technology, and the social system involving people with their various roles, behaviours, etc. These two systems must be separated from one another, initially, to determine the requirements of each. It emphasizes the role of the user in systems analysis. Bostrom (1980) discusses this point more succinctly:

The goal of joint optimization implies the best design alternatives in the technical system and their effects on having the best in the social system are jointly considered. Technical system optimization is usually measured in terms of improvement in task accomplishment (i.e improvements in productivity) while social system optimization is measured in terms of gains in the quality of working life of the work system’s members (i.e improvements in the ability of employees to satisfy their personal needs, e.g meaningful and satisfying work, recognition, control and influence, learning opportunities, good wages and working conditions, and the like).

The main argument of Mumford et al. is that the users ought to be involved in the design of a system in which they participate or preferably design it physically themselves.

The approach has generated a lot of interest recently. Moreover, Mumford’s account tends to be based only on the assumption that a computer is to be employed in the solution².

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²What the user may design is the work situation into which the computer is to be brought and he helps to determine how the man/machine interface is organized. For more on this see: Mumford, E and D. Henshall, A Participative Approach to Computer System, New York: Halsted Press, 1979.
Land (1982) describes three broad categories of participation:

1. Consultative. This is where the participants provide input into the systems design process but where the bulk of the decisions are left to some other group, e.g. systems analysts.

   The grounds on which the various decisions are reached should be published for the participants to see. In this situation, participation is often confined to particular special interest groups identified as being affected by the proposed system/technology introduction. Normally the kind of input provided by the participants is limited to social system considerations such as job satisfaction needs.

2. Democratic. This is where all participants have an equal voice in the decision affecting systems development or at least in the decision-making process. The implementation of decisions, however, is left the hands of some group or authority, e.g. senior management. The participants make decisions, but it is left to another group to approve and make sure they are implemented.

3. Responsible. This is where the participants not only make the decisions but also assume full responsibility and authority for their implementation. In this situation all workers who will use the new system or technology are involved, on a continuous basis, in the development and implementation process. This approach has been described as the only true form of participation.
The main criticism of this approach is that it is not a systems solving methodology, beneficial though it might be; it is an attempt to achieve smooth implementation of a system, and successful operation of the computer in the workplace. Thus it may be said to be concerned with solving implementation problems.

Others, notably Child (1977) suggest that participation may not be totally effective when faced with active counter-implementation. He writes:

One can however expect too much from it. Participation is a way of confronting the political issues involved in change, not a means of avoiding or smoothing over them. If there is a deep seated conflict of interest between parties involved in a proposed change, participation will probably not turn up a mutually acceptable solution. Also, if hidden anxieties and hostilities are present, it may be necessary to introduce a skilled third party, a social consultant, to bring things into the open, where they can be confronted and dissipated. So long as anxieties and conflict are present, and not totally recognized, participation is likely to prove an unfruitful exercise (p98).

Thinking along the same line, Eason (1977) cites three disadvantages with involving users in the design process: (1) difficulties in developing a system specification understandable to the users, (2) potential delays caused in dealing with multiple groups, and (3) possible sub-optimal design because of the involvement of competing user groups. Mumford (1981) doubts whether participation will be effective when the objectives include reducing labour costs by making employees redundant.

Perhaps no critic is harsher in his opinion towards the approach than Kraft (1979) who sees it as a form of manipulation—yet another management tool to usurp further power away from the workers.
Herdberg (1975) asserts that some user participation is dysfunctional. He claims there are two such types: (1) 'hostage', when the participating user groups become shy and introspective because of the technical jargon used by the systems staff; (2) 'indoctrination', when the user is indoctrinated into the systems group, providing little input. Herdberg suggests that participation is not good enough; users must have influence.

Nevertheless, participation is widely supported among organisational theorists (Bate and Mangham, 1981; Guest and Knight, 1979). Blumberg (1969: 123) writes:

There is hardly a study in the entire literature (on participation) which fails to demonstrate that satisfaction in work is enhanced or that other generally acknowledged beneficial consequences accrue from a genuine increase in worker’s decision making power. Such consistency of findings, I submit, is rare in social research.

2.4.5 THE TRADITIONAL APPROACH

The approach to Systems analysis advocated by the National Computer Centre (NCC) is the commonest, often referred to as the traditional approach (Lee, 1978; 1979), (Daniels and Yeates, 1982). In most cases, this is the approach adopted by a majority of systems analysts. It contains the well known phases of investigation, analysis, design and implementation. The underlying philosophy of traditional techniques is their concern with the identification and documentation of the flow of work through an organization and the sequence of activities for achieving system objectives.

No guide is given as to how these techniques may be used, instead an analyst uses his experience and know-how to derive a system specification. The specification is documented in the form of charts which in turn are supplemented by narrative.
It is an approach based on the idea that there exists a problem which can be solved by the application of a computer. Each application is considered separately and the problem resolved by the design of an optimal subsystem. The optimization is achieved by investigating the existing system in terms of the functions that it performs. The analysis is the distillation of the results of investigation into a documented form and design is achieved by considering the required outputs and designing the inputs, files and processes to achieve those outputs. The aim here, too, is the implementation of a piecemeal computer system to replace the manual one.

What has usually not been solved is the problem that led to the demand for the introduction of a computer in the first place (Wood-Harper and Fitzgerald, 1982).

By contrast, today’s systems are complex and their high degree of interdependence requires an integrated solution. Furthermore, today’s computer applications need to cover not only operational-level systems but also systems for tactical and strategic management.

Dissatisfaction with the traditional approach has sprouted a large number of techniques and methodologies which have, at their core, proposals for achieving one or more of the following (Brookes, et al., 1982, p148):

(i) Improving the documentation and visibility of the analysis and design phase

(ii) Standardizing the approach taken to systems analysis and design
(iii) Improving the predictability of the design (i.e. increasing the probability that two individuals faced with the same problem will produce the same design)

(iv) Improving the efficiency of subsequent maintenance and enhancement through readable, predictable, and well-structured systems and program design

(v) Improving communication between users, analysts, designers, programmers through the use of a disciplined and commonly understood approach

(vi) Reducing the complexity of design by appropriate segmentation.

2.4.6 DATA ANALYSIS APPROACH

The methodology of data analysis or conceptual data modelling as it is sometimes called is concerned with taking an amorphous mass of facts about the data used within a system and turning them into a set of precise, unambiguous and non-redundant data description. The hypothesis is that if we can classify and identify the set of data elements (entities and attributes) that exists within a particular situation then we have identified the true nature of a system. The use to which that particular system can be put can change or be changed, but the underlying nature of the system remains unchanged because the data is static, or much less likely to change than the function or processes applied to it. This means that one can define the system without defining the individual applications that need to use it. In addition if relationships between the data are defined then one has, in effect, developed a model for the system which can be validated before implementation.
Data analysis can be seen, therefore, as a 'neutral' way to come to an agreed understanding about the nature of an organization. It fits in very well with the concept of database.

The techniques encourage the analyst to think in terms of the structure and meaning of the data in a way which is machine-independent rather than in terms of specific file or database structures (Layzell and Loucopoulos, 1987).

This approach also emphasizes the fact that an organization deals with many different types of data which may have complex interrelationships. Before any attempt is made in designing and creating computer files a thorough understanding of the data and its relationships is required. This understanding is achieved by following a systematic way of modelling organizational data in a way which is independent of any physical consideration such as access points, record pointers or file structures.
2.5 HUMAN ACTIVITY SYSTEM: THE CHECKLAND 'SOFT' SYSTEMS METHODOLOGY

The soft systems framework is concerned with tackling the "ill-structured" problems of the real world and suggesting solutions that may, or may not, include computers. It attempts to tackle the fuzzy and complicated problems of organizations where there often appears to be insurmountable obstacles in defining the problem, let alone solving it (Skidmore and Wroe, 1988). The framework was developed and presented by Peter Checkland (Checkland, 1981).

The overall model is given below:

Fig 2.1 The Checkland Methodology (Checkland, 1981)
The soft systems approach is centred on a small number of key ideas, of which the following seem to be the most important (Naughton, 1984):

(i) First, there is the idea that 'problems' which arise in government and organizations do not have an existence independent of the human beings involved with them. On the contrary, 'problems' are constructs of the concerned mind, defined by the perceptions of individuals who are troubled or intrigued by them. This implies that a crucial stage in the problem-solving process is the answering of the question: what shall the situation be deemed to be? (Note that the question is not: 'what is the problem?'.) This is essential because many real-life situations are problematic precisely because people differ on what 'the problem' is. This idea is crudely expressed by the old saying that one person's problem is another person's opportunity. Furthermore, different 'problems' tended to be highlighted by different people ---the position, personality, values, outlook and conditions of an individual manager tended to affect the aspects of the overall situation which he identified as being problematic.

(ii) People have different appreciations of situations because they see them in genuinely different ways. Each of us looks at, and interprets, the world through a kind of personal prism which refracts the light of experience and gives us a unique picture of 'reality'.

This prism is clearly very complex, but it includes two kinds of beliefs: beliefs about what is, and beliefs about what ought to be. The first sort are really about facts and what we take to be true ____ for example, the belief that the world is round, or that motor cars are propelled by engines rather than by supernatural forces.
The second sort of beliefs are often called 'values', and are really beliefs about what is 'right and proper', good or bad, appropriate or inappropriate, and so on. All these 'prisms' are extremely important in determining how individuals interpret the world. Their importance is signified, in a way, by the fact that a distinctive technical term has been coined to describe them—**WELTANSCHAUUNG** which is the German word for 'world-view'.

(iii) A third key idea of the soft systems approach is this: if we accept that 'problems' are intellectual constructs which are determined by the perceptions of concerned actors, then we have to accept the corollary of that proposition, namely that ideas of what might constitute 'solution' are also intellectual constructs.

(iv) Moreover, the soft systems approach also compels its practitioners to scrutinize the whole concept of what constitutes a 'problem'.

A conventional definition of a problem is 'a perceived discrepancy between an actual state and a desired state'. This implies that: one knows what the actual state of affairs is; and one knows what the desired or target state is.

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1This term occurs with almost monotonous frequency in the literature of systems approach. Its pervasiveness is due to the fact that soft systems analysts have realized that insight into problem-settings comes from an appreciation of the **Weltanschauung**-driven perceptions of the people involved in the situation. This is difficult enough to achieve in practice, but in cases where there are radically different **Weltanschauungen** in question a further difficulty arises, namely that there are no logical or a priori grounds for deciding that one perception is more valid than another.
No one denies that problems in this sense arise all the time in daily life and in organizations. But as a description of the kinds of situations which soft systems analysts are called upon to tackle, it has some limitations. This is because the existence of conflicting Weltanschuungen sometimes leads to a situation where people disagree about descriptions of the actual state of affairs as well as about what might constitute a desired state.

A second difficulty is that the above concept of a problem suggests that problems exist in isolation. But real-life situations are often not that simple. If a company finds that it has a supply 'problem' because a key supplier has gone into liquidation, it may soon find that it has a production 'problem' which, because of laying off workers, creates an industrial relations 'problem'. It may also lose customers and in the process acquire a sales or delivery 'problem'.

To meet this difficulty, Ackoff (1974) has suggested a new concept:

We have also come to realize that no problem ever existed in complete isolation. Every problem interact with other problems and is, therefore, part of a set of interrelated problems, a system of problems... Furthermore, solutions to most problems produce other problems... English does not contain a suitable word for 'systems of problems'. Therefore, I have had to coin one. I choose to call such a system a 'mess'.

In this regard, one could then say that much of the work of soft systems involves 'mess management'. This, indeed, has serious implications. For the essence of a mess is that its component problems are systematically interconnected, which means, among other things, that it will have emergent properties, and will not yield to a reductionist approach which tackles one sub-problem at a time.
(v) Regarding change processes in organizations, a central tenet of the soft systems approach is that improvements in complex problem situations are most likely to be brought about through the sharing of perceptions and through persuasion and debate. Analysts working in this tradition, therefore, tend to take what Ackoff calls an 'interactivist' attitude towards change, and to see their own role as 'therapeutic' rather than 'expert'. This implies that soft systems analysts tend to see their task as that of assisting the people involved in the problem situation to engage in a debate about their perceptions of it in a way that will generate proposals for fruitful change, to which they will be committed.

(vi) Finally, an important principle of soft systems analysis is its abandonment of the idea that the analyst can be divorced or detached from the analysis. Instead he or she is assumed to be part of the problem situation or mess. Much soft systems analysis is thus close to what is known as 'action research', in that the analyst is attempting not to understand the situation but also to help change it for the better.

Soft systems analysis is a comparatively recent development, stemming mainly from the late 1960's, though it has affinities with other approaches to organizational problems which have longer historical pedigrees — for example, the socio-technical systems approach pioneered by the Tavistock Institute in Britain (Naughton, 1984).
2.5.1 A BRIEF REVIEW OF THE STAGES IN SOFT SYSTEMS ANALYSIS

As Checkland (1981) writes:

The methodology contains two kinds of activity. Stages 1, 2, 5, 6, and 7 are "real world" activities necessarily involving people in a problem situation; stages 3, 4, 4a, and 4b are "systems thinking" activities which may or may not involve those in the problem situation, depending upon the individual circumstances of the study (p163).

He adds that

In general, the language of the former stages will be whatever is the normal language of the problem situation, that of 3, 4, 4a, and 4b will be the language of systems, for it is unravelled and understood as a result of translation into the higher level language (or meta-language) of systems (p163).

The first two stages are concerned with examining a particular problem situation and expressing it without imposing a solution. The problem area needs to be explored as widely as possible, building up "the richest possible picture of the situation being studied".

Stage 3 begins at the end of the problem expression and tackles the question: what are the systems which, from the analysis stage, seem relevant to the problem? This question has to be answered carefully and explicitly and the resultant Root Definition will also reflect a certain personal view of the organization. Root definitions have the status of hypotheses concerning the eventual improvement of the problem situation by means of implemented changes both feasible and desirable. To drive home the point, Checkland gives the example of a priest making systems analysis of certain problems in the Church, taking as his basis for a root definition the famous epigram in Karl Marx's essay of 1844:

Religion is the sigh of the oppressed creature, the sentiment of a heartless world, and the soul of soulless conditions. It is the opium of the people (p167).
The priest, according to Checkland would presumably not agree with this view, but it could well provide the basis of an insightful analysis of his problems. He adds: "the question to ask is...given the picture of the problem situation and the perceptions of 'the problem' by people in it, does the suggested root definition seem to have a chance of being useful?"

And that can only be answered by testing some possible definitions, even if they seem commonplace" (Checkland, 1981, p167).

Stage 4 makes and tests relevant conceptual models. This is concerned with what should be happening to support the requirements specified in the Root Definition: "the aim is to build an activity model of what must go on in the system". (Checkland, 1981) Modelling thus becomes a question of asking: what activities, in what sequence?

Because the conceptual model is a model of an 'activity' system its elements will be verbs. Modelling involves the assembling of the minimum list of verbs covering the activities which are necessary in a system defined in the root definition, and to structure the verbs in a sequence according to logic (Checkland, 1981). A conceptual model for an order generating-and-processing system is illustrated as follows:
The fifth stage is concerned with comparing conceptual models with reality. This, in effect means examining the system that is required to support the Root Definition (stage 4), with the one that actually exists (stage 2). The 'comparison' stage, in Checkland's words is so-called because in it parts of the problem situation analyzed in stage 2 are examined alongside
The fifth stage is concerned with comparing conceptual models with reality. This, in effect means examining the system that is required to support the Root Definition (stage 4), with the one that actually exists (stage 2). The 'comparison' stage, in Checkland's words is so-called because "...in it parts of the problem situation analyzed in stage 2 are examined alongside the conceptual models: this should be done together with concerned participants in the problem situation with the object of generating debate about possible changes which might be introduced in order to alleviate the problem condition". This comparison is the point at which intuitive perceptions of the problem are brought together with the systems constructs which the systems thinker asserts provide an epistemologically deeper and more general account of the reality beneath surface appearances; it is the comparison stage which embodies the systems hypothesis that systems concepts provide a means of teasing out the complexities of 'reality' (Checkland, 1981).

The results from comparing stages 4 and 2 will lead to the final two stages --- the stage 6 and stage 7, which are concerned with implementing 'feasible' and 'desirable' changes. Three kinds of changes are possible:

(i) Changes in structure i.e. changes made to those parts of reality which in the short term, in the on-going run of things, do not change. Structural changes may be to organizational groupings, reporting structures, or structures of functional responsibility.

(ii) Procedural changes i.e. changes to dynamic elements: the processes of reporting and informing verbally or on paper, all the activities which go on within the (relatively) static structures.

(iii) Attitudinal changes This does not only include attitudes such as may be sampled in the 'attitude surveys', but also many other crucial characteristics which reside in the individual and collective consciousness of human beings in groups. The term includes such things as changes in the expectations which people have of the behaviour appropriate to various roles, as well as changes in the readiness to rate certain kinds of behaviour 'good' or 'bad' relative to others.
2.5.2 HARD AND SOFT APPROACHES COMPARED

A number of points have to be taken into consideration when comparing the two approaches. First, there is a temporal dimension to the relationship between the two. The hard systems approach evolved first and developed rapidly to meet the needs of modern engineering and industrial systems. In many of its applications it has proved highly successful indeed there was no real alternative to it. But as the range of its applications steadily widened, the approach ran into trouble in cases where its implicit pre-requirements (well-defined or constrained problems, quantitative data, legitimacy of a means-ends view of the situation, etc.) could not be met. The soft approach evolved partly from the failure of its predecessor in such cases.

Secondly, the two approaches have some similarities. Both, for example, are firmly rooted in a pragmatic tradition which values real-world applicability rather than theoretical development. Both approaches are geared towards largely practical ends, and in this sense are classically technological in their orientation.

Thirdly, however, there are also some fundamental differences between the two approaches. Basically, these revolve around conflicting assumptions about the nature of social (and organizational) reality. The hard systems approach predicates an organizational world in which goals and objectives can clearly be specified, where the relevant data for any particular problem can realistically be quantified, and where hierarchies of power and authority have legitimacy and muscle. The soft approach, in contrast, maintains that social reality is essentially an intellectual construct, the outcome of an ongoing debate between rival (and sometimes conflicting) perceptions.
The strength of soft systems approach is in its insistence on a framework, rather than a prescription, for organizational activity. Checkland criticizes the 'hard system' school for assuming that systems exist in the real world and can be unequivocally described. This, he argues, leads to the idea of manipulating models of the assumed reality in order to discover a solution which is either optimum or at least 'good enough' in a particular situation. In contrast, soft systems methodology embodies a paradigm of learning (Checkland, 1979).

To this extent the methodology as a whole clearly articulates a phenomenological investigation into the meanings which actors in situations attribute to the reality they perceive. Its emphasis is thus not on any external 'reality' but on peoples' perception of reality, on their mental processes rather than on the objects of those processes.

The hard approach sees organizations as social entities describable in terms of hierarchical, functional and other components; the soft approach sees them as social systems perceived in subjectively different ways by their individual members, and concedes some legitimacy to these different 'ways of seeing things'.

Fourthly, because of its historical 'head starts', and also because of the enormous range of its applications, the hard systems approach is established as the dominant one in the field, with the result that most references to 'the systems approach' are in fact references to the hard tradition.
2.5.3 APPLICATIONS

Watson and Smith (1988) reviewed the main applications of the Soft System Methodology in Australia. The authors were themselves involved in a major systems study in the Australian Department of Defence. Their main argument was that the SSM is itself a generic term covering a number methodologies with a 'family resemblance' to each other. Various versions of SSM have evolved in the United Kingdom, and the Australian studies reviewed in their paper give every evidence that the same evolutionary process is occurring in Australia.

Their paper begins by discussing some of the ways that the SSM had reached Australia. It then surveys the entire field of Australian applications for which information was available to them, and characterises each study in terms of its purposes, nature and achievements. Four major studies, each distinctive or novel in some ways, are then discussed in more detail and their departure from Checkland’s original version of SSM highlighted.

The variants of SSM discussed in the paper are:

(a) The Classical approach with explicit root definitions:

which denotes the version of SSM described by Checkland (1981) and elaborated by Wilson (1984). In this approach, Root Definitions relevant to a problem situation are postulated explicitly, possibly using the CATWOE analysis procedure to ensure that they are well-formed. A hierarchy of conceptual models may be derived if the original Root Definition leads to a conceptual model which is considered too broad to be of practical use.
(b) The Classical approach with implicit root definitions: which denotes a version of SSM in which only one explicit root definition is postulated to encapsulate, at the broadest level of resolution, the purpose of the part of the organization under study. A conceptual model is derived from this root definition, but any further development of the model to a higher level of resolution uses 'implicit root definitions', based on knowledge in the mind of the analyst of what activities are logically required.

(c) Challenge and consensus approach: in this approach, definitions and models are worked up from a range of viewpoints, often challenging the status quo by, for example, bringing in views of the business and its future which are dependent on emerging technology. These are debated, and from the elements which are particularly insightful, refined models are produced and their support requirements (for information, skill, technology, etc) determined. The debate and refinement takes place both within working groups and with managers, with emphasis on communication and interaction. The resultant model is used to examine activities and to determine information requirements and a development plan. Alternatively, it is used as the basis of organisational change.

(d) The Hawkesbury Agricultural College approach: this is an adaptation of the classical approach with explicit root definitions. It differs, however, in that although models are based on a hierarchy of root definitions incorporating the CATWOE elements, the mapping from root definition to conceptual model is less rigorous than the classical approach would urge. Furthermore, the linkages between sub-systems are not limited to a 'logical link' notion, but use a wide variety of transfers. Finally, the
titles of sub-systems do not include only one or two verbs, but instead are qualified by prose, or a series of phrases, which foreshadow the model developed at the next level of resolution.

(e) The Central Studies Establishment approach: this is an adaptation of Wilson (1979), which is used mainly for building conceptual models which map on to existing systems, but depict what is done rather than how it is done. Since, however, it was developed for the purpose of accurately mapping a very complex existing system, the distinction between the real-world and the conceptual world is somewhat blurred by the CSE approach than it would be by the Wilson's 'Primary task' methodology, so that quite idiosyncratic features of the real-world can be included in the conceptual model. Furthermore, hierarchical development of the models is not, in practice, fully 'top-down' in the CSE approach.

(f) Scenario building approach: this is the approach developed by Galliers (1985), and it is a version of SSM oriented to information systems planning. The analysis, therefore, concentrates as much on possible 'futures' as it does on the current situation. The approach, therefore, introduces scenario building in what is termed the 'organisational synthesis' (i.e, problem expression) phase of the methodology. Different root definitions and models associated with different scenarios (or futures) are then developed and associated information needs (given different futures) are identified. In addition, critical assumptions regarding these alternative views of the future (along with critical success factors and critical decisions) are made explicit with a view to identifying information systems to support strategy formulation.
(g) The Harris and Sutherland approach: this is similar to the classical approach with implicit root definitions but includes also some of the ideas of the scenario building approach discussed earlier. Specifically, it is oriented towards information systems planning. The approach requires development of conceptual models based on the analyst's knowledge of what goes on in an organization, but not necessarily using explicit root definitions throughout. Instead, only the first level model is based on an explicit statement of the mission or corporate objectives of the organisation concerned. The model is then expanded to several more levels of resolution and used to derive categories of information in a manner similar to that used by Wilson (1984) and that used in scenario building approach. Essential to Harris and Sutherland approach is the explicit inclusion of activities which define completely both the information systems required and the strategy for their implementation. The most recent Harris and Sutherland studies have also utilised a computer graphics system to automate management and drawing of the conceptual models.

2.5 OTHER APPLICATIONS

Computer Investigations: Soft systems analysis does not specifically address the development of computer system specifications, and consequently does not replace or preclude any other systems analysis and design methods (Patching, 1990). It is often used as a prelude or supplement to these methods, mainly to give a well rounded view of situations as the technical analysis proceeds. Some investigative packages, notably the FAOR approach, also adopt some of the notions used with SSM to consider computer developments in a variety of ways, eg as an information system, a communication system, or a functional support system, etc.
2.5.5 THE FAO R METHODOLOGY

The FAO R (Functional Analysis of Office Requirements) methodology is a comprehensive approach for determining the requirements for office support systems. The package provides the analyst with an effective means for exploring a given situation, and focusing on those areas where technology could significantly improve the achievement of selected organisational objectives (Schafer, et al. 1988). It views an office as a system where human activity is taking place, and where the activity is largely unstructured and ill-defined. The analysis is carried out as a series of activities, moving from the preparation of a study brief in consultation with the client to the selection of suitable instruments for a detailed examination of selected areas.

A detailed statement of system requirements is then produced and the likely benefits and disadvantages of alternative computer solutions envisaged.

The SSM is used in three contexts. During the Office Exploration it assists the analysts in understanding the client organisation and focusing on problem areas. During the Method Tailoring exercise it assists in constructing a method from the 'instruments' according to the defined study objectives. In the Requirements Analysis it provides a basis for coordinating the results of the previous study work, and controlling the progress of the study towards a fulfilment of the study objectives. This is a good example of the use of SSM as a suitable strategy for the appropriate introduction of information technology.

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2A detailed discussion of the FAO R Methodology can also be found in Patching (1990, chapter 14).
2.5.6 THE MULTIVIEW APPROACH

The Multiview approach as described in (Wood-Harper, Antill and Avison, 1985; Avison and Wood-Harper, 1990) recognises the need to consider the functional, technical and sociological aspects of an organisation when carrying out a computer systems investigation.

The approach has five main stages, which can be summarised as:

1. The analysis of human activity systems.
2. The analysis of entities, functions and events, referred to as 'formation modelling'.
3. The analysis and design of a socio-technical system.
4. The design of the human-computer interface.
5. The design of the technical subsystems.

In this methodology, some initial elements of the soft systems approach are combined with more conventional techniques (eg data analysis and structured analysis) to create a framework for the computer system design which takes account of the viewpoints of all people who will be involved. For the technical analysis and design aspects the techniques of Structured Systems Analysis and Design are drawn upon, together with the standards developed by the National Computer Centre.

Socio-technical issues are addressed using participative design methods such as those developed by E Mumford and R Hirscheim, and human-computer interface applications.

Regarding this approach, (Patching, 1990) writes:

Of particular interest is the use in the early stages of the soft systems ideas to examine the organisation and draw out, in consultation with the client, statements about purpose of the organisation and a clear idea of what information system will be in functional terms, and what it will do (p138);
adding that "The Multiview approach quite deliberately moves from generalisations about
the organisation to specific details, the outputs from each stage becoming inputs to the
following stages, or major outputs of the methodology". Soft systems ideas are used to
structure a debate and subsequently identify problem themes, eg conflict between departments,
poor communications, lack of co-ordination, and so on. The problem themes are then
examined to determine if and where technology can be used to improve the situation.

Skidmore and Wroe (1988) argue that Soft System Methodology’s problem definition is much
stronger than its problem solution. The lack of prescription, and the rather academic notions
and guidelines given in the framework, they add, may not endear it to the practising Analyst.
One important factor which they seem to ignore, however, is that SSM embodies a paradigm
of learning. The notion of a 'solution', whether it optimizes or satisfices, is inappropriate in
a methodology which orchestrates a process of learning which, as a process, is never-ending
(Checkland, 1981a).

To this extent the methodology as a whole clearly articulates a phenomenological
investigation into the meanings which actors in a situation attribute to the reality they
perceive. Perhaps aware of such criticisms, Checkland (1981) writes:

...Soft systems thinking will not appeal to determinists, dictators, or demagogues. It
will appeal to all those people in any discipline who are knowledgeable enough to
know that there is much they do not know, and that learning and re-learning is worth-
while. For such people a systems approach is not a bad idea.
2.6 THE APPLICATION OF SYSTEM DEVELOPMENT METHODOLOGIES IN PROBLEM-SOLVING: A REVIEW

Hundreds of more or less similar academic as well as practical methodologies abound in the field of information systems. There is a conceptual as well as terminological gap between principles and methods developed in academic environments and those developed and applied in practice (Bubenko, 1986).

Researchers as well as practitioners easily develop very strong beliefs in their own concepts, methods and products. This, coupled with the terminological confusion in the field severely restricted transfer of knowledge, know-how and technology between different groups. This even compels some critics to question whether there exists a distinct scientific field of inquiry named 'Information Systems' or whether it is a mixture of contributions from several other disciplines, such as for instance, Programming Languages, Data Bases, and Artificial Intelligence. No wonder then, the 1986 theme of the CRIS -III conference was "Improving The Practice" ... an attempt to transfer theoretical concepts, principles and know-how from research to the field of practitioners.

Along the same line, Skidmore and Wroe (1988) write in their introduction that they prefer to use a non-methodological approach because..."we do not believe that any of the methodologies [available] are applicable in all development circumstances". The literature search centred on the complex problems posed by systems analysis and design methodologies with particular reference to their application in solving, or at least alleviating the problems of managing academic libraries.
This, as earlier explained in the introductory chapter includes considerations of modelling and system design, and evaluation. The discussion is therefore extended to the literature of model and theory building and systems, as well as touching on the literatures of other fields, such as service professions concerned with management effectiveness and total system approach. This is done with a view to highlighting some of the major works, findings, techniques, and concepts relevant to the problem-situation. However, it is necessary at this point to give a brief summary of general trends in systems methodologies.

2.6.1 A SUMMARY OF TRENDS IN SYSTEMS METHODOLOGIES

Practically all systems methodologies in practice today employ and are often heavily based on a graphical description technique to depict activities, processes, flows, data objects, relationships and whatever modelling concepts are advocated in specifying information systems (Bubenko, 1986). It is such a pity that during all these years, when many methodologies were being developed and tested no scientific studies have been carried out and reported concerning experiences of using them on realistic, practical cases. Some notable exceptions, perhaps, are the works of Checkland (1972, 1975, 1976, 1979, 1981a, 1989); Maddison, et al. (1983) and Floyd (1986). Checkland (1981) gave an account of more than one hundred studies which contributed in determining the shape of SSM as it departed from 'hard' systems practice. Maddison et al. based their work on feature analysis of a number of selected systems methodologies, whereby they constructed a framework of about 100 questions and applied these uniformly to each methodology. Their work gives greater coverage of the analysis phase activities, reflecting the orientation of the methodologies. One of their conclusions is that most of the methodologies rely very heavily on an intuitive approach to analysis and design.
The phases and tasks which form a methodology a described in terms of 'what' should be
done and rarely, if ever, in terms of 'how' they should be done. Two practitioners, they
added, often derive completely different solutions, models, data flow diagrams and so on, by
using the same steps.

Floyd (1986), on the other hand used a unified case study to investigate several system
development methodologies, although SADT, AS/SD, and JSD are treated in more detail.
Main points of her generalized critique include: the lack of structuring concepts for large
systems, the absence of adequate techniques for data modelling and for the design of man-
machine interfaces, the vast amount of documentation produced, and the linear world-view
embodied in existing methods.

Bubenko (1986) also noted that among the methodologies published, the great majority are
developed in academic research environments. A very small fraction of these methodologies
have ever been applied to practical cases of realistic size and complexity.³

³It must be pointed out, however, that methodologies studied by Bubenko did not include
the Soft Systems Methodology developed at Department of Systems, University of Lancaster.
REVIEW OF RELATED LITERATURE (SECTION 2)

2.7 MEASURES AND MODELS OF SYSTEMS EFFECTIVENESS IN LIBRARY AND INFORMATION STUDIES

A search in the library and information science literature revealed a wide variety of attempts to systematically address and overcome the problem of seeking an appropriate system model by which to adequately select and assess overall effectiveness. Some models are so empirical that operationalization could not be accomplished on a regular basis. For this reason, it appears that few, if at all, are being used (Knightly, 1979). In this regard, De Gennaro (1978) summarized the situation thus:

In each [total management] system, there is a number of concepts, ideas, tools, and techniques that have validity and can be used to advantage by library managers, but as comprehensive systems they are all far too theoretical, complex, and simplistic to be applied successfully by ordinary managers in the day-to-day work environment. Few managers have the time or the specialized knowledge and skills required to make these systems work, and those that do are probably astute enough to manage as well or better without them.

Some of the significant studies related to modelling in libraries are briefly described here. Baker (1968) developed a theoretical descriptive and behavioral model by which to derive an operationally meaningful measure of total library effectiveness in terms of participants in the setting. These include the "servicers" (the entire library staff and administrators), the "funders", and the "actual and potential users". The needs and satisfactions of the users, the goals and aspiration of the servicers and the criteria and constraints of the funders must be considered.

User behaviour is perceived as a trade-off between rewards and costs in a risk situation related to user assessment and expectations.
Horace Hassell also designed a framework for academic library formulation using Baker's approach (Hassell, 1968). Regarding user needs-specification, he stratified the user community at a University library according to the type of media required. He also worked on the hierarchy of objectives required, as well as the service specification problem. He only partially tested his model on Pardue University's inter-library loan services, concluding that his was only a preliminary exploratory study in an early stage of development.

Another related work is that of Orr, (1968), in a three part series, reported on their work since 1966 in developing a methodology and instruments useful for managing and planning overall library services, concentrating on academic libraries serving biomedical populace. Methods were field-tested. The conceptual framework of the overall project was evolved from the "user view-point" maintained through the project.

Other significant works relating to total system effectiveness found in the literature search are those of Olson (1972), Griffen and Hall (1972) and Evans, Borko and Furguson (1972). Olson, in looking at libraries from the total system perspective says that what is especially needed is ..."research which focuses on the goals and functions of library and information systems and on their user service outputs" (p 100). He especially called for the construction of various types of models from which to define major problems or questions, and to identify and articulate the most crucial elements and relationships among these elements in the universe studied. He presented a preliminary descriptive model of the linkage between some significant dimensions of the library service process, from which policy-oriented questions can be explored (p103). These include inputs, policy, performance, utilization, and impact.
Writing mostly from the perspective of impact of public libraries upon the society at large in the United States, Griffen and Hall (1972) viewed libraries as total open systems which are part of the larger social system. The problem, however, is that of no adequate indicators existing by which to measure and demonstrate library effectiveness in terms of positive value and impact upon the social system at large. They wrote that:

...We do not now have any parameters that will enable us to evaluate the effectiveness of library services, much less changes for better or worse. Beyond intuition, all we have are a few library statistics. Those statistics that are collected are not standardized, nor do we know how to manipulate this data for purposes of informed policy planning, much less for evaluation.

The article concluded by presenting a case for developing indicators of effective library services by understanding the development in Social Science of other social indicators. All these efforts were attempts to find a more suitable model for solving library problems.

Researchers commissioned by the United States National Library of Medicine to address the problem of the difficulties in evaluating library performance in terms of effectiveness came out with a report stating that:

...most of the present evaluation techniques do not seem to be sufficiently sensitive to both quantitative and qualitative factors of library service and are therefore not completely acceptable to either librarians or non-librarians.

The authors then suggested that:

...research should be directed to the development of a technique to aid in establishing for each individual library a list of its services, ascribing to each service its relative importance to the total library program. A second phase of this problem would be to determine which criteria were appropriate to measure the performance of these services and the weight that should be assigned to each (Evans, Borko, and Furguson, 1972).
In 1986, a conference was organized by librarians and information scientists from all over Britain, at the University of Salford. Among the reasons for organizing the conference was the realization that "libraries have always been notoriously weak in their use of management information". In his paper at the conference, Brophy (1986) noted that librarians "have made considerable strides with relatively quantitative data, but have given little priority to the assessment of quality", adding that "what is needed is a major, systematic effort to identify those managerial information needs and to design methods for fulfilling them through comprehensive information systems" (p39).

Totterdell and Bird (1976, p30) describe total library activities in the following diagram, whereby library activity comprises four parts: needs, goals, inputs and outputs, which relate to each other in that order in a cycle of interest.
Fig. 2.3 Total library action (from Totterdell and Bird (1976))
Needs and outputs are the external factors, the cause and effect of goals and inputs. Goals and inputs are internal products of the system of the librarians or managers and must be related to the external factors. Insofar as the four areas of library activity are necessarily linked, goals and inputs of a system obviously have a bearing on the effectiveness achieved, even though the area of testing for effectiveness is the relationship between outputs and needs. The area for testing efficiency is that between inputs and outputs. Efficiency is maximum return from units of input as opposed to effectiveness, the satisfaction of needs. Operations are efficient: services are effective (Wessel and Cohrssen, 1967). While efficiency is indisputably a problem of library management it is never the basic problem. Efficiency is a way of relating means to ends; the real problem facing librarians is what the ends or outputs should be. The concern should be with how far an effective service is provided, not simply how far operations are being efficient (Wessel and Cohrssen opcit, p31). This is line with Orr’s argument (Orr, 1968) that:

From the user’s point of view a library is a black box, what goes on inside the box, that is how it operates, is not his concern, he is concerned only with its output --- the service it can provide.

The work of Richard Orr and associates in this regard is quite lengthy, and only a summary will be given as it affects a portion of the present research. The study was undertaken as follows:

First, the data obtained by any method should be sufficiently reliable --- that is, reproducible --- to provide a sound basis for planning and management decisions. Second, the methods should have prima facie validity to users and non-librarian administrators, as well as to librarians. Third, they should be practical --- costs should be reasonable, and execution should not seriously interfere with a library’s regular operations nor be burdensome to its clientele. Fourth, they should be widely applicable to libraries, regardless of differences in size, location, environment. ... Fifth, a library’s capabilities for calling upon the resources of the "library system" should be assessed, as well as its ability to meet demands solely from its own resources. Sixth, the methods should be suitable for application by a library’s own staff, rather than being useful only
in the hands of outside "experts". Finally, they should be valuable for assessing changes in a given library over a period of time, and for comparing different libraries. (Orr et al., part I, p236)

The conceptual framework of the project was structured upon five basic concepts, all evolved from the "user viewpoint" maintained through the project (Orr, et al. part I, pp 237-240).

1. The library as a black box. What goes on inside the box, that is how it operates, is not his {the user's} concern; he is concerned only with its output --- the services it can provide. Likewise, from a systems viewpoint, the primary consideration when assessing its effectiveness is how well its users' needs are served, rather than its mode of operation. A library's ... effectiveness can be assessed by looking only at its output --- the services it provides to users --- without concern for how it goes about providing these services. This concept, which may appear trivial, turns out to be essential in thinking about how one might go about measuring, objectively and quantitatively, the effectiveness of a particular kind of service. Without it, one can easily be overwhelmed by the complexity and diversity of operations within different libraries; and the task will then seem impossible.

2. A functional classification of library services...
This list of functions suggest a simple classification of library services based on what the user receives. ...One major advantage of classifying library services by the "user function" served, rather than in the usual way, is clarity and precision...

3. The user's criteria for assessing library services. A user assesses a library by its effectiveness as a means he can employ to meet a given need and by what it costs him to meet the need in this way...

4. The central role of the user's primary library...
In the primary library concept, the librarian's sole responsibility is to make it possible for his client to tap the total store of recorded information as effectively and efficiently as possible. ...

5. The dynamic, competitive nature of the information complex. ... Any particular library, and libraries in general, are utilized only when other means for meeting a given need are perceived as having a poorer cost-effectiveness ratio than the library. ...

In the second part of their project, "Measuring a Library's capability for providing Documents", Orr, et al. (ibid, 1968,235-67) describe the Document Delivery Test (DDT) and its Capability Index.
This is described as a means of measuring the latent effectiveness, or capability or quality, of the library chiefly in terms of its major functions of providing documents needed by its primary clientele.

In the third part, "Standardized Inventories of library Services", Orr, et al. constructed an inventory of all services and alternatives available to the primary clientele, based mainly on the first four of their concepts listed above. As earlier pointed out, the work of Orr and associates was conducted in the user view-point, and so they started by heads of libraries in regard to services that concern the users directly as they interact with the library. A user-oriented inventory was developed, as well as consideration of its potential for management. In order for them to do this with the inventory, a way to derive meaningful data from it in the form of quantitative scores had to be devised. This required some scheme for assigning a number, or weight, for each service provided.

The weighting scheme had to reflect what they call the relative "desirability", or "value", or "importance" of the services. Since value judgments regarding library services reflecting the judge's personal values are required, the question of who should be the judge becomes an issue. For scaling, rank ordering was rejected for various good reasons (Orr, et al, Part III, p393). The concept of the "optimal" library was selected as the basis for a meaningful scale because it forces the "judges" to consider the greatest possible benefit, in terms of total services, taking into account fixed quota constraints:

The method consists of three sequential operations:
(1) selecting a criterion group of individuals representing the population whose value judgments are considered relevant or appropriate for the specific purposes to be served; (2) having each member of this group allocate a fixed quota of points [for this particular inventory a quota of 100 points] among all the inventory alternatives [items or services] in such a way that the distribution
of points reflects his judgement about the relative value of alternatives; and (3) arriving at a weighting scheme that analogously reflects the group's values, either by averaging the points allocated to each alternative, or by achieving consensus through discussion. ... (ibid, 393-94)

The researchers also discuss using the weighting scheme itself to determine and maximize "benefit" on an inventory for management purposes (p.400). This research by Orr and associates is very authoritative, although it lacks conceptual and operational definitions of what it sets out to measure, concepts such as "value", "benefit" and "desirability".

Any library manager involved in the process of interpreting effectiveness must of course examine the cycle leading to the relationship of output to needs. Library literature is full of exhortation to define goals; be clear about purpose; state objectives; regrettably this on its own will not ensure effective service. There is a need for further definition. This need is re-echoed by Totterdell and Bird (1976, p31) where they write:

"...We suggest that an effective service depends, to a significant degree, on a clear and correct conception of three levels of library goals that we have labelled purpose, objective, and functions."

Purpose, the broadest level of goals, they define as equalling the role of the library. In its turn role will define what needs are considered relevant to libraries. The second level of goals is objective, which is defined by Totterdell and Bird (ibid) as the satisfaction of relevant needs. The distinction between purpose and objective is important because a library could carry out its objective of satisfying relevant needs, without providing an effective service --- as when an artificially narrowed purpose exists in the first place. In this case the range of needs considered as relevant will be automatically narrowed in the same way. This type of situation, where needs become a semi-internal factor instead of the purely external factor that they should be, is very common.
Totterdell and Bird (ibid) refer to the third level of goals as the library's functions, i.e. particular actions that the library must take in order to fulfil its objective. Thus the necessary sequence is: clarify objective first, then define functions or activities. They conclude that purpose, objective and function are all aspects of library goals. A clear relationship between goals, inputs and outputs is a requirement for an effective service. Such an effective service is unlikely to be achieved when the three aspects are confused and not clearly defined: it is certain not to be achieved when they are wrongly or unnecessarily narrowly defined.

Cooper (1973) wrote a two-part paper on measuring the effectiveness of retrieval systems, to include on-going library operations. His basic concern was initially with criteria to apply when selecting a measure, and his approach was that of deciding on an "ideal" measure of effectiveness. The "ideal" measure should be "straight forward and obvious, involving no confusing mathematical or theoretical complexities, and having an ultimate validity apparent on the basis of common sense alone. ... An ideal evaluation methodology must somehow measure the ultimate worth of a retrieval system to its users in terms of an appropriate unit of utility (Part I, p88). Concerning the ideal evaluation measure, he adds:

Since there is probably no better way of getting at the value of a system than by questioning its users (and possibly other people) directly, the meaning of the phrase 'ultimate worth' is most readily clarified in terms of some kind of questioning or elicitation procedure (ibid, p88).

The straight-forward method, of which he describes one possible approach, is "entirely subjective":

... [It is] merely an orderly way of collecting and quantifying the users' personal, wholly subjective, evaluations of a system's worth. But is subjectivity necessarily bad? And if it is, is there any real alternative? Surely a service system of any kind exists for the satisfaction of its users, and the users themselves are generally the ones who know best whether their wants have been satisfied or not. Any so-called 'objective' method claiming to measure user satisfaction according to rigid and preconceived criteria is likely to diverge, to whatever extent it is 'objective' from the user's actual criteria of satisfaction. ... Moreover, in traditional evaluation methodology [regarding
relevance judgement] it is often not the system users themselves who make the relevance judgments, but outside judges who are in the position of having to second-guess the users' real information needs as best they can. Thus if the [straight-forward] methodology is to be accused of subjectivity, traditional methodology is doubly accused, relying as it does on a judge’s subjective guesses about a hypothetical user's subjective evaluation (ibid, p91).

Consequently, Cooper is of the view that it is natural for the user to be the judge of the utility of the system, because "by assumption only the user’s own evaluation will affect future user behaviour" (ibid, p95). He also recommended and justified the construction of confidence intervals as the most appropriate statistical analysis to apply in analysis over time of evaluative data. Part I of the article concludes thus:

... there can be in principle no better evaluation ... of a retrieval system’s benefits than a subjective evaluation by its users, provided that such an evaluation is made with all due care, and is measured judiciously in terms of an appropriate utile (ibid, p100).

In the second part of the article, Cooper stated various simplifying assumptions on which compromise evaluation techniques could be based and the various procedures that could perhaps be done to give a best subjective estimate of effectiveness (ibid, p100), admitting that these could not possibly be done. He recommends further validation research.

One of the most authoritative contributions concerning the measurement of library effectiveness was made by Orr (1973), who says that the focus of his article is toward practical aid in the management of individual libraries, in terms of justification, allocation, and maximization. All management tasks entail making decisions based on beneficial effects of the services, actual and planned. It should be done systematically. All systematic techniques require that resources needed and the beneficial effects of service be expressed quantitatively. "Central to all decisions required for planning and control is the exercise of weighting the goodness of results (expected or realized) against the resources required ... All
[management science] techniques require that not only the resources needed, but also the goodness of results be expressed quantitatively" (ibid, p317). He adds that "intuitively, the concept of 'goodness', as applied to a particular library service, seems to have two basic aspects, which are reflected in the simple questions 'How good is the service?' and 'How much good does it do?'... The first aspect may be called quality, and the second, value" (ibid). Orr presents the following diagram, showing the ultimate criteria of "goodness" — quality and value — with their direct measures being "capability" and "beneficial effects" respectively (ibid, p318). Since these latter are difficult to measure directly, indirect measures or indicators are more often used to assess quality and value. These are "resources" and "utilization".

![Diagram](image)

**Fig. 2.4 Orr's Relation among Criterion Variables**

About the diagram above, Orr writes ... "Although this diagram is grossly simplistic and does not attempt to show many important interactions .... it can be useful for examining the logical support for indirect measures of quality and value (ibid, p319).
In examining these measures, Orr proposes that:

1. **other things being equal**, the capability of a service will tend to increase as the resources devoted to it increase, **but not proportionately**;

2. **other things being equal**, the total uses made of a service (utilization) will tend to increase as its capability increases, **but not necessarily proportionately**;

3. **other things being equal**, the beneficial effects realized from a service will increase as its utilization increases, **but not necessarily proportionately**; and

4. **other things being equal**, the resources devoted to a service will increase as its beneficial effects increase, **but not necessarily proportionately** (ibid, p319).

Orr then develops a construct of his hypothetical library to illustrate further the specific needs for different kinds of measures of goodness.

In this library,

... a manager's responsibilities are usually defined by the next higher level only in rather general terms. He is expected to suggest and defend specific performance goals for his own level in the process of budget negotiation. ... in terms that are convincing and valid within the superior's frame of reference, and to demonstrate one's managerial competence by showing that goals for the previous budget period were met, or better exceeded within budgetary limitations. ... The librarian believes it will be impossible to implement this strategy at his level unless performance goals for the entire library can be expressed in terms of service outputs that the Administrator will recognize as being functionally related to the parent organization's programs, and that collectively represent the library's total effort, thereby making it possible to account for all expenditures in terms of these outputs. To this end, the librarian has adopted a classification of services based on what the user receives (ultimate service outputs) which accommodates both services that are staff-mediated and self-mediated. One classification that might meet the Librarian's requirements has six broad categories of services to individuals: (1) document services, (2) citation services, (3) answer services, (4) instruction services, (5) facilities services, and (6) adjunct services. ... Our hypothetical library has many distinguishably different kinds of service output; but to simplify his management tasks, the librarian ignores minor differences when counting units of output. ...The librarian's ideal tool for the justification task would be a global measure of the total value of the library's services, representing the sum of values attributable to all uses of Services A, B, C, D, E, etc., and expressed in two ways: (1) as a summary figure-of-merit in whatever units of value the Administrator employs in justifying his own budget, and (2) as an index relating to total value **actually** realized to an estimate of the total value that could be realized if the library had 'optimal' support.
This estimate would be based on empirically-derived mathematical models for each service showing how value increases as support increases. The librarian could use this measure both to defend his budget request and to demonstrate how the over-all performance goal for previous period was met. ... On the basis of this information, supplemented by his knowledge of factors not included in the mathematical models, he would have decided how to allocate the total resources available to the library among Services A, B, C, D, E, etc. ... To summarize, the principal yardsticks needed by the librarian, aside from measures of costs, would ideally be direct measures of capability, utilization, and value for each of his library's services. ... and the units of the measure of value would be suitable for aggregation into a global measure of the total value realized from all services (ibid, pp320-323).

Orr then discusses at length the inherent difficulties in attempting to develop direct measures of goodness and suggests a number of alternatives:

A second, and basically different, approach emphasized the essentially subjective nature of value judgments and proceeds to assess the beneficial effects of a service by determining the value people attribute to these effects. The resulting methods vary widely with regard to what assumptions are made (e.g., assumptions that allow users or librarians to act as the judges) and how values are made explicit; but they can all be considered to be relatively direct measures as long as the central question is not begged entirely by equating value with what is expanded (i.e., the resources devoted to a particular service or to the library itself) (ibid, p328).

The article concludes with a useful discussion of the desiderata for the measures of goodness, given as Appropriateness, Informativeness, Validity, Reproducibility, Comparability, and Practicality.
Mohamed (1976) developed a model for the purpose of measuring and evaluating the effectiveness of an academic library. In his words, the model... "has two important features:

A. It is designed to provide quantitative measures, as a function ranging from 0 to 100, for the overall effectiveness of a library’s performance in serving user needs;

B. It is designed to measure a library’s effectiveness directly from user perception, experience and behaviour in seeking need satisfaction in a library, rather than providing some hypothetical measures of a library’s capability, based on some simple documents and the simulation of user search patterns.

This model assumes that the measures for the overall effectiveness or performance level of a library have to be derived from three basic subsets or criteria:

I. Service Perception Factor (SPF)

II. Need Satisfying Capability (NSC)

III. Behaviour Determining Capability (BDC)

According to the model, each of these subsets will yield quantitative measures, as a function ranging from 0 to 100, so that the figure for the overall library effectiveness can be easily compared with the library’s goal, which is also set as a function extending from 0 to 100.

From his literature review, Mohamed concludes that... "some of the main theoretical constructs for measurement of library service relied on the perceptions and value judgements of users in order to obtain measures for the criteria of equality and value of library services", and SPF was thus included as one of the criteria for measuring library effectiveness (ibid, pp63-65).
Regarding his Need Satisfaction Capability, Mohamed obtained measures directly from user needs and real user experiences. For example, he tested whether a user is able to ultimately obtain, in the library, material related to his needs, disregarding such factors as time taken, frustrations endured, etc. The overall measure of Need Satisfaction Capability also ranged from 0-100, which is "the overall percentage of the patrons, who, through individual effort, or through interface with the library personnel, are able to obtain either the specific material they came to obtain, or some they deem to be relevant to fulfil their perceived need (ibid, p67).

With regard to Behaviour Determining Capability, Mohamed writes that "a measure of user need satisfaction and library effectiveness... should also incorporate a measure of the user's awareness of service modes, and their ability and readiness to make optimum use of these services. A measure of library effectiveness should, therefore, incorporate the factor of user behaviour or user interface with service needs, in seeking need satisfaction in a library (ibid, p69). The measurement model is summarized thus:

... the role of a library is seen as comprising two important functions: (a) the design and implementation of service modes essential to facilitate maximum user need satisfaction; and (b) the design and implementation of appropriate user education program to inculcate desirable user behaviour for optimum utilization of service modes, and the achievement of maximum need satisfaction in the library. A true measure of a library's effectiveness has to take account of both these important functions of a library (ibid, p72).

Mohamed gathered his data by means of questionnaires from 120 student users of the Hillman Library, University of Pittsburgh, 22 of the faculty who had study rooms in the library, and 20 librarians. The data on Service Perception and Perceived Importance were collapsed into three categories from low to high on each sub-service and analyzed with the chi square test.
One glaring short-coming in this work is that the sample size appears to be rather too small, and thus poor ... "the sample consisted of 141 patrons and 20 professional librarians from Hillman Library", and ... "the sample is more than 4 times the minimum of 30 required to meet the assumption of a statistically large sample size" (ibid p49-50).

White (1977) in surveying quantitative measures which have been proposed for evaluating a library's effectiveness, writes vaguely of "the quality of service or the value of information to the user" (p136). No definition of "quality" or "value" are given, however. Similarly, Rogers (1954) discuss the measurement and evaluation of library service and concludes that a library can only be judged on the basis of some undefined "competent and courteous service". Again, no definition is given by which "competent service" can be operationalized.
Abraham (1980) reported a type of goal programming method for measuring library effectiveness devised by the Washington State Libraries in 1972. He described it as a subjective managerial overview of the library’s effectiveness, derived, in part, from the first of Rzasa and Baker models in its use of weighted efficiency measures applied by administration. The managerial team rates the importance to the library’s mission of each goal, on a scale of 0-10. Then the importance of each objective, or sub-goal, in relation to its goal is rated on a scale of 0-10. After a period of time, such as one year, the managerial team rates the level of accomplishment of each objective over the rating period. The following formula is applied:

The formula for the model consists of five measurements resulting from manipulation of the three ratings:

\[ x = \text{Assigned GOAL importance factor (scale: 0-10)} \]
\[ y = \text{Assigned OBJECTIVE importance factor (scale: 0-10)} \]
\[ z = \text{Evaluation of OBJECTIVE accomplishment (scale: 0-10)} \]

The first calculation measures the contribution of the Goal to the mission of the library:

\[ (1) \frac{x}{\Sigma x} \quad (\Sigma x = \text{sum of all } x's) \]

The second calculation measures the contribution of each OBJECTIVE to its goal:

\[ (2) \frac{y}{\Sigma y} \]

The third calculation measures the contribution of the OBJECTIVE to its mission of the library:

\[ (3) \frac{xy}{\Sigma x \Sigma y} \quad (1) \cdot (2) \]

The value of accomplishment of each OBJECTIVE toward the mission of the library is determined by multiplying each OBJECTIVE accomplishment factor (z) by its contribution to the library’s mission (3), i.e:

\[ (4) \frac{zxy}{\Sigma x \Sigma y} \]
These are then summed to provide a figure expressing the effectiveness of the library:

\[ \frac{\sum_{xy}}{\sum_{x} \sum_{y}} \] (ibid, p6).

Abraham admits that the method has been developed, but never applied. The point of departure between Abraham’s model and some of the earlier models reported above (Orr et al., 1968; Cooper, 1973; Totterdell and Bird, 1976) is the level of importance attached to ratings and evaluation of library performance by librarians and that by clienteles. Most of the other works attach more importance to ratings by the clienteles. It is not very clear why Abraham tends to think that it is appropriate for librarians alone to rate the importance of library goal accomplishment, except, of course in cases of lower level objectives which support the overall goals.

Another significant contribution in the area of assessing and measuring academic library effectiveness is found in the work of Sell (1981), who did her research in the form of a Ph.D. dissertation at the Florida State University. The purpose of the work was to develop and test longitudinally a general open system model for academic libraries by which the effectiveness of a library’s performance, both overall and specific, can be assessed, monitored, improved, and thereby managed more responsively. Sell (1981, ibid) describes the research thus:

Using a holistic systems approach, a tri-level conceptual model was developed based on criteria generated by general system theory methodology. .... Constructs and indicators used in the instrument were operationally defined. A random sample from each stratum of primary intended users at each setting report the Relative Importance to them of each service dimension and their Level of Satisfaction with the performance of the library in providing service on that dimension. From these data, an index of Benefit and Index of Effectiveness are calculated across all dimensions, along with the overall levels of Benefit and Effectiveness (p iii)
Data were analyzed and displayed on time series, using confidence levels to detect significant changes. Sell's work represents a bold attempt to tackle the persistent problem of measuring effectiveness in library services, drawing also from several other service professions. Nevertheless, the approach taken, using the General Systems Theory, appears to be rather too broad to attribute success or failure to a particular methodology. It would have been more appropriate if a particular methodology was used. Moreover, the outcome of the work as done by Sell requires a long period of time to be realized, since the model was "... pilot tested at one fairly typical academic setting, with three annual iterations of the instrument for each of two strata of users", and "Testing over time at other academic library settings is recommended for further refinement, improvement, and applications" (ibid, iii).

A more meaningful effort to define library effectiveness relates it to the achievement of library goals. One common measure is to use statements of library goals as criteria of effectiveness. These goals may be the formal goals established as part of nationally promulgated standards, or located within individual library manuals or other formal documents (Du Mont and Du Mont, 1979). Statements of goals may also be derived from the functions of the library. Functions, in this context, refer to contributions made by the library in the form of tangible outputs to its patrons, or patent organizations (ibid, p107). Goals in this regard, take the form of useful outputs which are consumed by those outside the library system. For example, in discussing special libraries, Boaz (1968) emphasizes that the effectiveness of the library can only be measured in terms of its contribution to its organization; "each subsystem (of the organization ___ including the special library) must contribute to the whole and each is evaluated by its cost and its benefits" (ibid, p789).
Ping (1968) favours this view, where he notes that "libraries ... are man-made institutions, and one reason for their existence is to support the social organizations man defines ... (ibid, p.373). The library's effectiveness in his opinion, thus, relates to how well the library supports the functions of its parent organization.

It can be concluded from the literature review concerning effectiveness of library and information organizations that:

1. There is still an urgent need for evaluation in order to determine service effectiveness.

2. Many of the operational definitions of the concepts used were poor, and hence less helpful.

3. Librarians apparently have left most of the urgently needed research to be performed by individual specialists from other fields, who conduct most of the research from their point of view rather than from the library professional view.

4. Even in cases where librarians did the research, they tend to adopt a couple of techniques as the total solution to their problems. For example, it was because of his belief that most of the Systems methodologies available are only suitable for "engineering-type" problems that Checkland introduced his 'Soft Systems methodology' to tackle 'real-world' problems. There tends to be too much attempts to follow methods of scientific enquiry from the physical sciences without a sufficient background in the same.

5. Many of the works done, especially in the fields of systems analysis and operation research concerning circulation aspects of librarianship appear to be too mathematical in nature, and their potential contributions remain 'blurred' in mathematical complexities as to be of much help.

6. There appears to be no general agreement on the significance of various techniques for measuring effectiveness, and this poses a serious problem both for the library management and for the systems analyst who embarks on the task of analyzing the library as an organization.
2.7.1 CIRCULATION SYSTEM MODELS

Miller and Coleridge (1977) developed a semi-mathematical model for library circulation control, in an attempt to contribute to a more structured and yet flexible approach to library circulation management. In the authors' words, the advantages of the model include:

(1) a facility for the concise description of circulation policies and data collection procedures and practices;

(2) additional semi-mathematical insight into the circulation process and its problems; and

(3) an objective basis upon which to evaluate specific services, policies, and control methods.

They developed their model under the general assumption that the circulation control process consists of two distinct phases. First, the interactive phase involves the borrower, the books, the library's circulation policies, and the process of data collection. The data processing phase consists of maintaining the circulation files and generating operating and management reports (ibid, p197).

A model for the "systematic representation of activities and circulation policy" is then set out and illustrated using the application of the model at Carleton University, Ottawa. The circulation model maps activities into a transaction space and is defined by the function

\[ f: A \rightarrow T. \]
They explained that:

To provide for efficient data collection procedures while ensuring that all data collected defines valid activity triplets, \((b,v,x)\), two sets of validation processes have been developed. The first is a set of syntax specifications \(\{S_m\}\) governing the format of transactions and the second is a policy function \(P(a)\) governing the semantics and enforcement of circulation policy (ibid, p203).

Further

The policy function limits the domain of \(f(A)\) to those activities for which an entry exists in borrower class /transaction code (ibid, 203).

The article concludes by arguing that applying the model on Carleton University library led to clarity and consistency in the definition and interpretation of policy, and that ...

"hope-fully through the application of the model librarians will be able to gain new insight into the nature of their circulation control problems" (ibid, p204).

McGee (1972) explains key factors in the analysis and design of academic library circulation system. His paper started with several assumptions and definitions regarding the basic purposes of a circulation system, which are ... "to record, regulate, and control the movement (absences) of library materials from their designated locations" (p127). A file of materials removed from locations indicated for them by library catalogues (Absence file); a file of registered borrowers; shelf list; and any other transaction records which may be created for a variety of transactions that can occur between the library and its users: charging and discharging of items, placing reserves on circulating books for users who have requested them, settling fines, etc, form a set of key factors which McGee (ibid, p128) used in his analysis and design of academic library circulation systems. The article is generally helpful, though not comprehensive enough, toward an understanding of the factors that library managers and systems designers should consider in circulation system development.
In yet another paper, McGee (1973) identifies and describes aspects that are particular to manual circulation systems. The paper concentrates on the theme of "absence of items", because

The essence of a manual circulation system is how its absence records are coded, stored and retrieved (ibid, p213).

The paper discusses at length why the alternative ways of coding records and organizing and processing files are the most important considerations in the design of manual circulation systems. He then suggests two main classes of encoding methods: class A methods, that allow records to be quickly identified by a single physical characteristic, without close examination or concern for internal record characteristics; and class B coding methods that require inspection of record contents for an identification judgement, concluding that:

Understanding the alternatives for record coding and file organization should help librarians who are either designing large manual circulation systems, or operating acutely-burdened ones that need immediate relief. The latter may find themselves busily surveying computerized circulation systems, while overlooking opportunities to tighten up on an absence category or two and establish a couple of cleverly coded R2 files (ibid, p216)

Adding that ... improving a manual circulation system can, for some libraries, provide a cheaper and less troublesome solution than automation (ibid, p216).

The paper ends with a challenge:

... too often the failures of manual circulation systems are subjectively described as reasons to automate. Quantify them, and a hard bit of progress will be won (ibid, p216)
A review of the literature on models of circulation systems, too, reveals that most of the types of work in the area tend to lean toward the use of one mathematical method or another. There appears to be a tendency for developing models which are too abstract and unrealistic for meaningful application, while most variables and constructs are used without paying much attention to the implications of including them in the model. Here, too, there doesn't seem to be agreement as to what factors play a more significant role than others in presenting a workable model, with most of the studies recommending that further refinements are needed in the form of more detailed research.
CHAPTER 3

3 RESEARCH METHOD AND PROCEDURES

3.1 Introduction to the Research Framework

In this chapter, the conceptual framework within which the research has been conducted is discussed and rationalized, while justifications are also given for the selection of SSM as the methodology within which the study is conducted. The work is conducted as a case study within the framework of action research, i.e., attempting to bring about improvement in the problem-situation while at the same time learning from the process.

Busha and Harter (1980) noted the difference between two broad types of research. Basic research includes studies conducted to achieve a fuller understanding of a phenomenon without consideration of how findings will be applied. A study undertaken primarily to acquire knowledge for its own sake can be classified as basic research (or theoretical research). Basic research is derived from fundamental, intellectual problems; it tends to be of an original and theoretical nature. On the other hand, applied research is pragmatic; its purposes are more specific and are generally aimed at solving practical problems or at the discovery of new knowledge that can be utilized immediately in actual "real world" situations. This, however, does not mean that findings of a theoretical research cannot be applied later to the solution of a pragmatic problem.

Research methodologies in librarianship, as in many other disciplines, tend to be greatly influenced by the methods of the natural sciences. It is also characteristically uneven in quality and demonstratively weak methodologically; therefore too much of it has only approximated scientific inquiry.
Some investigators within the field have apparently been reluctant to use the key instrumentation of science ___ experimental research (Busha and Harter, 1980).

However, things are gradually changing for the better. Serious investigators now regard the scientific approach to research as an idea ___ something to which librarianship not only aspires but which it can actually realize through persistent, diligent, and rigorous inquiry. In this regard, however, the most important single characteristic of the paradigm of the natural science is its "reductionism" (Checkland, 1980). This approach assumes that the only "correct" way to knowledge is to break down the issues in question into the smallest possible components, to study these components in isolation or in the laboratory, to find simple relations among them, preferably causal, and build from these parts an explanation of the more complex phenomena (Hein, 1978).

Although this works well in the physical sciences, it is less successful in the social management sciences. More recently, especially between the late 1960's and the early 70's a tenet of systems thinking began to emerge which argues that the whole is greater than sum of the parts: properties of the whole are not explicable entirely in terms of the properties of its constituent elements. Human activity systems are more complex and the human components in particular may react differently when examined singly to when they play a role in the whole system: something is lost when the whole is broken up in the 'reductionist' approach of scientific analysis. The academic library is a complex and purposeful human system, and should, therefore, not be studied in a purely analytic approach alone.
Along the same direction, Jennesse (1978) states that in the social sciences ..."the fixed-design experiments, geared to answer unequivocally a predetermined question of lasting interest is not often the model of investigation we need" (p300). To understand and improve the functioning of a complex social phenomenon one must study the phenomenon as a living or dynamic entity operating in its natural environment. This calls for looking at a system in terms of the wider system of which it is a part. It should be made clear, however, that the concept of "holism" as advocated by many researchers, is not totally opposed to the purely analytical approach of the physical sciences; as a matter of fact, it complements it. This is the reason why some researchers, notably Rist (1977) see the value of aspects of each mode, where he considers the present era as one of "detente" in which it is wiser and more beneficial for a researcher to choose a methodology that is most appropriate to the problem at hand. Others, such as Springer (1977) believe that both approaches are necessary:

Despite the academic dialogues which post reductionist-holist and intensive-extensive dichotomies, many of the empirical assumptions and methods associated with the alternative approaches can be profitably seen as necessary compliments to adequate social theory. Each position can be effectively argued as representing important insights into social reality. Thus, the task before us is to derive empirical theories and research procedures which, as accurately as possible, acknowledge [information content] trade-offs and maximize information appropriate to the theoretical problem at hand.

3.2 SOFT SYSTEMS METHODOLOGY AND PROBLEM-SOLVING

As the protagonists of this methodology emphasize, the "Soft" Systems Methodology is historically a development of the 'failure' of hard systems methodologies to deal with soft problems (Checkland, 1980), (Wilson, 1984) and (Naughton, 1977). 'Hard' systems methodologies take their origin in conventional systems analysis, Control Engineering and Operations Research.
The problems to be addressed in this research, i.e., the need to assess and improve the performance and effectiveness of circulation systems in academic libraries is essentially a soft or 'unstructured' problem which is typified by being a mixture of "what" and "how" questions.

Checkland (1981) has adapted systems theory into a practical methodology. By methodology he means the study of methods to achieve certain purposes. He adds that "for any particular problem situation, the study will lead to a subset of principles which can be applied for that particular situation". He argues that systems analysts apply their craft to problems which are not well defined.

These 'fuzzy', ill-structured or 'soft' problem situations are common in organizations. The description of one category of systems, Human Activity Systems, also acknowledges the importance of people in organizations. It is relatively easy, it is argued, to model data and processes (the emphasis placed in many methodologies), but to understand the 'real world', it is essential to include people in the model, people who may have different and conflicting objectives, perceptions and attitudes.

This is difficult because of the unpredictable nature of human activity systems. There is no such thing as a repeatable experience in this context. The fundamental theoretical foundations of this methodology rest in the belief that a true understanding of complex problem situations is more likely using the soft systems approach than if the more simplistic structured or data-oriented approaches are used, which address mainly the formal, 'hard' or scientific aspects systems.
Wilson (1984) throws more light on the principles of the methodology. He considers two examples of problems. The first is a flat tyre. The solution is clear, and would be recognized as such when the desired pressure is maintained in the tyre. The second is 'What should the U K government do about Northern Ireland?' The solution, here, is not clear and it would be difficult to find any solution that satisfied all the interested parties.

Wilson suggests that 'hard' methodologies that may be suitable for solving 'burst tyre type problems' are inappropriate for organizational problem situations. It is not only a question of techniques and tools, but also concepts, culture and language.

Another difference between 'hard' and 'soft' systems thinking is that in hard systems thinking a goal is assumed. The purpose of the methods used by the analyst (or engineer) is to modify the system in some way so that this goal is achieved in most efficient manner. Hard systems thinking is concerned with how of the problem. In soft systems thinking, the objectives of the system are assumed to be more complex than a simple goal that can be achieved and measured. Systems are argued to have purposes or missions rather than goals. Understanding is achieved in soft systems methods through debate with the actors in the system. Emphasis is on the what as well as the how of the system. The term 'problem' in this context is also inappropriate. There will be lots of problems, hence the term 'problem-situation' ___ a situation in which there are perceived to be problems (Wilson, 1984).

The strength of the Soft Systems Approach is in its insistence upon a framework, rather than a prescription, for organizational activity. It tends to recognize the difficulty of getting to grips with a problem area and, in doing so, acknowledges a complexity which may be missing from the 'sanitized' corporate vision of the Strategic Plan.
In the words of Checkland (1981a):

Most of the work .... has been directed either to establishing tentative methodology and then testing, modifying, and re-testing it, or to drawing general lessons from a number of systems studies considered together (p237).

Checkland, further explains that "...every systems study carried out could be seen as taking place in circumstances in which there is a perceived problem and a readiness to take action to solve it".

In such a situation, argues Checkland "...there is a 'problem-content' system, containing the role of problem owner, and there is a 'problem-solving' system containing the problem solver. The problem solver uses the systems methodology to take action to improve aspects of the problem-content system" (ibid,p238), adding that there will also "...be several potential occupiers of the roles, and there will be several possible ways of describing problem-content and problem-solving systems".

In using the 'Soft Systems methodology, Checkland (1981a) offers the following basic advice:

If it is clear what the 'problem content system' is being taken to be, and who is 'problem solver' with what resources, then organized work according stages of the methodology can begin. And if subsequent experience causes the initial perceptions to be modified, as is quite likely, that can be done without the study drifting into incoherence (p238)
This system to use the methodology is pictured below:

The problem solver defines one or more problem owners and the problem content(s) associated with that ownership. He uses the methodology to recommend or take action in the problem-content system, or to redefine it and/or its owner(s). And he uses the experience as a means of further developing both the methodology and the concept of a human activity system (an important feature of action research).

Fig. 3.1 An outline of a system to use the methodology: (After Checkland, 1981:239)
To fully understand the 'Soft Systems methodology', it is very necessary to reproduce here, the several intellectual (or philosophical) constructs on which Checkland and his associates (Checkland, 1981) base their reasoning:

1. "There is a real world of great complexity in which we find ourselves. Our species has a curiosity about complex reality, and has developed ways of finding out about it. We are able ___ and we do this all the time ___ to make intellectual constructs pertaining to complex reality. The constructs (which though themselves abstract, may of course be expressed in words on paper or as physical artifacts) are themselves simpler than reality, but may be checked against it.

2. The activity we call 'science' happens to be the most powerful means we have of making valid some of our intellectual constructions, our notations, by checking them against the real world itself. The power of science arises from the fact that its constructs, or their consequences, are publicly testable...

3. When the intellectual constructs survive severe tests we tend to slip into describing the world as being what the simplified constructs say it is. It would be pedantic to do otherwise. Nevertheless, we ought occasionally to remind ourselves that our descriptions and models of the world, even when well tested, are not the world itself. The most spectacular example of this discrepancy between models and reality is in physics. Newton's intellectual model of the world as consisting of space in which there are objects survives
some severe tests. Not unnaturally we talk about the world as if it actually
consisted of space and objects-in-space. In fact, the model which survives the
most severe tests so far is Einstein’s, in which space and objects-in-space are
not separable as in Newton’s model. The discrepancy between Newton’s model
and reality does not matter for everyday purposes, or for many scientific ones.
And even Einstein’s model, though more powerful than Newton’s model, is not
reality itself, only the best model of reality that we have so far. Occasionally,
we do need to remind ourselves that there is a distinction between complex
reality and our notations of it.

4. Systems ideas constitute one particular set of intellectual constructs, one
particular notation, which can be tested against reality itself. The system idea,
in summary, is one of hierarchical wholes showing emergent properties and
characterized by mechanisms of communication and control. If this paradigm
is used to investigate natural phenomena, then the intellectual constructs, here
systems models, can be tested against reality in a straightforward manner—
can they reproduce the repeatable observable? If they can do so successfully,
we slip into saying that the natural world actually contains or consists of
systems. We forget that we are talking about our notations of reality, rather
than about reality itself...

5. Now suppose, however, that the systems thinking is applied to human beings
and their interactions, and involves the concept of a ‘human activity system’.
Because a model of human activity system will express only one particular
perception of a connected set of entities out of a range of possibilities, we cannot expect the kind of match between reality and model which natural science seeks, and which it is possible to achieve in the case of natural systems. Suppose that a systems model of a chemical system, say a model of the kinetics of a chemical reaction, does not match the (repeatable) measured kinetics: then the fault must lie with the model builder. But when a model of a human activity system does not match observed human activity the fault might be the model builder's but it might also be due to the autonomous real-world behaviour of human beings. We cannot expect a match between model and reality in the latter case both because of the multitude of autonomous perceptions and because those perceptions will continually change, perhaps erratically.

6. This means that in the case of human activity systems we need to be particularly aware that they are mental constructs, not would-be accounts of reality. Our purpose in building them cannot be to grope towards a systemic ontology. They are tools of an epistemological kind which can be used in a 'process exploration' within social reality.

7. If, in trying to find out about the world around us we use that part of the systems notion which deals with 'human activity systems' we must be especially careful not to talk glibly as if human activity systems exist in the world. Methodologically, we need to be especially aware of the line separating stages 1, 2, 5, 6, and 7 from 3 and 4. When using the methodology ______ in
whatever sequence we need to be aware of crossing that line, and of the different models of working appropriate when we are above it and below it. Above it, we are operating in and on the world of reality. Below the line, we are constructing models for epistemological use above it" (pp247-249)

Reflecting on the lessons learnt from using the methodology, Checkland (1981a) notes that

...although it seemed obvious that the studies started by finding out about a situation and proceeded by formulating root definitions, building conceptual models and then following a sequence of activities which eventually led to action in the problem situation, it gradually became clear that the sequence from stage 1 to 7 is only one rational way in which the methodology can be used, rather than the way in which it has to be used. The relationships between the stages are what is important, and it is frequently possible, not only to start at any stage, but to do some work in the problem situation which simultaneously contributes to more than the stage (Checkland, ibid, p246),

adding that

"...a good example here is Singh's (1979) suggestion that in research in problems of industrial relations it is important to distinguish 'operational' models (of real-world) and 'conceptual'(systems) models, and to proceed by comparing the latter with the former. This fits well with the experience of developing and using the methodology. If the problem situation studied is a strike, for example, this may be taken as an extreme manifestation of stages 5 and 6, in which the strikers are proposing some changes which derive from their view of reality and the employers are opposing the changes as unreasonable or unrealistic according to their different view of reality. By starting at stage 5 and 6 it is possible to work back to the root definitions implicit in the stances of the two opposing sides. This offers the prospect of changing the terms of the argument, enabling the appreciative systems of strikers and employers to be modified".
Another significant lesson from the whole experience of developing and using the methodology concerns the systems ideas underlying the formulation of root definitions and the building of conceptual models in stages 3 and 4.

3.2.1 CRITIQUE OF THE SOFT SYSTEMS METHODOLOGY

The 'Soft' Systems Methodology faces a number of criticisms from some quarters, especially in relation to the question of what model of social reality is implicit in it. Jones (1978), for example suggests that using the methodology is akin to constructing 'an ad-hoc theory' about the problem situation which is derived 'neither from general theory nor from scientific testing, but from a pre-formed set of concepts developed in experience'. In defending this point, Checkland (1981a) writes:

...the methodology provides not only 'pre-formed concepts' but also some well-tested procedures for using them, [and that] ... this view of the methodology usefully underlies that the use of it, unlike the application of a technique, does not lead automatically to a solution.

Also regarding the remark (Jones 1978) that it is not the purpose of the methodology to construct models of real-world 'systems', Checkland agrees that this is correct ..." but it is a point which many people find difficult to grasp" (Checkland, 1981a, p251). Prevost (1976) in his case, argues that the 'Soft' methodology is located in the structural-functional tradition of sociology, as represented by Parsons and Merton.

The difference, he claims, is only one of scale, Parsons working towards a comprehensive theory of all social action, Merton developing 'theories of middle-range', the methodology constituting a tool to tackle particular real-world problems comprehensively.
He then labelled the methodology as having a static and conservative bias, being unable to deal satisfactorily with conflict and change.

In responding to Prevost's criticisms, Naughton (1979) points out that a conceptual model in the methodology is ... 'a device for helping actors to explore aspects of the problem situation' rather than a description of part of the real world. 'Soft Systems research', writes Naughton ...

... is more accurately viewed as a kind of social "technology", interpreted as "the systematic application of scientific or other organized knowledge to practical tasks" .... consequently Prevost is not comparing like with like'. Nevertheless, Naughton concludes by partly conceding to Prevost, where he later agrees that ' there is ... a "whiff of functionalism" about the methodology even if it is difficult to pin down precisely'. On this, Checkland (1981a), only made a partial concession to Prevost when he writes:

There are similarities, certainly, as there are bound to be given holistic framework of structural functionalism, but the aims of the social scientist and the systems oriented problem solver are different, and this makes an application of the methodology different from functional analysis. The social scientist wants the most accurate possible, testable account of what a social system is. The systems man using the methodology wants improvements in what is taken to be a problem situation. Given these aims, the functionalist sociologist wants the richest possible model he can get, including manifest and latent functions; the systems analyst wants his systems thinking to be as clear and coherent as possible, leading to clear-cut debate, and hence he makes his systems models of possibilities (Checkland, 1981a p 237).

Naughton (1977) has also provided an exegesis and commentary, written originally because of difficulties in teaching the methodology to systems students of the Open University.
In it a most useful distinction is made between 'Constitutive Rules' which 'must be obeyed if one is to be said to be carrying out a particular kind of inquiry at all', and 'Strategic Rules' which are more personal, which 'help one to select from among the basic moves ... those which are "good" or "better" or "best" '. The rules of the two types, slightly modified by Checkland (1981a,253) are presented in the table below. The distinction made is useful not only because it emphasizes that the methodology is a set of firm guidelines within which individuals may operate personal strategies, rather than a technique guaranteeing an answer, but also because it makes the user aware that if he chooses to break a constitutive rule he may lose some of the help which the methodology can provide when it is used as a linked whole, as an enquiring system.
Table 3.1 Constitutive and strategic rules of the 'soft' systems methodology, Checkland, 1981, p253 (after Naughton, 1977)

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constitutive rules

*The complete methodology is a 7-stage process.
*Each stage from 2 to 6 has a defined output:
Stage 2: rich picture; relevant systems
Stage 3: root definitions evaluated by CATWOE criteria
Smyth and Checkland, 1976)
Stage 4: conceptual models of the systems described
in the RDs built by assembling and structuring verbs
Stage 5: agenda of possible changes (derived from
comparison of CMs with 'rich picture' expression of the problem situation)
Stage 6: Changes judged with actors in the situation to be (systemically)
desirable and (culturally) feasible
* Conceptual models should be checked against RDs and 'formal systems' model
* Conceptual models should be derived logically from RDs and from nothing else
* Conceptual models are not descriptions of systems to be engineered (although stage 6 may
  yield a decision to engineer a system)

Strategic rules (some examples among many possibilities)

* Preliminary expression conducted by searching for elements of structure and process
  and examining the relation between the two
* Expression may be facilitated by asking "resource allocation" questions:
  What resources are deployed in what operational process, etc.
  How is this monitored and controlled?
* Problem themes i.e one-or two-sentence blunt statements used to focus
  attention on interesting and/or problematic aspects of situation
* Iterate, especially: relev. syst ---->RD ---->comparison ----> relevant system
* Set up stage 5 as a debate with important actors in the situation
  ... etc....etc.
--------------------------------------------------------------
3.3 WHY SSM?
As pointed out in chapter 1, the objective of this study is to analyze (explore the what and how of) a university library’s circulation system in the spirit of ‘action research’ conducted within the framework of the ‘Soft’ systems methodology, with a view to assessing, monitoring and exploring ways of improving performance effectiveness. It was primarily conceived in view of the library management’s aspiration to explore whether or not computerization could alleviate the problems often encountered in the operations of the circulation control system, an issue which was laden with internal wrangling. Soft system approach is thought to be more helpful in this particular situation because, whereas 'hard' systems analysis addresses those parts of an enterprise that have tangible form, 'soft' systems thinking considers the systems that could be envisaged throughout, and in particular, those that involve human activity. Moreover, the soft approach leads to increased understanding and accommodation, and helps to clarify potential areas of disagreements. The approach encourages an analyst to take an overview of situations and consider relationships (social interactions) that may not be apparent when using 'hard' techniques, and this is of particular value in today's organisational climates. This kind of research calls for the investigation into social interactions and hence action research is the best strategy.

Positivist science is based on the philosophy that the external world can be observed objectively. In contrast, action researchers argue that, to investigate the actions of people functioning within organisations, a researcher should acknowledge that both observer and observed are not value 'neutral', i.e, the subjectivity both of the objects of research and the
researcher should be recognised and admitted into the research domain\(^1\).

Churchman (1968) remarks:

One of the most absurd myths of the social sciences is the "objectivity" that is alleged to occur in the relation between the scientist-as-observer and the people he observes ... [it is a] silly and empty claim that an observation is objective if it resides in the brain of an unbiased observer (p86).

Clark (1972) on his part, put forward a taxonomy of research methods based on the researcher's problem orientation; action research is seen as appropriate to a practical problem to be addressed in a given organisation, but one which has wider theoretical implications.

As Checkland (1981) elaborates, the assumption by both positivist system thinking and traditional management science that systems exist in the real world and can be unequivocally described leads to the idea of manipulating models of the assumed reality in order to discover a solution which is either optimum or at least 'good enough' in a particular situation. However, since SSM embodies a paradigm of learning, the notion of a 'solution', whether it optimizes or satisfices, is inappropriate since the process of learning is never-ending. For this, the methodology declines to accept the idea of "the problem". It works with the notion of a situation in which various actors may perceive various aspects to be problematical. The methodology, thus, acts as a general problem-solving approach appropriate suited for human activity systems. Indeed, problems that can be expressed decisively, in a straightforward manner may undoubtfully fall into the realms of systems engineering. When, however, problems cannot be clearly and plainly stated, SSM becomes a tool of examining that uncertainty by including a means whereby a debate is organized about the possibility for

\(^1\)For a thorough discussion of the contention between proponents of positivist science and action research the reader is referred to Checkland, 1981, chapter 8; Clark, 1972).
change. The act of organizing such a debate is in itself a consideration of the fundamental framework of human activity systems. This framework is based on the conviction that unlike other types of system, HAS cannot be described or portrayed in a single, exclusive account that stands unchallenged. Such a system, thus has as many perceptions or descriptions Weltanschauungen as there are people who are directly or indirectly affected by its activities. Hence the need for organizing debate and discussions, to gather as many view-points as possible. This is a major point of departure between SSM and Systems Engineering methodologies which are a means of engineering efficient "solutions". SSM in contrast, tries to provide help in getting from a position of finding out about the situation to a position of taking action in the situation. In hard systems thinking, this is often done by relying on finding similarities with previous experiences.

In contrast, SSM offers the chance of making the transition from finding out about the real world. It emphasizes peoples' perceptions of reality, their mental processes rather than their objects of those processes. This has been the stand adopted in this research a view amplified further by Warmington (1980) thus:

...for the time being we are putting aside the notion that research may result in the discovery of universal truths about human behaviour in organisations or about the kinds of technical solutions which work best in organisational settings ... [action research may result in] new analytical concepts, tools, frameworks, which are apparently more appropriate, or more useful to this kind of problem.

Thus, unlike positivist science with its pursuit for context-free formula of precisely predicting the outcome of events, action research is mainly concerned with developing general conceptual and analytical frameworks that will expedite actions for generating desirable outcomes.
Describing the purpose of the present work in the context of action research, one can therefore say that it has attempted to examine the viability of an intervention guide which can subsequently enable computer systems specialists to operate effectively in ill-structured problem situations. This is achieved by extending 'soft' systems methodology to incorporate tools and techniques used in 'hard' computer systems analysis.

The essence of action research is the fundamental belief that the analyst should not remain a mere observer outside the subject of study but should become intimately involved as a full participant in the action, while also the process of improvement or change becomes the subject of research.

Furthermore, regardless of the business or other aims of organisations, few if any can function effectively unless some characteristics of systems are present in their day-to-day operations. Measures of performance and mechanisms for feedback and control in particular are essential to an organisation's survival; frequently these aspects are not formally recognised in any way, or consciously considered when a review of activities is being considered. In many situations quantifiable measures of performance are difficult to define; nonetheless, the process of addressing such matters, which is an integral part of the soft systems approach, inevitably produces some means of judging the success (or otherwise) of an enterprise. Other characteristics that are desirable in systems terms (eg the resource needs, communication links and related information flows etc), will also be deliberated as the approach is applied.
In the words of Patching (1990), "It follows that soft systems ideas can be used for a variety of different types of investigations, such as general departmental reviews of performance, value-for-money audits, analysis of functional needs to meet new commitments etc; and, by putting specific developments into an organisational context, in support of computer systems analysis" (p34).

Most importantly in this work, the advice of Wilson (1984) is borne in mind that these situations (problem-situations) and the environments in which they reside are in a dynamic state, and the direction to be taken by the research, unlike traditional scientific research, it is difficult to test hypotheses; because even if it is possible to formulate an hypothesis, it is unlikely that a real-world situation can be found which turns out to be just the vehicle for testing it.

It is the opinion of this author that this approach, new as it may appear to be in its application to library systems analysis, would present a fresh and more realistic angle from which we can take yet another look at the total as well as dimensional aspects of the academic library's services, with the major aim of sharpening the framework for assessing and improving overall effectiveness by 'sanitising' the problem-situation through the introduction of a kind of structure. Moreover, this researcher, unlike many critics of the SSM sees a role for it in the area of information systems development, by serving as a major guideline for the information system design process itself. As Busha and Harter (opcit, 1980, p29) rightly comment:

... to ensure that libraries remain viable social institutions in any locale and in whatever setting they might be found and that library collections and programs of service are relevant to the information and communication needs of clientele, librarians must continue to explore new approaches and methods that are applicable to the roles of libraries.
3.3.1 MAJOR RESEARCH QUESTIONS

To be able to achieve its stated objective, the research first attempts to find answers to the following questions, which, up to this stage are poorly perceived:

(i) What is the mission of the circulation system? Are there any contradictions between what the system claims to be doing and what it actually does?

The need here is to address not only what services the circulation system performs, but how they are carried out and what 'deficiencies' (if any) can be found.

(ii) What information is needed for effective decision making?

The question here addresses the type of information kept by the circulation department and its perceived relevance from the point of view of the operators of the system, and the type of information they would have wished to be kept by the department.

(iii) What is the library's place in the overall curricula of the university?

(iv) To what extent should a library develop its own expertise in information systems development?

(v) What is the best strategy for implementing modern systems management technique in an organisation whose overall services are intangible, such as the academic library and whose problem-situation can be categorized as 'soft'?

As part of the conclusion of the work, action research, its implications and the nature of learning that it affords are discussed in connection with the principles upon which the soft systems methodology is based.
3.3.2 OPERATIONAL DEFINITIONS

**EFFECTIVENESS** in the context of this research refers to the systematic evaluation or analysis of the extent to which the library produces the desired beneficial results in satisfying its primary intended users, and contributing in meeting the stated mission or objective of the wider system within which it operates.

"RESOURCES" is used here to refer to the combination of key managers and other skilled and able personnel of the department; building, equipment and other capital resources, as well as the librarian's ability to secure financial backing for new and ongoing programs in the system.

"OBJECTIVES" is referred to as what the system intends to accomplish, here taken to be the official statement of mission.

3.4 ASSUMPTIONS

Taking into consideration (a) the role of the circulation control system in the university library and the services that it provides, and (b) the fact that SSM in its original form does not embody data processing techniques, the study is conducted under the following assumptions:

1. That the major purpose of a circulation system is to provide services for the benefit of the library users by recording, regulating, and controlling the movement of library materials from their designated locations.
2. That the circulation system, through the main library system is an integral part of the academic programme, which renders assistance to students and faculty in accomplishing their academic and research goals.

3. That by introducing some appropriate techniques and methods of computer systems analysis into the 'Soft' systems methodology it is possible to use it as a solid basis for computer-based information system development.

4. That the users of the system (those who benefit directly from its services, i.e., students and tutors) as well as the operators of the system (i.e., the library personnel) should be the main judges in evaluating the benefits imparted or not by the system.

5. That the best circulation system for a given academic library depends largely upon certain factors peculiar to the environment which the system is a part of.

3.4.1 DATA COLLECTION

3.4.2 Sampling

The population size for the research includes some four hundred and fifty students and faculty of the Usmanu Dan Fodiyo university, Sokoto, Nigeria, ten senior staff of the university library (including the University librarian), and heads of circulation control systems for the Main, Medical and Law libraries of the university.
The research method is essentially that of action research, conducted in the form of a case study, because the focus is a single research object. The case study approach allows a concentrated focus on a single phenomenon and the utilization of a wide variety of data gathering methods (Busha and Harter, 1980: 151). The overall purpose of a case study is to obtain comprehensive information about the research object, while at the same time maintaining and benefitting from the action research.

This method is very common in librarianship where the objects or subjects could be:

(a) organizations, such as libraries, media centres, information centres, or library schools;
(b) librarians, library assistants, clerical workers in libraries, or groups of library users;
(c) programmes or processes such as information systems and various library projects or techniques.

Action research allows a collaborative, close examination of unique problems of individual groups or situations --- something which many other research methodologies do not readily permit.

Busha and Hart (ibid, 1980) also add that in view of concern about social utility and responsibility of libraries as institutions, the case study approach to inquiry appears to be particularly appropriate in studying relationships between library services and a variety of social problems. "Indeed, the case study approach is particularly applicable in inquiries concerned with the role of libraries as social institutions --- that is, their social control, performance, and impact on society in general and special groups in particular" (Busha and Harter, ibid, p152).
The major advantage of case studies is the opportunity they afford for thorough and detailed examinations and analyses of a research problem so that findings can be applied directly to the object of an inquiry.

When applied as a research method, case studies are usually carried out to generate findings of relevance beyond the individual cases. As a research method, case studies are known to be appropriate for investigating phenomena when:

(i) a large variety of factors and relationships are included,

(ii) no basic laws exist to determine which factors and relationships are important, and

(iii) when the factors and relationships can be directly observed.

The case study method is an investigation of a phenomenon as it occurs without any significant intervention of the investigator.

Becker (1970: p75) describes case study as a detailed analysis of an individual case supposing that ..."one can properly acquire knowledge of the phenomenon from intensive exploration of a single case".
3.5 Data Collection Method

The main techniques used for data collection during the research were: questionnaires, interviews and observations/visits to similar libraries.

3.5.1 Questionnaire Surveys

Two questionnaires were developed and administered in the study. One was developed for the library users, i.e., students and staff of the Usmanu Dan Fodiyo University community. Another questionnaire was also designed to collect data from the heads of circulation control systems of the Main, Medical and Law libraries of the university. Before they were administered, questionnaires were field-tested with one hundred students and staff from the University College London, which has about the same size of enrolment as the actual case study.

Short-comings were noted and rectified before going into the field. A number of respondents pointed out a few problems and suggestions which were either removed or incorporated in the final version.

3.5.2 Questionnaire to Students and Staff

The questionnaire to these groups of users was designed to identify the frequency and purpose of using the library, adequacy of library's stock in the respondents' various fields of study and/or teaching and research, the degree of satisfaction with some basic services provided by the library, and difficulties encountered in getting the information they needed from the

\[\text{Appendix}^{1}\]

\[^1\text{See Appendix.}\]
library. Other items included how often the users approach library personnel for assistance, utilize interlibrary loan services, photocopy services, and their personal assessment of library staff attitude. Since users or customers of a system are very important in assessing the system's performance, data obtained from this source will be very helpful in achieving a better understanding of how the circulation system is viewed by the users, and will assist in making suggestions for plans that will serve them better.

3.5.3 Questionnaire to Heads of Circulation Units

This questionnaire is designed and administered in view of this author's conviction that important as they are, library users alone can not provide all the information and data needed to construct a measure of service effectiveness. The personnel within the library and the satisfaction they derive from their jobs is equally an important factor that must be taken seriously. A separate questionnaire was mailed to the heads of the three circulation service points of the university library concerned in order to find out their opinions about the type of system they operate at the present, and their levels of satisfaction or otherwise with the type of working files kept by their various units. This questionnaire also aims at finding out the type of information more frequently needed by the management as well as users from the circulation system personnel. The objective, here is to gather as much data as possible about the state of the circulation system under investigation, from as many sources as possible in order to see what type of changes or improvements it may require.

\(^2\)See Appendix
3.5.4 Interviews
In addition to the questionnaires administered, interview sessions were conducted in order to supplement data gathered. Interviews were held with staff and/or management of the following institutions: Usmanu Dan Fodiyo University library, Bayero University, Kano, Ramat library (University of Maiduguri), Kashim Ibrahim library, (ABU Zaria) among others. Despite the fact that the research was designed as a single case study, this investigator felt that other similar university libraries would provide a good test-case in terms of sample size and the nature of some of their problems. Discussions during the interviews with library management centred on goals and missions of the library, structural set-up, staffing, financing, infrastructure, books and journals procurement, security of materials, office space, ability of the present circulation system to cope with surging enrolments, and plans for the future. Data from these interviews have gone a long way in directing the course of the research, especially concerning the future needs and expectations of the library management.

3.5.5 Observation/Visits to Other Libraries
In order to see what was happening in libraries similar to the one under investigation the investigator visited six other university libraries in Nigeria during a field-trip lasting ten weeks. The libraries visited were all established around the same period as the Usmanu Fodiyo University library. These were: the University of Maiduguri, the University of Calabar, the University of Port-Harcourt, the University of Ilorin, the University of Jos and the Bayero University, Kano. The six are the youngest generation of universities in Nigeria, and it is the opinion of this researcher that almost all of them are at the same stage of development. One fact has to be appreciated, however: whereas each of the six universities mentioned above, which were established together with the Usmanu Dan Fodiyo university was an off-shoot of
one institution or the other, the Usmanu Dan Fodiyo university, Sokoto had to start from the scratch. It did not inherit any infrastructure or book collection from any other institution as was the case with many of the others. The University of Maiduguri, for example, was established on the foundations already set by the former North-East College of Arts and Science; Bayero University, Kano was a well developed campus of the Ahmadu Bello University, Zaria; Jos was a campus of the University of Ibadan.

3.5.6 Development of Research Instruments

The main research instruments were developed by this investigator after a thorough survey of the literature of research methodologies and previous works done in the field of library and information science. The instruments were revised with the assistance of the investigator's supervisor, and then field-tested, as mentioned earlier, at the University College London.

The investigator was personally present in Nigeria for a period of ten weeks, from July to September, 1988, to administer the questionnaires and conduct interviews. As a result, the returns were very good, since the presence of the researcher enabled him to collect most of the distributed questionnaires before returning to London.
3.5.7 Data Processing

The statistical Package for the Social Sciences (SPSS) was used to process and statistically analyze the data contained in the completed questionnaires, by providing overall figures for each variable as well as preparing cross tabulations, which were later used with the Harvard Graphics software at the University College Computer Centre to produce graphic representations.

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3The researcher is grateful for helpful suggestions from colleagues in the department, as well as Brian Newman of the Middlesex Hospital, University College London.
CHAPTER 4

4. THE SYSTEM STUDY

4.1 OPERATIONAL CRITERIA FOR THE ANALYSIS

This chapter is intended to give a background of the situation as it exists in the Usmanu Dan Fodiyo university library on which the research is about. It is, therefore, the finding-out stage of the analysis.

The most logical as well as the most difficult starting point of any systems analysis exercise is the phase(s) that concern finding out about the situation. Part of this phase will be to try to identify some factors or statement about the situation which is thought to be problematic.

In his book, *Systems Thinking, Systems Practice*, Checkland (1981) offers some caution about the 'expression' phase, which he describes as a phase during which:

...an attempt is made to build the richest possible picture, not of 'the problem' but of situation in which there is perceived to be a problem. The most useful guideline here ___ in the interest of assembling a picture without, as far as possible, imposing a particular structure on it ___ has been found to be that this analysis should be done by recording elements of slow-to-change structure within the situation and elements of continuously changing process, and forming a view of how structure and process relate to each other within the situation being investigated (p163-164).

This relationship he calls *climate*. Elements of structure are defined as those features related to physical lay-out, power hierarchy, reporting structure, and pattern of formal and informal communications. Process is related to the on-going activities of conversion of raw materials into output, monitoring, decision-taking and controlling.

The rich picture referred to above by Checkland, represents both subjective and objective perceptions of the problem situation in diagrammatic and pictorial form, showing the structures of the processes and their relations to each other.
Elements of this rich picture will include the clients of the system, the people taking part in it, the task being performed, the environment, and the owner of the system. This picture can be used as an aid to discussion between the problem solver and the problem owner, or may simply help the solver better understand the problem situation. The rich picture is mainly intended as a communication tool between the analyst and the users of the system and therefore uses the terminology of the environment. In the case of this research, this calls for:

(i) an explicit, meaningful and unambiguous statement of objectives of the system under study, in the context of the wider environment in which it resides;

(ii) Clear demonstration of the flow of information within the management structure, i.e., analyzing the situation in a neutral way which would not distort the problem in any other way;

Before embarking on the enquiry, however, the advice of Peters and Naughton (1984) is worth bearing in mind where they write that two points must be made absolutely clear:

The first concerns the role of the analyst himself. The soft systems approach evolved in a management consultancy environment, and draws much of its legitimacy from practical application. But it is different from some other approaches to consultancy in one important respect, namely that the soft systems analyst does not see himself as an 'expert' in particular problem types. He is not, in that sense, like an accountant or a simulation modeller — a professional whom one would call if one had an accounting or a modelling problem. The soft analyst will, in general, know little about the detailed nature of the activities and tasks of the organization which seeks help. What he does know about is how to assist people to think rigorously about their difficulties, to see them in different lights, and he hopes, to come to views about them which will make beneficial changes possible. The analyst is, in that sense, some kind of catalyst, or change agent, or therapist. Just as a marriage guidance counsellor will not issue detailed guidelines to a couple who seek advice, but rather encourage both parties to express and explore their perceptions of the situation, so too a soft systems analyst will seek to bring out and build upon the perceptions of the people he is trying to help.
This has lots of implications, the most important of which is the fact that as a soft systems analyst, one is not detached from the problem situation in the way say, an accounting consultant would be. On the contrary, once you decide to get involved, you become part of the problem situation, for once the analysis gets under way, the inquiry process itself will start to affect the situation. This means that you should try to be explicit about your goals and objectives, and about the reasons why you have chosen to become involved.

The second advice given by Peters and Naughton (1984. ibid) is that the analysts should try to clarify the distinction between three other roles relating to those members of the organization with which he/she is dealing. These roles are: the client, the problem-solver, and the problem-owner, adding that:

"In hard systems analysis, these roles usually present few problems. The client of the study is usually (or can be taken be) the problem owner, and the analyst is the problem solver. But experience with the soft systems analysis suggests that it is important to separate these roles in the following way:

(i) The client is the person who causes the study to happen in the first place. Without the client there would be no system study.

(ii) The problem solver is the person who hopes to do something about the situation which is perceived to be problematical. This could be the client, but need not necessarily be. Given the general therapeutic orientation of the soft systems approach, the problem solver is unlikely to be the analyst.

(iii) The problem owner could be a variety of different people in the situation. In many soft systems studies one should, at some stage, experiment by allocating this role to a number of different people (or groups)". 
(i) The client is the person who causes the study to happen in the first place. Without the client there would be no system study.

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Peters and Naughton also listed various ways or guidelines for compiling a rich picture, along the same line as given by Checkland mentioned above, although different people do it in different ways. A few of the guidelines given include the following:

(1) First look for the elements of structure in the situation. These are the parts of the situation which change relatively slowly over time and which are relatively stable. They may include things like departmental structure, physical lay-out, numbers of products, etc.

(2) Next look for elements of process within the situation. These are things which are in a state of change ___ the activities which go on within the structure.
(3) Then look for the ways in which the structure and the processes relate to one another. For example, you might find decentralized processes taking place within an organizational structure that is heavily centralized. This in itself is often very insightful, for the simple reason that processes change, whereas structures tend (by definition) to remain stable.

But that can mean that, over time mismatches occur between the two, with the result that you wind up with a situation where the necessary processes have to take place within a structure which is no longer suitable or helpful.¹

(4) Do not try to represent the situation in terms of systems. Do not, in other words, say things like: 'Well, the situation is made up of a marketing system and a production system and a quality control system'. There are two reasons for this: the first is that the word "system" implies organized interconnections and it may precisely be the absence of such interconnectedness which lies at the heart of the matter, and by assuming its existence (by the use of the word system) you may be missing the point. The second reason for not representing the problem situation in terms of systems is that doing so will channel you down a particular line of thought, namely the search for ways of making these systems more efficient. You will, in other words, be following the track of much hard systems analysis, which is concerned with making systems better at doing their tasks or achieving their objectives, without questioning whether these tasks are worth doing or these objectives worth achieving.

¹In this case Peters and Naughton gave the example of a computing firm, in which they found that the supervisory systems for field engineers had been set up at a time when most engineers carried out repair work with screw drivers, multimeters and soldering irons, and had not changed to meet the needs of field engineers working with integrated circuits and self-diagnosis systems.
You may be helping to devise better ways of doing things that should not be done at all. Similarly, if you begin to start seeing an industrial firm as comprising of a marketing system and a financial system and a production system then of course you will find that they have got physical departments which correspond with these categories, and you will begin to start taking these departmental entities as given almost as if they were laws of the universe rather than as essentially arbitrary ways of dividing up an overall task.

If you fall into this trap, then you may be throwing away the opportunity of questioning whether some of these divisions might be made quite differently.

(5) Make sure that your picture includes not only the 'hard' factual data about the situation, but also the 'soft' subjective information.

(6) You should look at the social roles which are regarded within the situation as meaningful by those involved, and look at the kind of behaviour which are expected from people in those roles. This will give you some insight into the norms which operate in the situation. Then you should ask what kind of behaviour in those roles is regarded as 'good', or 'bad', or 'acceptable'. This will give you some clues about the values people hold in the situation.

(7) Annotate your picture with a set of terse footnotes.
(8) Finally, include yourself in the picture. Make sure that your roles and relationships in the situation are clear. Remember that you are not an objective observer, but someone with a set of values, beliefs and norms which colour your perception. If your involvement has been sponsored by any figure or agency in the picture, make that clear also.

Armed with the above advice, this section of the work now takes a look at the organization within which the study is conducted.

4.1.1 ORGANIZATIONAL BACKGROUND: The Usmanu Dan Fodiyo University Library, Sokoto, Nigeria

The Usmanu Dan Fodiyo University, Sokoto was established in the ancient city of Sokoto, in North-western Nigeria in the year 1975. A library was established along with the university in the same year, but it only opened its doors to readers in June, 1977. The library caters for the nearly 4000 undergraduates, about 200 postgraduates and some 300 full and part-time staff of the university by acquiring, processing, arranging, preserving and disseminating instructional and informational materials on a wide variety of academic and (in a few instances) recreational fields. Strength of the library’s collection currently stands at about 250,000 titles of books, with some 45,000 backset of bound periodicals. The library has a strength of eighteen full-time senior staff and sixty clerical and support staff.

4.1.2 STATUTE ESTABLISHING THE LIBRARY

The statute establishing the university empowers it to:

...erect, provide, equip and maintain libraries, laboratories, lecture halls, halls of residence, refectories, sport grounds and other buildings or things necessary or suitable or convenient for any of the objects of the university

The statute further states that:
There shall be a librarian who shall be responsible to the Vice-Chancellor for the administration of the university library and the co-ordination of all library services in the university and its campuses, colleges, faculties, schools, departments and institutions and other teaching or research units.

4.2 IDENTIFICATION OF ORGANIZATIONAL OBJECTIVES

Before we can discuss and analyze what the university library’s role is, we must first accept as given the following assumptions about the wider environment within which the library functions, i.e. the university:

(i) That students enrol in the university to accomplish specific and individual academic goals;

(ii) That all goals, objectives, activities, and resources of the university exist primarily for the education of students, and for the research and other services to the community;

(iii) That the library is an integral part of the academic programme, primarily in a direct supportive role, although often in an instructional role in assisting students and faculty accomplish their instructional and research goals.

Over the years, various individuals and groups have come out with statements of objectives for various types of libraries. Some of these objectives are comprehensive enough in scope; many however, are vague and too general. This problem seems to be the case in virtually every large-scale organization. Hamburg, et al (1974), too, noted this in their research where they stated …’in analyzing recorded objectives of public and university libraries, we found that these objectives were not sufficiently explicit to be of direct assistance to management
in planning and decision making for libraries', adding further that 'this sort of finding occurs in management science analyses of virtually every large-scale organization or system'.

4.2.1 DEFINITION OF "OBJECTIVES" AND "GOALS"

Before embarking on a detailed analysis of the total and dimensional services performed by the organization which is the focus of this study, it would be helpful to define what is meant by "objectives", and also to attempt to differentiate between "objectives" and "goals". Ackoff (1970) defines "objectives" as valued states or outcomes. An organization may desire either to obtain something that it does not have, or to retain something it already has. Hence objectives may be either acquisitive or retentive.

Goals, on the other hand are objectives whose attainment is desired by a specified time within the period covered by the (corporate) plan (Ackoff, 1970, p23).

Objectives, according to Ackoff are categorized into two: stylistic and performance. Stylistic objectives are composed of things that are valued "intrinsically", i.e, for their own sake. He gave an example with a person's preference for, say, black ink over green ink, and pointed out that both are valuable instrumentally but different intrinsically as a matter of personal taste or style. The second type of objectives, performance objectives have to do with things that are valued instrumentally, i.e, because they can be used to retain or acquire something. Money, for example, has instrumental value. It is the second type of objectives that are used by organizational analysts in examining the effectiveness of an organization or system. It is thus, this second type of objective that would be continuously referred to throughout this work.
4.3 ANALYSIS OF OBJECTIVES: The Usmanu Dan Fodiyo University library, Sokoto

The objectives of a university library are generally stated in terms of the fundamental functions it performs in the areas of instruction, research and community service. Since the university library supports the university’s academic programmes, objectives for the library are viewed by many in terms of the needs and requirements of the personnel involved in the teaching and research efforts of the university in question. The question of whether and which option to adopt to computerize the library’s services became a common point of bitter arguments during most congregation meetings among staff. This provokes hot arguments, especially because the membership of the university community included both those who saw a solution in computerization and those who did not a situation saturated with conflicting cultural issues which suits the application of SSM in investigating the potentialities or otherwise of computerization.

The University Calendar states the objectives of the university as follows:

The object of the university shall be:

(a) to encourage the advancement of learning and to hold out to all persons without distinction of race, creed, sex or political conviction the opportunity of acquiring a higher education;

(b) to provide courses of instruction and other facilities for the pursuit of learning in all its branches, and to make these facilities available on proper term to such persons as are equipped to benefit from them;

(c) to relate its activities to the social, cultural and economic needs of the people of Nigeria;

(d) to encourage, promote and conduct research in all fields of learning and human endeavour; and to undertake any other activities appropriate for a university of highest standard.
4.3.1 THE ROLE OF THE UNIVERSITY LIBRARY

In line with the stated mission of the wider university above, the objectives of the university library were set as follows:

(i) to provide materials in support of the learning process; that is, materials for students’ course-work, assigned readings as well as background readings for essays, term papers and projects;

(ii) to provide materials to meet the requirements of faculty specialists, postgraduate students and researchers;

(iii) to provide materials to assist library users in their own personal self development;

(iv) to cooperate with other university libraries with a view to developing a network of academic library resources which are at the disposal of all students and teaching faculties;

(v) to do everything possible to meet the specialised information requirements of the community within which the university is situated.

As can be seen from these objectives, the statements are too generalized and ambiguous as to yield any helpful measures of service effectiveness. There is bound to be difficulties in trying to measure these objectives and relate them with the library’s programmes. Further analysis of the statement of objectives is necessary to make them explicit for purposes of analysis.

Objectives (i) through (iii) above can be taken to refer to the acquisition of relevant library materials in line with the requirements of the members of the university community, and the storage of acquired materials; objective (iv) refers to services such as interlibrary loans and cooperation, while objective (v) refers to the means of assisting library users in identifying, locating and making use of these materials in a variety of forms.
Since the library exists to support the wider system (the whole university) in achieving its stated objectives, it can be safely said that the library performs this role by serving as an interface between bibliographic resources and a particular user population.

The overall objective of the library is to "expose" this universe of bibliographic resources (or at least that portion having the most immediate relevance and interest) maximally to its users (Hamburg, et al. 1974). In order to satisfy its overall objectives, the library is broadly organized into technical services and public or readers' services. The technical services interface "directly" with the library’s collection and thus provide a link between this collection and the user, while the public services interface "directly" with the user community and provide a link between the user and the collection. This interface relationship is represented in the following diagram:
**LIBRARY MANAGEMENT**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
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<tbody>
<tr>
<td><strong>TECHNICAL SERVICES</strong></td>
<td><strong>PUBLIC SERVICES</strong></td>
</tr>
<tr>
<td>Selection and Acquisition</td>
<td>Collection</td>
</tr>
<tr>
<td>Cataloguing</td>
<td>Finding Tools</td>
</tr>
<tr>
<td>Indexing</td>
<td>Staff services</td>
</tr>
<tr>
<td>Classification</td>
<td>References</td>
</tr>
<tr>
<td>Physical preparation</td>
<td>Dissemination</td>
</tr>
<tr>
<td>Binding and Repair</td>
<td>Document Delivery</td>
</tr>
<tr>
<td></td>
<td>Circulation</td>
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<td></td>
<td>Photocopying</td>
</tr>
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<td></td>
<td>Borrowing</td>
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**UNIVERSE OF BIBLIOGRAPHIC RESOURCES**

Fig. 4.1 Organization of a library to serve the interface function (from Lancaster, F W, 1977).

**INTERLIBRARY COOPERATION.**
The library staff is involved in both types of activity, while the management directs and coordinates both. The library may cooperate with other institutions in both public and technical services. Thus, in general terms, the library’s major objective is to maximize the accessibility of its resources to the user or to maximize the exposure of the users to the resources, while also always attempting to minimize the amount of effort required to obtain access to needed bibliographic materials, and supplying such materials as soon as possible when the need for them arises (Hamburg, et al. 1974) and (Lancaster, 1977).

4.4 THE PROBLEM-SITUATION UNSTRUCTURED: DESCRIPTION OF THE CIRCULATION CONTROL SYSTEM IN THE USMANU DAN FODIYO UNIVERSITY LIBRARY, SOKOTO

The circulation control system in the Usmanu Dan fodiyo university library, like that of most Nigerian university libraries is manual. The purpose of the circulation control is to manage readers’ use of the library’ collection. One of the most important facets of circulation control is the creation of records of loan transactions of the library. This has to be done with accuracy, despatch, and minimal effort on the part of the users and staff. There is, thus, a record of who has what and when.

This objective of managing the use of library collection is achieved by:

-creating records for each item lent out by the library;
-creating records of users’ personal information (name, department, status of registration, etc);
-maintaining these records according to user-status (i.e, staff, undergraduate, postgraduate, etc);
-identifying outstanding loans;
-identifying reserve holdings;
-preparing and despatching recall notices;
-maintaining the main catalogue access to the collection.

In the type of manual control arrangement that the Usmanu Dan Fodiyo university library uses, in order for a user to borrow an item from the library, he/she must present the item to borrow along with the library card(s) given during initial registration with the library. Each card will enable a user to borrow one item only.

The number of library items a user can borrow at a time is determined by the number of library cards he/she is entitled to.

This is determined by the status of the user, i.e whether a faculty staff, a postgraduate or an undergraduate. Behind the cover of each circulating item there is a "pocket" containing a book card, with provisions for names and signature of the borrower, the title of the item, its accession and class numbers. The library retains the borrower card with information about the title of the book, its accession number, its class mark and when it is due back, and these records so created are filed in issue trays which are in turn marked staff or students accordingly, by accession number. The borrower ticket containing name, registration number, department and course of the borrower, and the book card which contains book title, accession number and personal data of the borrower are presented to the circulation desk staff, who must verify the information filled in by the borrower, before stamping the date-due on the book card on a date-due slip pasted also somewhere on the inside cover of the book. The book card is then inserted into the borrower's card, and this constitutes a record of transaction.
It is from such a record that the library clerk will know which library user is in possession of what item and when it is due back. Each day's transaction is filed separately at the end of the day's work by accession number.

When a borrower returns an item, the circulation desk staff would first, check the due date of the item and look it up from the corresponding issue tray, to find the borrower's card. The book card is removed from the borrower's card and inserted back into the book pocket; the book is put aside for re-shelving, while the borrower is handed back his/her library ticket. In case of any overdue penalty, the date-due of the item is compared with the actual date of return. The difference should be used to calculate the fines due.

4.4.1 SECURITY OF LIBRARY MATERIALS

4.4.2 Effectiveness of detection methods

A search in the literature revealed that library abuse had been approached from different angles. Tyler (1976) isolated the history of large scale book theft and focused on the magnitude of the problem. Kaske (1976), in conducting a library inventory search, found that 13.07% of that library's missing collection could have been stolen.

A survey by Hendrick and Murfin (1974) at a state university in the United states explored some of the social dimensions of those engaged in book mutilation. Looking for motivation for the mutilation of periodicals, they found no outstanding differences between those who mutilate periodicals and those who do not. The reasons given were circumstantial: the library was closing, the copy machine broken, no money was available to make a copy, the copy machine will not reproduce photographs of charts.
Every library has a delinquent reader problem; but its dimensions may be so restricted that it can be accepted and overlooked. However, there comes a point when the situation is no longer tolerable. Souter (1976) identifies three parties that are involved when reader delinquency occurs: the library, the delinquent reader, and the mass of other readers. In the library context, many factors including security, availability of material, photocopying facilities, and sanctions are interconnected. The librarian must know which one of the variables to manipulate, which to maintain unchanged; and if he makes the wrong decisions, he will positively encourage reader delinquency. Souter (1976, ibid) defines "delinquent reader" as...'a user of the library who over-borrows to a high degree, or retains books after they have been recalled; or illegally borrows, steals or mutilates books' (p97). If security is poor, it is likely that certain people will steal. In the Souter study librarians were interviewed in an attempt to better understand "delinquent readers", and it was concluded that students did not consider their theft to be wrong and they behaved in similar ways outside the university. Broadhead (1973) argues that: "This in turn enhances the demand factor, frustration sets in, causing an increasing number of library users to adopt the same attitude. This chain reaction causes a spiral effect in book losses" (Broadhead, ibid, p236).

An issue of major concern in the area of library security is whether or not to have exit controls; and if so whether they should be manual or electronic. The manually controlled exit possesses varying capabilities, in that it is only as efficient as the person manning it. Thus a considerable improvement may be achieved by substituting a conscientious, capable individual for a lazy or incompetent one. On the other hand, when electronic security systems are installed, it is normal for mutilation to increase. Cummings (1973) noted this at Upsala College.
The explanation for this tendency is given by Roberts (1975) where he points out that...

'books are stolen because people want to use them (which is typically, though not invariably the case); a system which in effect protects the cover or spine of a book, but not the contents, can be circumvented by removing the contents and leaving the protected part behind. In truth, such a system might even be said to make book stealing easier and safer'. Library security systems, whether manual or electronic, can thus be said to have advantages and disadvantages. On the one hand, Cummings (opcit, 1973) writes of the manual check: 'an examination of this kind cannot do more to deter the faint-hearted or remind the careless'.

On the other hand, Roberts (opcit, 1975) notes that: 'in the opinion of the editors of the Library Technology Reports Electronic Surveillance Systems are effective only to the extent that they keep honest people honest ___ reminding the honest borrower that he has neglected to charge the book with which he is leaving the library', adding that no exit control can frustrate the designs of a determined thief, unless he is totally inept.

4.4.3 SECURITY ARRANGEMENTS AT THE USMANU DAN FODIYO UNIVERSITY LIBRARY, SOKOTO

The responsibility for the security of library materials rests with the circulation control department. Like all other operations in the circulation department, the security system, too, is entirely manual.

When leaving the library, a reader must show any item (whether library item or not) to the security personnel at the main exit point of the library. The main duty of the security personnel is to make sure that any item being taken out of the library is duly checked out.
This is done by checking to make sure that space provided for on the book-slip for the date due is stamped at least a few days ahead: for instance, if on the say, 15th of March, 1989 the security personnel of the library finds a reader taking out a library item stamped say, 10th March, 1989 they will not allow the reader. Unless the circulation staff admit responsibility for that error, the security personnel would treat the case as that of a stolen library item.

The present manual circulation system renders the library collection vulnerable (security wise) because some readers have direct access to their transaction records, and a delinquent borrower might perhaps remove his/her transaction records from the library's file. Once that happens, there is no way the library can trace the transaction, and such an item is lost for ever.

4.5 OPERATIONAL ANALYSIS

This method of issuing out library materials on loan and accounting for their safety and return when needed poses a number of questions, minor and more serious ones to library users and library staff alike.

These questions in turn have direct relationship with the ability of the system to provide effective service, which is one of the major concerns of this work. For example, it is very common for a library user to be denied the use of a badly needed library item due to simple clerical error of either a misfiled library transaction record or lack of accurate and timely information about the whereabouts of a library item.
Another source of difficulty which this investigator had observed during the ten-week-period study visit to Nigeria was the inability of two circulation desk clerks to search an issue tray simultaneously. Desk staff thus have to wait and use the issue trays in turns. This way, the number of people waiting to be served might be building up, forming a long queue.

One common error which occurs frequently is that of mixing up the accession numbers, which makes it difficult, if not impossible to trace a transaction record. Coupled with this difficulty is the fact that often, a less careful library clerk may insert a wrong book card into a borrower's card, an action which results in ascribing a wrong transaction record to a borrower. The circulation desk clerks have informed this researcher how the policy of holding responsible the owner of a library ticket for any item charged out on his/her ticket creates additional confusion. This way, a library ticket is like a credit card; once lost, it can somehow be used by anyone who happens to pick it up and as far as the library is concerned the actual person originally issued the ticket is held responsible despite the boldly written warning that library tickets are "non-transferable".

There are also a number of questions regarding the status of a given library item, which the present manual procedure cannot satisfactorily answer on the spot. For example, it is difficult to tell a reader immediately if a book is actually on loan once it cannot be found on the shelves. To be able to do that, all the transaction trays will have to be "combed", searching for a book with that title.
Another major issue that this researcher personally observed in his brief spell as a circulation librarian was the way some "clever" library users would legitimately borrow an item, take it out and remove the date-due slip from the book cover, re-enter with it into the library, only to paste it on another book of their choice. The security personnel would have no reason to suspect any foul play, since the date-due stamp on the book was "genuine" and it requires an extra meticulous gate-keeper to flip the pages so as to compare the accession number on the book-slip with the one stamped on the inner pages of the book.

Economically speaking too, the fact that every registered library user has to be issued between four and twenty library tickets depending on their status in the university, and that these cards might have to be renewed (or re-issued) every semester, consumes no small amount of scarce resources. Here, too, it is very common for a borrower to be denied badly needed services when the circulation department runs short of borrower cards, waiting for them to be supplied by the library administration.

Another major question which the current circulation system cannot answer satisfactorily at the moment is that since each book carries a book pocket and a book card which contains the book title, call number and a provision for names and signature of the borrower, many atimes the cards fall off. A well meaning browser with a tidy mind may replace a fallen card into a wrong book. This means that any time the next person wishes to borrow that book, a delay will occur because the circulation desk staff must fill out another book card in order for it to give a record of transaction. In some cases such extra cards are not available, and they have to be looked for elsewhere in another department, say cataloguing department from where all labelling works are handled.
The delay caused the borrower in keeping him/her waiting while looking for a new book card to fill out and the glue to fix it is found to be a source of frustration to both library clerks and the borrowers.
So far, we are still in the first two stages of the analysis, the stages in which we "attempt to find out about the problem situation without imposing a particular structure on it" (Checkland, 1981, p164). The best studies, according to Checkland, have been characterized by a holding back in stages 1 and 2, by a readiness to collect as many perceptions of the problem as possible, and by a determination not to press the analysis in systems terms at all. The main argument here is that in 'soft' systems, which include most human activity systems considered at a level higher than that of physical operations, there will always be many possible versions of 'the system to be engineered or improved' and system boundaries and objectives may well be impossible to define.

What we have been doing so far, therefore, is an attempt to build 'the richest possible picture' of the situation being studied. Such a picture then enables selection to be made of a viewpoint(s) from which to study further the problem in the particular situation. In other words, the initial stages covered so far, "display the situation so that a range of possible and, hopefully relevant choices can be revealed" (Checkland, 1981, p166). It is evidently possible from the above account to realize the "unstructured" nature of the situation at the Usmanu Dan Fodiyo university library.

4.6 RELEVANT SYSTEMS AND THEIR ROOT DEFINITIONS

The relevant system is a system which is, in some way, relevant to the problem situation in the sense that it will yield insight into the situation when it (the system) is described more fully. Relevant systems and their Root Definitions can be of two main types: issue-based or primary-task.
The former fasten on specific basic issues—i.e., topics of concern to someone in the situation or to the analyst—and seek to address or act upon them in some way. Primary task relevant systems, in contrast, are attempts to describe or capture the essential nature of the fundamental task which must be carried out by the organization under study. However, on the question of selecting relevant systems, Checkland (1981, opcit) writes: "...the most important point is that there is in principle no limit to the analyst’s freedom to make whatever choice he thinks or feels might lead to insight. He may wish to name systems which carry out basic operations which go on in the problem situation; or systems which manage or subvert such operations; or he may choose an ad-hoc system of limited life, for example a system to take a particular decision" (p221). He adds that the analyst must be free to make any or all of these choices in particular instance, if the methodology is to remain a guiding framework allowing for individual style and temperament in problem-solving rather than become a uniformly applied technique. To propose a particular definition is to assert that, in the view of the analyst, taking this to be relevant system, making a conceptual model of the system, and comparing it with present realities is likely to lead to illumination of the problems and hence to their solution or alleviation. 'Relevant' does not imply that the system selected is necessarily desirable, certainly not; it is the system which ought to be designed and implemented in the real world.

In the 'Soft' systems approach a root definition is the name given to the process of "careful formulation of concise verbal descriptions of systems believed by the analyst to be relevant to the problem-situation within which he is working" (Smyth and Checkland, 1976).
4.6.1 The role of Root Definitions

The 'Soft' systems methodology takes as its starting assumption that real-world problems will be associated with systems of a particular kind, namely "Human Activity System" (Checkland, 1971).

The first and second phases of the methodology involve describing the situation in which the perceived problem lies and analyzing it in a neutral way which does not distort the problem into any particular form. The Root Definition stage involves selecting some viewpoints which seem potentially relevant to bringing about some improvement in the problem situation. This is done by naming some notional systems which seem to the analyst to be relevant to solving the problem, or at least to improving the problem situation.

The systems named do not have to correspond to organizational groupings such as departments or sections. Wilson (1984: p45) warns:

...bear in mind that the system analysis that we are doing is an attempt to structure an unstructured situation through simplifying the complexity not by trying to mirror it. Hence a Root Definition should contain one transformation process and should contain commitment to a single W,

adding that "...using multiple transformations in the root definition tend to build into it part of the conceptual model." The Root Definition, therefore, is a description of what the system is and the conceptual model is a description of what it must do to be that system.
Model building should focus only on the Root Definition; every phrase in it will lead to particular activities in the model; every element in the model should relate to a particular part of the Root Definition. The aim is justifiable combination of RD and conceptual model. It is not expected that different modellers will derive exactly the same model from an RD, simply because words carry different connotations for different people. What is sought is a model which is coherent and defensible rather than "correct".

Smyth and Checkland (1976) explicate this point further by giving an example with a manufacturing company seeking to reduce materials costs, in which case a relevant system might be "a materials-flow system" or "a temporary-storage-of components system", neither of which are likely to be institutionalized within the company. The most important lesson to be derived at this stage is that any particular viewpoint chosen will be consistent with, and, more than that, will be meaningful in terms of some particular view of the total reality which the world presents to us. Any system named as "relevant" to the problem will carry with it some particular world-image or Weltanschauung. The methodology tries to analyze problem-situations in a way which enables different Weltanschauungen, which may be conflicting or incompatible, to be exposed and made the subject of concerned debate.

It is, therefore, necessary to make a concise verbal description of the system which captures its essential nature; i.e, to formulate a Root Definition of the system selected as most relevant to tackling the problem. Each Root Definition will derive from a particular subjective view of reality, a particular Weltanschauung, and it is important to realize that this particular stage (as well as the next one) is not concerned with describing reality, but with working out the implications of adopting a particular world-view.
In order for the model building in stage 4 to be exact a Root Definition should be a richly precise expression of a particular view. Every word in it should be carefully weighted.

### 4.6.2 HYPOTHETICAL COMPONENTS OF ROOT DEFINITION

Hypothetically, an adequate Root Definition should embody the following six areas in an explicit way, or, failing that, any of these areas which is omitted should be omitted consciously and with good reason (Smyth and Checkland, 1976). The six considerations may be easily remembered by the mnemonic CATWOE as follows:

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Amplification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &quot;Customer&quot; (C) Client (of the activity), beneficiary, or victim, the subsystem affected by the main activity(ies). The indirect object of the main activity verb(s).</td>
<td></td>
</tr>
<tr>
<td>2. &quot;Actors&quot; (A) The agents who carry out, or cause to be carried out, the transformation process(es) or activities of the system</td>
<td></td>
</tr>
<tr>
<td>3. &quot;Transformation&quot; (T) The core of the Root Definition. A transformation process carried out by the system. Assumed to include the direct object of the main activity verb(s)</td>
<td></td>
</tr>
<tr>
<td>4. &quot;Weltanschauung&quot; (W) The (often unquestioned) outlook or taken-for-granted framework which makes this particular Root Definition a meaningful one.</td>
<td></td>
</tr>
<tr>
<td>5. &quot;Owner&quot; (O) Ownership of the system, control, concern or sponsorship; a wider system which may discourse about the system.</td>
<td></td>
</tr>
<tr>
<td>6. &quot;Environmental Constraints&quot; (E) Environmental impositions. Perhaps interactions with wider systems other than that included in (5) above, these wider systems being taken as given.</td>
<td></td>
</tr>
</tbody>
</table>
Wilson (1978; 1979) reported on other studies concerning information systems creation within the framework of SSM in which attention is paid to the activity systems which the information will serve. In those studies, the team decided to model a notional system which can be related very directly either to an organisation as a whole or to a well-established task carried out by a section, department or division. The relevant system chosen in the studies were also those which expressed the 'official' explicit task which is embodied in the organisation, section or department. Such a choice will require a root definition which expresses this 'primary task' in a neutral. This approach is borne in mind when choosing the relevant system on which to base our root definition in this work.

As mentioned earlier on in this work, the library's circulation control system has the main functions of promoting and controlling access to, and assisting members of the university community in the effective use of library materials through an organized system of policies, programmes and procedures. This, in fact, can form the basis of a 'primary task' root definition which will subsequently be modelled. The following relevant systems are considered after a thorough discussion with management staff and a number of personnel directly concerned with, or affected by the services of the circulation control department:

1. A curricula-aiding system.

2. An environment-appreciating system.

3. An 'information as a co-operative' scheme system.

Relevant system No.1 is found to be the most central, because the remaining two are linked to it in a number of ways. In order to aid the overall curricula, it is necessary, for example, to both appreciate the environment (relevant system No.2) and cooperate with similar systems in other environments.
Three root definitions were based upon relevant system No.1, these being definitions of systems to aid the university academic curricula from the university’s and users’ points of view.¹

In forming the Root Definition for such a system, therefore, the advice of Smyth and Checkland (1976, ibid) is well kept in mind, that:

Good systems thinking depends upon an abiding sense of "systems" as the name for a whole entity, connected with others, which is coherent within its boundaries and serves as an intellectual tool (whether or not the system coincides with an observable entity) by means of which we reduce the fecund variety of the real-world and its problem situation.

4.6.4 Root Definition 1

A University-library-owned system run by professional and support staff to enable library users identify and explore academic information in their various subjects of interest by providing instructions and assistance, within existing organizational structure, manpower and financial constraints.

INPUT -------------> TRANSFORMATION -------------> OUTPUT

Library users unable to identify academic information  Provision of instructions and assistance  Library users able/more able to identify and explore academic information

¹This idea is similar to Checkland’s work on a UK company in a science-based industry, reported in Checkland (1989)
4.6.4 C A T W O E ANALYSIS

We may now analyze the structure of this definition above as follows:

CUSTOMERS: Members of the university community (Library users)

ACTORS: Professional and support staff

TRANSFORMATION: Library users unable to identify and explore academic information → Library users able/more able to identify and explore academic information

WELTANSCHAUUNG: Academic programmes can be better supported by giving instructionss to, and assisting library users to identify and explore information relevant to their fields of study/research

OWNERSHIP: The university library.

ENVIRONMENTAL CONSTRAINTS: Existing organisational structure, University financial and manpower constraints.

The above set of elements represents a useful checklist against which a Root Definition can be tested. Its usefulness lies, not in ensuring that each element is contained in the definition, but of ensuring that, if one is omitted, it is because a conscious decision has been made to do so. Since a basic concept of a Human Activity System is that it is a transformation process, the element must be present. Also, because the definition only makes sense from a particular point of view, it must be possible to identify the W which gives it meaning. This view is supported by Wilson (1984,p44) who writes that ..."All of the other elements can be included, or excluded, on the basis that they are either important or not, according to the judgement of the analyst".
On the analysis process of the whole CATWOE, Wilson (1984, ibid, p46) throws more light by stating that the process is:

...concerned with identifying what is stated in the root definition, it is not a mechanism for unconsciously adding to the definition. It is not unusual to find elements described under the CATWOE headings that are in the mind of analyst but which are not contained explicitly in the root definition;

adding further that if the CATWOE analysis has prompted thought about certain elements, and they are judged to be important, then the root definition should be modified to include them:

```
Root definition > CATWOE Analysis > Modified RD > CATWOE Analysis
```

4.6.5 Root Definition 2

A University library-owned system run by professional and support staff for the provision of services through cooperation with similar institutions outside the organisation (whenever necessary) to satisfy library users’ information needs, within manpower and local service constraints.

```
Input -------------> Transformation -------------> Output
Library users with unsatisfied information needs.
```

Library users with satisfied information needs.
CATWOE ANALYSIS

CUSTOMER: Members of the university community (Library users)

ACTORS: Professional and support staff

TRANSFORMATION: Library users with unsatisfied information needs
----> Library users with satisfied information needs.

WELTANSCHAUUNG: It is possible and feasible to satisfy library user’s information needs.

OWNERSHIP: The university library.

ENVIRONMENTAL CONSTRAINTS: Existing organisational structure, university financial and manpower constraints

4.6.6 Root Definition 3

A university library-owned system run by professional and support staff, employing technical and other skills, assisted by modern information technology to process and provide lending and other bibliographic and/or referral services, (including the updating of records of such transactions) in order to satisfy library users’ actual and potential information needs, within statutory and local environmental constraints.

<table>
<thead>
<tr>
<th>INPUT</th>
<th>TRANSFORMATION</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library users’ information needs unsatisfied</td>
<td>Services provided by employing technical and other skills, assisted by modern technology.</td>
<td>Information needs satisfied.</td>
</tr>
</tbody>
</table>
CATWOE ANALYSIS

CUSTOMER: Library users.
(Members of the university community)

ACTORS: Professional and support staff.

TRANSFORMATION: Library users with unsatisfied needs —> those needs satisfied.

WELSTANSCHUUNG: It is possible and desirable to satisfy library users’ information needs by employing technical and other skills, assisted by modern information technology.

OWNERSHIP: The university library.

ENVIRONMENT CONSTRAINTS: Existing organisational structure, modern technology, financial manpower resources.

4.6.7 BUILDING CONCEPTUAL MODELS

In a 'human activity system', conceptual model is a model of an activity system, and its elements should be verbs. The 'technique' of modelling is to assemble the minimum list of verbs covering the activities which are necessary in a system defined in the root definition, and to structure the verbs in a sequence according to logic (Checkland, 1981, p170). A model of a human activity system in its most basic form is illustrated below:
Fig. 4.2 Illustration of the general form of conceptual model of a human activity system (after Checkland, 1979)

In the illustration above, six connected activities constitute a transformation process which produces periodic reports (outputs) and requires information inputs. Activity 4, described by verb 4, requires the prior completion of Activities 1 and 2 (verbs 1 and 2). Activity 5 depends on 4 and 3, and enables Activity 6 to take place, this being the origin of the system’s output. It is this basic version of the model that can be used as a basis for further expanded versions.

Shedding more light on the ‘techniques’ of building conceptual models, Checkland (1979) adds:
A frequent elaboration is to ask of each activity: what information is needed to carry out this activity? From what source? With what frequency? In what form? The basic activity model then becomes the origin of an information flow model which can be used to enquire into present information flows or to design new information systems.

Starting from the root definition, "...the minimum set of necessary activities needed in a system which is to be described in the definition is assembled. Each major activity in this first model is now notionally a system which exists to serve the purpose of the system as a whole. Model building may now proceed by taking each major activity together with its inputs and outputs as itself a root definition, and assembling the minimum necessary sub-activities in this (sub) system. This process has to continue, working at lower and lower levels of detail until, in the model-builder's judgement there exists a model worth bringing to the real world for comparison" (Checkland, 1981, p235).

From our earlier root definitions, some basic assumptions and explications can now be made about the circulation system.

The basic purposes of the circulation system are to record, regulate, and control the movement of library materials from their designated locations. It follows, therefore, that the circulation system of the library is an intricate combination of policies, procedures, data processing, equipment, and staff operations which may demand a significant portion of the library budget.

It contains records for items such as books, journals, and microforms that have been removed from the locations indicated for them by library catalogues. The circulation system may also contain other kinds of records. The library maintains files of user records, e.g., a record of registered library users.
To be able to record, regulate, and control the movement of library materials, the circulation system activities require a set of basic data. These data are derived from:

(i) The borrowers or users of the library, on whose behalf the library staff perform tasks _______ and who are distinguished by their own characteristics (user-status).

(ii) The materials used by any kind of user in the library. This results in activities such as loaning materials from the library.

(iii) The time span for the use of the material, whether used in or outside the library (i.e., duration of loan). The common basic data are date of loan, date due, and date of return. This, too, may vary according to user-status and type of material.

(iv) The borrowers’ requests for items that are not available in the library. These could be either currently in use within the library, loaned out to another borrower, or that the library system does not have it altogether (in which case the library may resort to contacting other libraries for an interlibrary loan).

From the root definitions chosen, conceptual models can be built by assembling the list of verbs describing the activities required by each root definition, connecting them according to the requirements of logic, and indicating any flows which appear essential at this first resolution level. Here, too, the advice of Checkland is borne in mind regarding the 'technique' of building a first-level conceptual model, where he suggests that:

1. "From the RD and its CATWOE elements, form an impression of the system as an autonomous entity carrying out physical or abstract transformation process."
2. Assemble the small number of verbs which describe the most fundamental activities necessary in the system described. Try to maintain one resolution level, avoiding the mixing of activities defined at different levels of detail.

3. If it can be justified from the RD, structure the activities in groups which bring together similar activities (e.g. grouping those which together generate some output which passes elsewhere in the system).

4. Connect the activities and the groups of activities by arrows which indicate logical dependencies.

5. Indicate any flows (concrete or abstract) which are essential to expressing what the system does. Distinguish these flows from the logical dependencies of 4 above, and in any case keep the number of flows to a minimum at this stage.

6. Check that the root definition and conceptual model together constitute a mutually-informing pair of statements: what the system is and what the system does (Checkland, 1981, 290-91).

Once the model has been built according to this sequence, it may be used as a source of other versions, either models of the same kind at higher resolution levels or models expressing flows and/or possible structures.

Each basic conceptual model which expresses what the system does, for example, can be expanded into a group of models which express possible hows. Going back to the CATWOE elements of the system under study, it can be stated that the basic transformation brought about by the system is to apply its professional skills, knowledge of the university community’s information requirements based on the academic programmes, and use these inputs to generate action regarding the university community members’ desire to locate, borrow and/or consult needed library materials in such ways as to make the best possible contribution in realizing their academic goals. The system serves an academic community, and the beneficiary is the university community as a whole. The main environmental constraints of this system are the rules and regulations concerning the provision of informational
materials, financial and manpower constraints, as well as the existing organisational structure; the Weltanschauung is that the system operates in an academic environment which makes it necessary for all its resources to be managed in such a way as to make a contribution to educational and instructional success of the university. This, therefore, suggests a system which will have a number of information inputs (the various categories of users and their requirements, capability of the system, and the state of the rules and regulations governing the success of its services); which will in turn take action to manage the operational activities of providing services; and which will monitor the success of all its operations in order to take control action aimed at ensuring effective contribution to instructional and learning success.

The action the system could take regarding circulation services is to make arrangements to cater for all categories of users by putting together its resources in 'managing' the arrangement and preservation of informational materials for inside as well as outside-the-library use by the academic community served. The outputs from the system is effective academic information provided to the users (which could be difficult to quantify).

The activities minimally necessary in the three sub-systems are then considered in a more detailed level. Consider first, the 'appreciation' system which is necessary in order for the system to operate. The system will have to bear in mind the university's academic nature and its programmes, since it has to make contribution toward their success; it has to have rules and regulations concerning service periods, loans durations, copyright laws, etc; and it also has to acquire and maintain modern technology as well as adequate professional skills, taking into consideration the changing nature of the environment. These considerations in turn give rise to the diagrams below:
Fig. 4.3 Conceptual model for Root Definition 1

1. Appreciate university’s academic programmes which require provision of information.

2. Appreciate the facilities of the library and how they may be used.

3. Identify library users.

4. Identify users' requirements for information.

5. Organize to be able to meet information requirements.

6. Identify users' status in terms of 2.

7. Compare 2 and 6.

8. Instruct user to identify and explore information.

9. Provide assistance and services.


12. Evaluate relevance of "assistance" and "services" vis-a-vis university programmes.

13. Know resource constraints.

14. Take control action.
1. Appreciate university’s academic programmes which require provision of information
2. Appreciate rules/regulations pertaining to service
3. Identify library users
4. Appreciate programmes of similar organizations outside organization outside and cooperate with them.
5. Identify users’ information requirements
6. Relate 2 and 5
7. Organize to be able to meet information requirements of users
8. Provide services to satisfy information requirements of users
9. Define measures of performance for service success
10. Monitor efficiency of 1-8
11. Take control action
12. Know resource constraints

Fig. 4.4 Conceptual model for Root Definition 2.
Fig. 4.5 Conceptual model for Root Definition 3
Considering the 'operational' subsystem, the main activities in it involve utilizing the knowledge gained in the 'appreciation' subsystem to acquire and manage resources necessary for carrying out the required operations, and provide services. However, 'providing services' may sound vague, and it is thus, necessary to mention explicitly what services are referred to. Given the nature of the system under study, 'services' refers to the act of arranging and preserving library materials, maintaining vital equipment, such as catalogues, issue files, etc, and the process by which users are assisted to locate needed library materials, the charging and discharging of materials, as well as interlibrary cooperation for securing materials which are needed by users but which the library, for one reason or the other does not have. Other aspects of 'services' include also the recall of materials specially requested by users, and the calculation of fines for borrowed materials not returned after a particular period.

Also, in order to ensure that the system's operations make positive contributions to the university's academic programmes it is necessary for the system to monitor and control the operations in the light of the contribution it makes. Thus the conceptual model derived from RD3 above is thought to be the one that would most likely hold promise for discussions that could lead to beneficial changes, i.e, feasible and desirable changes, and it is thus the one that is used for subsequent comparison in the next stage ____ which in practice has been agreed with the problem owner.
4.6.8 THE COMPARISON STAGE

The conceptual models presented in the previous sections are in terms of activities describing a set of 'whats'. They define what must happen in the system described in the Root Definition. All the activities described take place outside 'the real world'. In the real world we observe a set of 'hows' (Wilson, 1984, p73). However, a 'what' cannot be implemented without, first of all, deciding 'how' to do it. This point is elaborated by Wilson (1984):

For example, if 'what' you wish to do is 'invest spare cash', you cannot do it without selecting one, or more, 'hows' from the set of following: {pay into a bank deposit account; buy savings certificates; purchase land; etc.}. In principle it is not possible to reverse this process and to decide, with any certainty, the nature of 'what' underlying an observed 'how'.

Each of these possibilities, a 'how' to the previously defined 'what', is itself a 'what' with respect to lower considerations. At the level of the above example given by Wilson, 'invest spare cash' is a 'what' to a set of 'hows' which include one or all the options given.

Checkland (1981), supports this view where he states that the relationship between 'what' and 'how' is a hierarchical one, a 'what' being at a logically higher level than a set of possible 'hows' related to it. "The what / how relation is the same as that between sub-system: the latter is 'sub' with respect to the former, but is in its own right a system, and may itself have sub-systems.

Wilson (1984, p75) suggests four methods of comparison which emerged from the variety of projects carried out. These are: (a) general discussion; (b) question definition; (c)(historical) reconstruction; and (d) model overlay.
The first method of comparison is concerned with a general discussion about the nature of the models, and any organization implied by them, when related to the nature of what is believed to exist" (ibid, p76). This discussion serves to raise strategic issues in relation to role, and to the existence of certain activities rather than issues at a detailed procedural level.

The second method of comparison given above, question generation, is the most commonly used (Wilson, 1984,p79). In this method, a number of questions are raised about the organization or system under study regarding the nature of the services or products it produces, the nature of demand (or customer characteristics), its relationship with similar systems, material and personnel interactions, constraints, performance expectations, etc. Questions are then asked regarding each activity along the following direction:

(a) Does the activity exist?
(b) How is the activity done at present?
(c) Who is responsible for doing the activity?
(d) Is the activity done well or badly? (What evidence is there to support this subjective view?)
(e) Do the relationships exist?
(f) In what form do they exist?
(g) What are the relationships between the people doing the activities?

The third method of comparison is referred to as historical reconstruction, and it consists essentially of reconstructing a sequence of events according to a conceptual model and then comparing this sequence with what would have happened if the relevant conceptual models had actually been implemented.
Checkland (1981) describes two projects in which this method was used successfully, but he issues a warning that it needs to be used with care:

...This is in logic a satisfactory way of exhibiting the meaning of the models, and may be the inadequacies of the actual procedures, but it is a method to be used delicately because it can easily be interpreted by participants as offensive recrimination concerning their performance.

The final method of comparison, model overlay, consists of structuring the conceptual model in a manner which reflects as closely as possible the actual problem situation and, literally, overlaying one picture on top of the other (one being on transparent paper). The differences between the two are immediately apparent. Wilson (1984) reports that he used this method most successfully in studies concerned with organization structure where one is comparing decision-taking boundaries in a systems model with the areas of authority in an actual organization (ibid, p82).

At this stage, it is decided that due to the nature of the study, the historical reconstruction method would be used, i.e by creating a scenario of events as they happen now, and comparing it with what it should be had the conceptual model been applied. This method is most convenient because during the course of the study questionnaires were administered to users and operators of the system, in addition to personal interviews with management and middle-level cadres, centred on many aspects of services or activities carried out by the system. Answers to the questionnaires administered to library users and library personnel, as well as on-the-spot observation conducted by the researcher will later be analyzed and compared with the conceptual model of Root Definition 3 above.
However, in the next chapter the role of data modelling in the creation of information systems is briefly examined. In it, the selected conceptual model referred to above is 'translated' into conceptual information flow model, which in the subsequent chapters forms the basis of our "debate" for feasible and desirable changes.
5. PRESENTATION AND ANALYSIS OF DATA

5.1 Introduction

Based on the expression of the problem-situation in the previous chapter and one of the fundamental principles upon which SSM is founded, i.e., the fact that different individuals and groups are bound to make different evaluations which can lead to different actions, a series of discussion-meetings was organized during the researcher's study-visit to Nigeria so as to collect various interpretations from all concerned, which might be helpful in the debate about real-world processes. Such discussion-meetings with representative samples of the management, the other staff and users of the library were supplemented with questionnaires containing some of the most relevant issues raised by the various groups and individuals pertaining to the circulation control department.

In this chapter, therefore, data collected during the course of the research is presented and analyzed as it affects specific portions addressed by the work, so that the findings could subsequently be used to aid the comparison process, as well as to structure a debate about feasible and desirable changes that could lead to improvement in the situation. The data collected falls into two broad classes: data from the questionnaire surveys and data from the series of scheduled interviews.

It should also be added at this juncture that where they are found to be helpful in reinforcing the results of the findings, opinions of experts from the relevant literature in the field are cited not as part of these particular findings, but merely as examples which might augment them.
A Questionnaire survey was used mainly because of the several advantages the method has, especially the fact that respondents ... 'may have the confidence in their anonymity, and thus feel free to express views they fear might be disapproved of or might get them into trouble' (Selltiz, et al, 1959 p240). Data collected from the users described their personal characteristics, uses of the library, assessment of specific services, overall assessment of circulation services, and general satisfaction with the library.

5.1.1 THE QUESTIONNAIRES AND INTERVIEWS

Two sets of questionnaires were distributed during the course of the research: Questionnaire to staff and students of the Usmanu Dan Fodiyo University, Sokoto (here identified as users) and questionnaire to heads of circulation services division of the main library, the Medical library and the Law library.

On the part of the users, a total of 450 questionnaires were distributed on two working days in the middle of the second semester.

Two hundred and twenty-five questionnaires were distributed on Friday, 22nd July, 1988, and another batch of 225 on Monday, 25th July, 1988. On the first day 125 questionnaires were distributed at 11:00 am, while the remaining 100 were distributed at 5:30 pm.

\[1\] Many of the library staff were also included in this category.

\[2\] The university operates two semesters, each consisting of 17 weeks (15 weeks of teaching and two weeks of examinations). Examinations normally take place in the beginning of July; however, in 1988 the academic calendar was altered to cover the period lost as a result of the university’s closure after violent student demonstrations which affected several institutions. Consequently, lectures continued through the month of August.
At the second session of distribution (at 5:30 pm) additional instructions were given to respondents not to answer the questions if they answered one during the morning session, so as to avoid duplications.

On the second day, the order of distribution was reversed, so that 100 questionnaires were distributed during the morning session, and the remaining 125 during the evening session. The periods for the distribution of the questionnaires were chosen after examining the library's 'head-count' statistical records, as well as the researcher's observations regarding the use of the library by readers. The opening hours are:

8:00 am - 10:00 pm Monday to Friday
1:00 pm - 6:00 pm Saturday
5:00 pm - 10:00 pm Sunday.

However, during examinations period several readers queue outside much earlier so as to choose the seats of their likings, as well as to get hold of some of the most needed materials. Nevertheless, irrespective of period of the semester it has been observed that the library is normally at its fullest between 11:00 am 5:30 pm.

At the end of the first day of questionnaire distribution, 170 forms were duly completed and returned; 48 were not completed. One respondent simply wrote: "Too busy" on his questionnaire and dropped it at the circulation desk. Four respondents (apparently working together) wrote in bold letters: "WISHING YOU ALL THE BEST IN YOUR RESEARCH" and abandoned the forms on a reading table which were later recovered (neatly together) by one of the assistants working with the researcher, while three others were found with parallel lines running across the pages.
On the second day another 225 questionnaires were distributed, out of which 93 were returned uncompleted. This brought the total number of questionnaires duly completed and returned to 302, or 67.1%.

In addition, a series of 14 interviews were held: 5 at the University College London and 9 in Nigeria. Five out of the nine interview sessions held in Nigeria were conducted at the Usmanu Dan Fodio University library, the site of the research, while one each was conducted in Ahmadu Bello University, Zaria, Bayero University Kano, University of Maiduguri and University of Port-Harcourt. The researcher was physically present in Nigeria from the middle of July to the end of September, 1988 for the purpose of administering the questionnaires, conducting the interviews as well as on-the-spot observation of the operations of a few selected libraries. Four other university libraries were selected for visitation in addition to the actual case-study because:

(a) Three of the universities (Bayero University Kano, University of Maiduguri and University of Port-Harcourt) were established under the same Military Decree in 1975 along with the Usmanu Dan Fodiyo University, Sokoto, then known simply as The University of Sokoto. They represent a "new breed" of universities in Nigeria, and a mile-stone in the history of the country's higher education.

(b) Ahmadu Bello University Zaria (ABU) was included for observation (and one interview session) because it has been among the early breed of universities established, and in the researcher's opinion the study would no doubt benefit from its experiences.
Moreover, interviews and working visits were conducted at the main and other branch libraries of the University College London, arranged by the researcher’s supervisor in order to serve as a pilot study, as well as to highlight and solve any major problem that might arise during the actual study in Nigeria.

The distribution of respondents to the questionnaires and rate of returns is given in table 1. The table shows that out of a sample of 450 staff and students (representing approximately 10% of the entire population of Usmanu Dan Fodiyo University Sokoto as at July, 1988) 302 (representing 67.1%) responded. The questionnaire to staff and students was specifically designed to sample opinions regarding various aspects of service offered by the library with a view to ascertaining:

(i) Information and statistics concerning the effectiveness of the Circulation system of the library in satisfying the needs of both staff and students;

(ii) Areas of success and difficulties;

(iii) Main reasons for using the library;

(iv) Patterns of use, and level of awareness demonstrated by members of staff and students toward the services offered to them;

(v) Information on which to base any proposals for change in the system to effectively and efficiently meet these needs.
TABLE 5.1
BREAKEOWN OF QUESTIONNAIRE DISTRIBUTION AND RETURNS

<table>
<thead>
<tr>
<th>RESPONDENTS</th>
<th>QUESTIONNAIRED ISSUED</th>
<th>RETURNS</th>
<th>RETURNS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAFF AND STUDENTS (SOKOTO)</td>
<td>450</td>
<td>302</td>
<td>67.1</td>
</tr>
<tr>
<td>HEADS OF CIRCULATION DIVISIONS</td>
<td>3</td>
<td>3</td>
<td>100</td>
</tr>
</tbody>
</table>
Also, the distribution of interview sessions is shown in table 2, below:

**TABLE 5.2**

**DISTRIBUTION OF INTERVIEW SESSIONS AT SOKOTO, ZARIA, KANO MAIDUGURI AND PORT-HARCOURT**

<table>
<thead>
<tr>
<th>Institutions</th>
<th>No. of sessions</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usmanu Dan Fodiyo University library, Sokoto</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Ahmadu Bello University Zaria (main library)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bayero University Kano (main library)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>University of Maiduguri (main library)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>University of Port-Harcourt</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
5.2 QUESTIONNAIRE TO STAFF AND STUDENTS (USMANU DAN FODIYO UNIVERSITY, SOKOTO)

This group of respondents (referred to as the users) represents a sample of the university's population. The response of this group to the questionnaire has been presented in figs. 1 through 14 for each question or group of questions. In addition, numerical codes have been assigned to each variable for ease of analysis with the Statistical Package for the Social Sciences (SPSS).

Fig. 5.1 (question 1) shows a breakdown of the respondents who returned their completed questionnaires. The fig. shows a high percentage for undergraduate respondents (68.9%) which is a reflection of the entire undergraduate population of the university.
The frequency by which respondents use the library was also measured. In order to get a clearer picture, the results are reported according to user status in the form of a graph. Fig. 5.2 below (question 3) shows the results. Two things are clear from the fig.:

(i) that students (both Undergraduates and Postgraduates) constitute the bulk of those who reported using the library daily: 65.4% for undergraduates and 57% for Postgraduates.

(ii) that the frequency of library use by the members of staff is dispersed, i.e. no significantly clear pattern could be found as in the case of students.

For example, 30.8% of the members of staff who responded reported using the library daily; 21.5% reported that they rarely used the library; the same number (21.5%) reported that they used the library only once in a week, while 17% reported using the library once in a fortnight.

The figures for students show the extent to which that category of respondents rely on the university library for the pursuit of their studies. Coupled with the fact that funds are very scarce, the book market situation in Nigeria is generally poor. This has led Osundina (1974) to state that the Nigerian university staff and student had no alternative to relying heavily on the university library resources all the times. He writes:

... Because he has no funds to buy textbooks, 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.
Frequency

Frequency of using library

Usage

- Rarely
- Q/Mon.
- Q/F.N.
- Daily

Usmanu Dan Fodio University Library

Fig. 5.2
The way members of staff responded to the question on "frequency of using the library" could possibly be explained that (i) most of them have copies of the important texts that they would require for their courses, and (ii) that they only go to the library to find out what is available in order to recommend to their students, or place some most heavily used items in their courses on the reserve hold. This response from members of staff is in line with Soper (1972) who worked on the citation pattern appearing in some selected scholarly articles, after which he hypothesized that citation patterns would be directly related to the physical accessibility of materials: the more physically accessible a source the more likely that it would be cited.

Respondents indicated that they preferred to use their personal collections rather than university or other libraries, because their personal collections were more accessible and were arranged to reflect their own specific interests.

Questions 4 and 5 were asked in order to find out the main reasons for which respondents visit the library, as well as whether or not the library’s general stock was relevantly adequate to their needs. These responses too, are crosstabulated so that results could be analyzed according to status of users. This is important since the purpose(s) for which a member of staff visits the library could be different from that of a student, etc. Fig.5.3 below shows these results:
It can be seen from Fig.5.3 that the most frequently cited reason for using the library among members of staff was for the purpose of current awareness, with a frequency of 53, (representing 81.5% of the staff respondents). This is followed by "consulting recommended texts", which has a frequency of 42 (representing about 65%). Under the remaining factors: "to meet friends", "to use the library as a quiet reading place", and "other reasons", members of staff did not score any significantly.
A possible explanation for the response recorded from members of staff to this particular question is that the variable "to consult recommended texts" would be interpreted to mean the selection of texts to be used by their students, and/or the placement of some reading materials on reserve. "Current awareness" is also very important to staff members in their efforts to keep abreast with new publications in their disciplines. It is no surprise, therefore, that they scored highest under these variables.

Postgraduate students, too, scored high under the factors "to consult recommended texts" and "current awareness", which does not come as a surprise considering the nature of their study and what is expected from them vis-a-vis the undergraduates. Postgraduates score for these two variables were 80% and 71% respectively.

With the undergraduate students, the most cited reason for visiting the library was reported to be for the purpose of consulting recommended texts, which received a frequency of 183 (representing 88% of the undergraduates who responded to the question). All the other suggested reasons for visiting the library did not appear to be significant to this group of respondents, and the results are not significant enough to warrant any discussion here. The undergraduate students' response stresses the reliance of this group of respondents on taught methods and whatever materials might be recommended by their lecturers.

Fig. 5.4 is the result of an attempt to find out from the respondents how they judged the library's collection in their fields of study and/or research in meeting their needs. There are several methods of doing this. The terms "collection" and "stock" are hereby used interchangeably to refer to all types of library materials.
Two methods appear to be most frequently used in a study of this nature, i.e. quantitative and qualitative methods. For the purpose of this study, however, a qualitative method is found to be most appropriate. This study has also taken into consideration Hirsch's (1972) impressionistic method, whereby a collection is judged by one or more individuals _subject specialists, librarians, or scholars. Regarding this method, Williams (1967, pp23-45) writes:

...fortunately there are faculty members whom the surveyor of college and universities can consult by means of questionnaires or interviews or both. Ideally, he can hope to base his findings on the expert opinion of men who know their subject, have a broad knowledge of its literature, have intensely used both the library he is surveying and many others, and have kept themselves well informed of the degree to which the library is meeting the needs of their students, undergraduates and graduate...

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3A good breakdown of the available approaches under each method can be found in Lancaster (1977, p166).
The responses under this question, too are shown in Fig. 5.4 above, given under frequency distribution according to the group of respondents who answered the question. It can be found that 11 members of staff, representing 17% reported that the stock in their subjects was adequate, while 54, representing 83% reported that stock in their subjects was inadequate.

Among the Postgraduate students who responded to the question, only 7, representing 33% indicate that stock in their subjects was adequate, with 14 of them, representing 67% reporting that it was inadequate.

Among the undergraduates, 36, representing 17.3% reported that stock in their subject areas was adequate, while 172, representing 82.7% thought stock in their subject areas was inadequate.

Questions 6 and 7 were asked in order to find out if the respondents encounter any difficulties in getting the information they needed from the library. "Information, or literature searching" is used here to refer to any activity in which a search of the literature is conducted to find bibliographic material on a particular subject of interest.

This may be performed using the card catalogues, printed indexes, circulation issue trays, and such other manual tools as may be available. For example, a user might wish to know whether a particular item has been issued out on loan, when it is due back, whether it is placed on reserve, by whom, etc. The term "difficulty" can be seen in terms of the effort and time a user must expend in order to get the needed information.
The significance of this question can be viewed in terms of Mooers’ (1960) law, where he states that "An information ... system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it". Thus the extent to which a library or information center are used is likely to be heavily influenced by consideration of effort. Perhaps the relationship between this factor and circulation services may not be easily perceived. Suffice it however, to say that there is a correlation between accessibility (location of collection, hours of service, etc) and ease of use. For example, it is possible to achieve a particular level of performance in document delivery by alternative strategies, one of which could be the variation of loan periods, a function directly under the control of circulation services department.

Among the factors listed as possible approaches to evaluating various aspects of library services, the amount of effort that the user must himself expend in exploiting the services of the library (including factors of physical accessibility of the library and its collections, the size and quality of the library staff, and the way in which the collections are catalogued, indexed, shelved, and signposted); the speed with which a particular item can be located when needed; the ability of the library to deliver a particular item (or say its whereabouts) when needed have been mentioned by Lancaster (1977, p323).

Consequently, respondents were asked to report whether or not they had difficulties in getting the information they needed from the library. The question is considered relevant since most of the queries regarding the status of an item and other bibliographic requests would be directed to the circulation desk. Moreover, the reference section itself is directly answerable to the circulation department.
The results of the question are given according to the status of user, once again, to differentiate staff responses from students responses as in the other cases, and they are presented in Fig. 5.5 below:
As can be seen from Fig. 5.5 above, 29 members of staff (representing some 44.6%) who returned their questionnaires have reported that they encountered no difficulties in getting the information they needed from the library, compared with about 55% who reported having encountered some difficulties.

The pattern is rather different among the postgraduate category, where some 62% reported no difficulties, with only less than 40% reporting having had some difficulties.

The pattern of response among the postgraduate students is also found to be true with the undergraduates, 81.7% of whom reported having no difficulties in getting the information they needed from the library, whereas only some 16.8% of them reported that they had difficulties.

The explanation for the possibility from the responses that members of staff seemed to have more difficulties in getting the information they needed than students (both postgraduate and undergraduate) can perhaps be found in the pattern or frequency with which the different categories reported to be using the library, in which students (in general) recorded a high percentage in their daily use of the library compared to members of staff. This result further confirms the work of Allen (1966) who proposed a model of information seeking behaviour. According to Allen's model, which investigated criteria by which engineers select a source of information when faced with a particular problem-solving situation, selection of an information source is based almost exclusively on accessibility. Specifically, he concluded partly that "the more experience an engineer has with a channel, the more accessible he perceives it to be". 
If we replace Allen’s engineer with "the general user", we can possibly say that the student has acquired more experience with his "channels" in the library through daily use than the average member of staff who used the library less frequently, and so he finds no difficulties in getting what he needs.

Another explanation can be found from the suggestion made earlier that the low frequency of library use by members of staff could be due to the fact that most members of staff rely on their personal collections, unlike the student.

This is in line with Woodburn’s (1969) hypothesis that an individual having access to a comprehensive personal collection will not be inclined to visit the university library.

Figs. 5.6 and 5.7 show the results of questions 7 and 8 which were asked in the questionnaire, and which have to do with catalogue use by respondents. A catalogue is referred to as the single most important key to a library’s collection. Its major function is to show whether the library owns a particular bibliographic item whose author and/or title are known (known items) and, if so, where it is located. The catalogue also reveals the library’s holdings in specific subject areas and indicates where they are located, reveals the library’s series holdings, and provides bibliographic information. Three main reasons can be given for an interest in studying catalogue use in a research of this nature. First, with the librarians’ growing concern with library systems analysis, they want to know how well the catalogue performs, its deficiencies, and how to increase its level of effectiveness.
Second, it is very important before any automation exercise, to have information on how existing catalogues are being used, their major problems and limitations in order to design more effective on-line catalogues. Third, it is felt that if library users can successfully use the catalogue, they would enable library circulation desk staff to concentrate on more pressing services than spending time in conducting catalogue search for users. Question 7, thus, seeks to find out the primary medium used by the respondents in trying to locate the materials they needed from the library's collection.

It is generally agreed that "questionnaires administered to library users, eliciting opinions on catalogues, are of limited value, because they are heavily dependent upon what respondents remember about past experiences". Moreover, a study of this kind can gauge only general reactions. It does not deal with specific instances of use and, thus, cannot quantify successes and failures, or precisely identify instances of failure, to allow the recognition of their underlying causes. The question has not been put to represent a catalogue study per se.

On the contrary, it is only an attempt to measure respondents' awareness of the uses of the catalogue in relation to circulation services, because, as stated earlier on, a proper use of the catalogue by readers would save circulation desk staff the trouble of dividing their attention in order to assist a user with catalogue search.

Results obtained from questions 7 and 8 [Figs 5.6 and 5.7] respectively reveal more or less the most frequently used methods by both staff and students when looking for an information regarding an item, and the level of importance they attached to the uses of library catalogue.

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4See Lancaster (1977, p20)
Fig. 5.7 shows that "browsing directly on the shelves" when looking for an item in the library stood out more than any of the remaining methods suggested among all categories of respondents. This response among members of staff was 70.7%; among postgraduates it was about 81%, while it was about 48% among undergraduates.

In terms of relying on the card catalogue for information regarding an item they needed from the library, 51 members of staff (representing 78% of staff respondents) answered positively.

Also, about 66% of the postgraduate respondents reported relying on the card catalogue, while some 47% of the undergraduate respondents reported relying on the card catalogue. Among the 7 non-degree students who responded to the same question, only three reported actually using the catalogue.

Four of them reported asking their colleagues about items they needed from the library, while all 7 reported that most of the times they browsed the shelves directly in order to find an item.

These results do not indicate that there was any serious pressure on the limited staff resources which would divert their attentions from actual circulation duties. On the other hand, they could mean that users were not freely approaching library circulation desk staff for assistance—which could be a result of poor user-staff relation. Regarding the adequacy of the card catalogue in meeting their needs, all categories of respondents reported that apart from a few errors the library's catalogue was adequate for their needs. These figures for staff, postgraduate and undergraduate respondents were 57% and 76% and 68% respectively.
Fig. 5.6
In question 11 respondents were asked to report the approximate number of minutes they spent at the circulation desk in order to borrow or return an item. The library uses the Browne card system, and the amount of time one spends at the borrowing counter, especially when returning item(s) depends on the ability of the desk clerk to retrieve one’s borrowing ticket, which is normally filed as part of the transaction records.
A user assesses a library by its effectiveness as a means he can employ to meet a given need and by what it costs him to meet the need in this way. In his judgement of the effectiveness of a particular service, two criteria are important: (i) the quality of the service relative to that of some other means he employs to serve the same function or to that of some ideal service, and (ii) the time that elapses between his turning to the library and the fulfillment of his need. His idea of the "cost" of using the library is more complex—it includes: (1) his personal time, or that of any agent he may employ; (2) the physical-psychological effort required of him; and (3) any expenses or charges paid from his own pocket or from funds for which he has more or less direct responsibility. Since the time to meet a given need is measurable, for any service where it is also possible to devise some objective measure of quality, one can assess effectiveness in user terms by applying some elements of time study. Time study is a technique for determining the time required by a qualified, well-trained person working at a normal pace to do a specified job. In library operations, unlike an industry where many jobs require more precise timing, an ordinary wrist watch with a clearly visible sweep second hand is usually all that is needed (Dougherty and Heinritz, 1966, p98). The choice of equipment, therefore, depends on the nature of the job and the degree of accuracy required.

Users were simply asked to state the approximate time (in minutes) that they spent at the circulation desk either to borrow or to return an item. For this purpose, the charging/discharging processes were broken down into observable elements which could be easily timed.

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5For more on this see for example, Orr, et al. (1970)
The lending procedure was observed as follows:

i A borrower presents book with his/her library ticket to the circulation desk clerk;

ii The circulation desk clerk examines the identity of borrower and crosschecks information filled in the accompanying book card;

iii The clerk confirms whether book is for short loan, reserve collection, or a reference material;

iv Clerk crosschecks the accession number and book title on the book against those on the book card inside book pocket;

v If there are problems, rectify. Otherwise, issue book.

vi An appropriate expected return date is stamped on the book card as well as on the date-due slip pasted on the front page of book before book is finally handed to borrower;

vii The book card is filed along with the borrower’s ticket, which now forms the transaction record.

The above procedure is (most of the time) straightforward. Problems leading to some delays are, however, encountered especially when a book brought to the desk for borrowing is found to contain no book card, or when there is a problem with some aspects of labelling. The procedure that takes a little longer time is when a borrower returns an item and he wants to get back his ticket. Here, too, the procedure was broken down into observable elements as follows:

i Borrower returns book(s) to circulation desk;

ii Clerk checks date-due slip for date of return;

iii Clerk looks through appropriate issue tray for the date stamped earlier on the inside cover of book;

iv Clerk checks through the date files for an accession number and title matching those on the book;
v Book card (tucked in the borrower's ticket) is removed from issue tray and reinserted into book pocket;

vi If book is overdue, fines are charged, otherwise,

vii Borrower is handed back his ticket(s), while book(s) is kept aside for reshelving.

The investigator observed about twenty five charging/discharging activities at the circulation desk at alternating periods for five days, watching different desk clerks each time. This was done in order to standardize the times reported by respondents, as well as to crosscheck their validity.

The literature on circulation services does not give an approximation of the time considered to be "normal" in charging or discharging a book. However, one of the most important criteria for evaluation is the fastness with which such an activity is carried out, since a main aim of any issue system (whether manual or automated) is to minimize the amount of time a user spends at the desk, and, consequently the forming of long queues. A good issue system should enable a reader to be served in one minute or less if all things go well.

A look at Fig 5.8 shows that 69% of the members of staff who responded reported spending a period of between two and five minutes at the circulation desk; 67% of postgraduate respondents reported spending the same time, while 58.7% of undergraduates also reported spending between two and five minutes.
On the contrary, only one member of staff and one postgraduate reported spending a minute or less, while only less than 9% of undergraduate respondents reported spending that number of minutes. The longest waiting time of up to ten minutes was reportedly spent by some 29% of the staff, 28.6% of postgraduates, and 30.7% of undergraduates.
The researcher's personal random timings give the average of between 1.75 minutes and 2.05 minutes to complete the borrowing procedure, working under normal speed and encountering no problems. For returning an item the average time was observed to be between 2.50 minutes and 4.07 minutes.

These figures were worked out after multiplying the percentage rating factor (expressed as a decimal) by the average observed time in order to arrive at the normal time. It is interesting to note here, the closeness between figures reported by respondents and those arrived at by the researcher's random timing.

However, it must be emphasized that such a rating process can be subjective, since it consists of adjusting the observed speed to the researcher's conception of a "normal speed". Nevertheless it is very important because a worker under observation tends to work at a faster pace than he would normally work due to either nervousness or motivation of being singled out for special attention.

Fig 5.9 shows the responses to the question regarding overdue charges by the library. The provision of materials for research and course preparation on the part of members of staff, and the provision of most recommended reading materials for easy consultation on the part of the undergraduate are central to any successful university education.

Most academic libraries believe that since they provide vital services for the fulfillment of university education, no direct charges in whatever form should be made to the user who wishes to make use of the resources.
However, at the Usmanu Dan Fodiyo University library, the domain for this case study, free use has created a serious problem of overdue library materials, which left library management with the problem of what to do with users who constantly failed to respond to recall notices when materials borrowed by them were overdue and when such materials were needed by others. Members of staff are normally allowed to borrow ten books at a time, for a period of one month; Postgraduates could borrow a maximum of six books for the same duration as members of staff, while undergraduates can borrow a maximum of 4 books for a period of two weeks. Non-degree students can only borrow two books for the same duration as undergraduates. Renewals are permitted in all the cases. Two recall notices were usually sent to offending users: the first notice served as a reminder, while the second one should result in the deprivation of borrowing privileges.

However, when this policy did not provide the expected resultant drop in overdue library materials, the library got tough on charging offenders for the number of days they kept books overdue, irrespective of whether they were staff or students.

This, however, engendered serious criticism from users, especially members of the academic staff, who felt that they should not be charged for retaining a library material throughout the semester, while students felt that the amount charged were not commensurate with the offence. These criticisms form the basis of this question, to find out the opinions of users about the policy of charging for overdue library materials, and whether or not the charges were fair or exorbitant, considering the friction this policy created.
These results are shown against the status of users to find out the response among each group, and are shown in Fig. 5.9 below. Responses are categorized into whether respondents found the charges "reasonable" or "harsh".
A summary of the responses shown in Fig. 5.9 above reveals that 78.5% of members of staff were not happy with the charges on overdue library materials because they thought it was too high; 90.5% of the postgraduate respondents thought along the same line with the staff members regarding the charges, while about 68% of undergraduate respondents, too thought the charges were unnecessarily too high. These results are important in that they might help in establishing a plausible base for handling the apparent "irritation" caused by charging for overdue library materials, as well as making sure that whatever recommendations are given for a more effective system contain ways of better exposing and dealing with offenders especially since the present method of operation does not provide a means whereby borrowing privileges of offenders could easily be targeted for suspension.

Figs 5.10 and 5.11 (questions 15a and 15b) seek to find out from respondents facts regarding the library's interlibrary loans scheme. In this period of financial squeeze there has been an increasing reliance on external resources, including interlibrary loans to satisfy user needs. This reliance has led to an interest within the library community in understanding interlibrary processes and networks better in order to provide better services. One major focus of research has been in developing measures of interlibrary system performance. A number of measurements of performance have been developed: success rate, user satisfaction, turnaround time, and cost.

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6This aspect can be found in Waldhart (1985)
This question has been framed to reflect performance as measured by turnaround time. Users judge an interlibrary loan system's performance by the speed of fulfillment of a request. The question: "how long will it take?" is commonly asked by most users when requesting for an interlibrary loan, to which the librarian responds with mere guesswork based on past experience. It can be seen in fig. 5.10 that postgraduate students were the heaviest users of interlibrary loans services, with over 70% of the respondents among them reporting that they patronized the services. Among staff respondents, only 35% reported using the interlibrary loans services, while undergraduates recorded the lowest usage with only 8% of the respondents reporting that they used the interlibrary loans services. Here, too, the figure for postgraduate respondents' high patronage can be explained as being due to the nature of their study, which demands more research work than the undergraduates. The low usage by members of staff could be attributed to the point made earlier on that many of them might prefer to use their personal collections to library materials, especially if the needed items have to be sought for from another library. Another possible explanation for the generally high percentage of respondents who never utilized the services among staff and undergraduates is that they were possibly not aware of the services, which calls for a more effective publicity method. This point is corroborated by the percentage of those who reported that the library's stock was not adequate in their fields of specialization (refer to Fig. 5.4).
This could also be true because a few of the respondents, especially the undergraduates have (sarcastically?) written under the question about interlibrary loan in the questionnaire "does it exist?" and "I never heard of that term".

Question 15b, Fig. 5.11 was asked in order to find out the turnaround time for those who used the interlibrary loans service. It is doubtful, however, if the results would be of much use considering the high percentage of non-use recorded in Fig. 5.10.
Nevertheless, of the members of staff who used the interlibrary loans services, over 90% reported that they waited for over one month before they received what they requested, whereas 86% of the postgraduate respondents waited the same length of time. The number of undergraduate respondents in this context was too small to produce any reasonably convincing results. These results are shown in Fig. 5.11 below as well.

![Fig. 5.11]
Question 16 was asked in order to find out the extent to which the library users utilized the library's photocopying services. Good photocopy facilities are essential for the smooth operations of circulation services. Such services, provided within the means of the average student would minimize book mutilations, as well as ease the burden of circulation staff by cutting the number of charging/discharging processes. A user would gladly photocopy the few pages (s)he needs from a text, whereas in the absence of efficient and affordable photocopy facilities such a user would rather borrow the book if it is for loan or (for the inconsiderate user) tear off the needed pages if there is no way of checking it out legally.

In this regard, users were asked to report whether or not they availed themselves to the photocopy services provided by the library, and whether or not they found the existing photocopy services reasonably satisfactory. Under the existing arrangement, the library does not own the photocopy facilities. The services of an outside contractor are being used, whereby the library provided only the venue, while the outside contractor provided the machinery and the staff to run the services.
The responses received from this question indicate that a high percentage of each category of respondents used the photocopy services of the library, as shown by Fig. 5.12 above: 72% of members of staff who responded; 90% of the postgraduate respondents, and about 83% of undergraduate respondents reported that they used the photocopy services of the library.
As part of introductory activities undertaken by students and new members of staff immediately after joining the university, most university libraries organize orientation programmes about the use of available facilities. Different libraries organize different programmes. In some, this may take the form of a two-or-three hour tour of the library in the first week of term. During that period, literature is distributed regarding the use of the library and the facilities and services it offers. Alternatively, it could be conducted in the form of a speech by the university librarian or his appointed representative, supplemented with an audio-visual resources. In view of the significance of this aspect of library service, respondents were asked to report whether or not they received any introductory instructions, talks or tours about the library and how to use it during their initial periods in the university. The results of this were cross-tabulated under frequency distribution, and according to user status in Fig. 5.13 below. The Figure shows that 86.2% of the members of staff who responded to the questionnaire reported that they never attended any library tours or introductory talks, while only 13.8% of them reported they attended such a programme.

Among the Postgraduates who responded, 18 (representing 85.7%) reported having not attended library orientation programme of any nature, while 133 Undergraduates, representing 64% of the Undergraduates who answered the questionnaire reported that they did not attend any orientation programme, either. In contrast, only 34% of the Undergraduates reported having attended.
Based on the heavy reliance of both staff and students on the university library as indicated earlier on, this signals a problem for the library in its efforts to cater for the users. Despite the fact that figures obtained from the survey did not reveal that the staff were any more interested in the library orientation than the students, the former has to be actively involved in order for a successful user education programme to be mounted.
One limitation of this question, however, is that it had not been followed up with another which would seek to know the respondents' reasons for not attending the orientation programme.

An interview with the university librarian and one circulation librarian, as well as a scrutiny of the records of the main library have, nevertheless, confirmed that users had not been responding positively to the library's invitation to attend organized library orientation programmes during the past couple of years. Presently, "The use of library" has been incorporated into a compulsory course in the Division of General Studies in an effort to ensure participation. It could be, however, that the library had abandoned its efforts when the programme was incorporated into one of the courses of study.

Considering the rate at which students use the library (see Figs.5.2 and 5.3, for example), and the finding that a majority of the students rely on the university library for most of the texts they use in their studies, question 18 was asked to in order to find how adequate the seating facilities in the libraries were. The results of this are shown in fig.5.14. The Figure shows that over 90% of the members of staff who responded to the question reported having no problems with finding seats in the library. Over 80% of the postgraduate students also reported having no problems in this regard. However, among the undergraduate respondents, it was found that 73% reported that they had problems finding seats to do their work in the library. No doubt, the response by members of staff can be understood in the light of their response about the
question on frequency of library use, where it was found that the pattern for this group could not be traced by a specific frequency with any reasonable percentage.
Postgraduate respondents, too did not report having much seating problems, but this can almost certainly be explained by their small number, compared with the undergraduates. The figure for undergraduate respondents who reported having seating problem could be a signal that the present undergraduate population is outgrowing the available seating facility. Even when we consider the least standard of 20-25% of the student population as desirable seating capacity (Rogers, 1971, p337), the present arrangement under which barely 420 seats are used by about 4000 students is by far inadequate.

Moreover, the solution to this tends not to be in sight in view of the fact that plans for the construction of a more permanent library has been shelved into the third phase of development by the university’s planning committee. The situation is further worsened by inflation, which escalated the price of the contract, forcing it to be reviewed several times. This kind of situation tends to abound in several other African universities, which makes Ifidon (1985) to lament as follows:

> Examples abound of unplanned universities that were established without feasibility studies. Decisions were taken to establish such universities without considering the place of the library as an important academic support service. In their hurry to get the institutions going, the governing authorities advertised for and admitted students; the students accepted the offers and lectures began but without books... (p166)

He further writes that ... "a slightly better situation exists where a newly established university takes over the assets (including a library building) of an existing secondary institution". What made the Usmanu Dan Fodiyo university different from all the universities established along with it in the same year is the fact that it did not take over the assets of another post-
secondary institution, the type mentioned by Ifidon (ibid). Despite the advantage of having a free hand to start on a "clean slate", however, the university had not considered the building of a befitting library as a top priority.

5.3 QUESTIONNAIRE TO HEADS OF CIRCULATION: THE MAIN LIBRARY, MEDICAL LIBRARY AND THE LAW LIBRARY, USMANU DAN FODIYO UNIVERSITY LIBRARY, SOKOTO

A different questionnaire from the one administered to the library users was designed and administered on the heads of circulation units, which in the main library, the law library and the medical library. All the respondents in this case returned their completed questionnaires to the researcher’s address in London after his return from the field trip.

This questionnaire was specifically designed to aid the researcher in:

(i) Investigating the manner in which the circulation system(s) were organized

(ii) Ascertaining the type of records or files maintained, and any areas in which the operators of the system (circulation personnel) find specific problems as well as to tap any statistical or other information that could shed more light as to whether or not the problem situation needs to be restructured.
A major assumption under this section is that investigation of system effectiveness should not stop at the users of the system. This is in line with Du Mont's argument that ... "it is difficult to conceive of a library that would survive for long if it pursued user satisfaction to the exclusion of employee needs or if it concentrated on efficiency to the exclusion of user satisfaction" (Du Mont and Du Mont, 1979: 103-141). In other words, the circulation system staff, too, constitute an important factor in the investigation. As shown in table (1), all heads of the three circulation units responded to the questionnaire. The data from this questionnaire are tabulated under frequency distribution in tables (5.3) through (5.7). In order to simplify the presentation, the three circulation units are henceforth referred to as a, b and c. Table (5.3) summarizes the responses to questions 4, 5 and 6 which were put respectively as follows:

Q.4 What was your unit's total transactions in the last academic year?

Q.5 How many registered users do you now have?

Q.6(a) Taking into consideration your transaction figure in the last academic year, do you anticipate more, fewer or same in the next academic year?

Q.6(b) Can you estimate the percentage increase of users you expect in the next session? (any figure between 1% - 100%).
It can be seen from the table (5.3) that the circulation unit of library branch (a) had reported 400,923 transactions in the previous academic session, with 4,190 registered library users. This unit also reported that it was expecting increase in the number of users and transactions in the following academic session.

Library branch (b) has not reported the figure of its circulation unit’s transactions, but reported however, a registered users’ figure of 950. This branch, too, expected its number of users and transactions to increase. Branch (c) reported a transaction figure of 5,250 in the previous academic session, with some 750 registered users.
Like the remaining branches, this branch, too, was expecting increase in users and volume of transaction in the following academic session. All the three branches were asked to estimate the percentage of increase in transactions and user population if they answered 'more' in the question that preceded Q.6b. As can be seen from the table, all of them reported that the increase they were expecting was an estimated 100%. This response can be explained by the fact that the immediate attention of the newer universities is to aim at an ultimate undergraduate enrolment of 10,000 students with a reserve objective of about 2,500\(^1\). Of the 10,000 undergraduates, one out of every ten is expected to qualify for postgraduate work, with five percent reserve for expansion of the programmes. Another ten percent is set aside for non-degree earning courses. For this, the library braces itself for a total projected enrolment of 15,000 distributed as follows:

<table>
<thead>
<tr>
<th>Type of Study</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduates</td>
<td>12,500</td>
</tr>
<tr>
<td>Postgraduates</td>
<td>1,500</td>
</tr>
<tr>
<td>Certificate /diploma</td>
<td>1,000</td>
</tr>
<tr>
<td>studies</td>
<td></td>
</tr>
</tbody>
</table>

All the branches were also asked to identify from a prepared list, the type of records or working files kept in their units. The items included on the list are records or working file universally common to circulation systems. This formed the basis of question 7, the results of which are shown in table (5.4) below:

\(^1\)See for example, Ifidon (1985) for more on this.
Q.7 Mark with an 'X' if you presently keep any of the following records or working files

<table>
<thead>
<tr>
<th>Types of file</th>
<th>Branches that keep</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) User register</td>
<td>2</td>
</tr>
<tr>
<td>(b) Acquisition list</td>
<td>2</td>
</tr>
<tr>
<td>(c) Daily transaction file</td>
<td>2</td>
</tr>
<tr>
<td>(d) Reservation request file</td>
<td>2</td>
</tr>
<tr>
<td>(e) Recalled items file</td>
<td>2</td>
</tr>
<tr>
<td>(f) Items sent for binding</td>
<td>3</td>
</tr>
<tr>
<td>(g) Missing items file</td>
<td>2</td>
</tr>
<tr>
<td>(h) Delinquent users file</td>
<td>1</td>
</tr>
<tr>
<td>(i) Any others (Please specify)</td>
<td>1</td>
</tr>
</tbody>
</table>

All the heads of circulation units reported that they were keeping files for items sent for binding, while only one head reported keeping delinquent users' file. Under "any other files", one head reported having a 'New arrivals file'. One head also added other files kept as follows:
Over-night loans file

Interlibrary loans file

Duplicate materials file (for exchange/gifts purposes).

In questions 8 and 9 the heads of circulation units were asked to mark whether or not they had any problems in managing and/or fully utilizing the files they mentioned in question 7, and also to give the nature of the problems, if any. Question 10 asked the respondents to indicate the commonest information that the institutional management or other library users normally require from them about an item in their units. All of them reported having problem with file management and file searches as shown in table (5.5) below. The table also shows that all three of them reported the nature of problem being that:

(i) Files were too bulky to manage well.

(ii) Frequent clerical (filing) errors.

(iii) It takes too long to search for information.

One head of section also reported that statistics kept were not up to date nor reliable, while two reported no problems with statistics. All the files referred to in this case are manual files kept mainly on cards and stored in rectangular 12"x 6" boxes, stationed at the circulation issue desk. Other records are in the format of specially designed forms which are filed in standard vertical files. All searches are done manually.
Q.8 What problems if any, do you encounter in managing and/or fully utilizing the files you marked in Q.7 above? Mark 'X' where applicable.

(a) File management: Yes (3) No (-)
(b) File utilization(searches): Yes (3) No (-)

Q.9 Which of the followings adequately describe the nature of the problem(s) which you indicated in Q.8 above?

(i) File too bulky to manage well. Yes (3) No (-)
(ii) Frequent clerical (filing) errors: Yes (3) No (-)
(iii) It takes too long to search file: Yes (3) No (-)
(iv) Unreliable statistics: Yes (1) No (2)

Q.10 MARK WITH AN "X" THE TYPE OF INFORMATION THAT THE USERS, MANAGEMENT STAFF OR OTHER PERSONS NORMALLY ASK YOU ABOUT AN ITEM; E.G WHICH ITEM IS:

(i) Available in the library .............................................(3)
(ii) Out on loan .................................................................(1)
(iii) Overdue .................................................................(1)
(iv) Reserved for another user ........................................(1)
(v) Kept in permanent reserve ......................................(2)
(vi) Recalled ...............................................................(1)
(vii) Sent for re-binding .................................................(2)
(viii) More heavily used ...............................................(2)
(ix) Missing from stack ...............................................(2)
(x) Due when ............................................................(2)
(xi) Loaned to whom ...................................................(2)
(xii) Reserved by whom .................................................(2)
Regarding Question 10 (Table 5.5) all the respondents reported that management or other users like to know from them which item was:

available in the library.

Two heads of units responded that they were required to provide information as to which item was:

(a) in the (permanent) reserve collection;
(b) sent for re-binding;
(c) more heavily used;
(d) missing from stock;
(e) due when;
(f) loaned to whom;
(g) reserved for whom.

One head of unit reported that he/she was required by management and/or other users to give information as to which item was:

(a) Out on loan;
(b) Overdue
(c) Reserved by another user;
(d) Recalled.

The reason for the preponderance of two libraries in answering some of the questions is that the Law library is primarily a reference library that does not provide outside-the-library loans, so it is not concerned with overdue or recalls.
Table (5.6) records the responses to question 12 regarding the desirable objectives of every circulation system in the academic library environment. Here, respondents were asked to report the service objectives according to the levels of priority they attach to them.

Priorities are rated first through fourth depending on how the respondents saw them in the performance of their services. The question was put thus:

The functions and objectives of every circulation control system include assisting library users to make the best use of the collection. Considering the academic background of your library, indicate with an 'X' which level of priority you think should be given to the services listed below:

It can be seen from the table that two service objectives: "compiling relevant statistics about the use of collection" and "minimizing long queue at the loans desk" had been reported as first priorities to all the three heads of units. Four other objectives reported as first priorities were: "the efficient charging/discharging of library materials" (two respondents); "to tell the whereabouts of items with minimum delay" (two respondents); "re-shelve items as soon as they are finished with" (two respondents); and "library use instructions" (two respondents). Two objectives received high scores as second priorities. These are: "updating files" (with two respondents); "recalls/reservations" (two respondents).

Curiously enough, the objective of "giving accurate information to users about the status of any circulating item" received a third priority ranking from one branch, while the remaining branches did not even consider its inclusion among their priority.
TABLE (5.6)

Priorities of functions/service objectives

<table>
<thead>
<tr>
<th>Functions</th>
<th>PRIORITY RANKINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st F</td>
</tr>
<tr>
<td>(a) Charging/dischargin of library materials</td>
<td>2</td>
</tr>
<tr>
<td>(b) Renewal of loans</td>
<td>-</td>
</tr>
<tr>
<td>(c) Updating files</td>
<td>-</td>
</tr>
<tr>
<td>(d) Recalls/reservations</td>
<td>-</td>
</tr>
<tr>
<td>(e) Giving accurate information to users about the status of any</td>
<td>-</td>
</tr>
<tr>
<td>circulating items</td>
<td></td>
</tr>
<tr>
<td>(f) Tell whereabouts of items with minimum delay</td>
<td>2</td>
</tr>
<tr>
<td>(g) Ensuring that items leaving the library are duly checked out</td>
<td>1</td>
</tr>
<tr>
<td>(h) Compiling relevant statistics about use of collection</td>
<td>3</td>
</tr>
<tr>
<td>(i) Reshelving items as soon as they are finished with</td>
<td>2</td>
</tr>
<tr>
<td>(j) Tracing and handing back a user’s library ticket in less than sixty</td>
<td>1</td>
</tr>
<tr>
<td>seconds from the time of he/she returns item</td>
<td></td>
</tr>
<tr>
<td>(k) Minimizing long queues at the loans desk</td>
<td>3</td>
</tr>
<tr>
<td>(l) Teaching the use of library</td>
<td>2</td>
</tr>
<tr>
<td>(m) Any other (please specify)</td>
<td>-</td>
</tr>
</tbody>
</table>
Question 15 asked the respondents to report the effectiveness of the records (files) kept by them in enhancing their services. The responses got confirmed those given to questions 8 and 9. Two heads of units reported that their present files were "barely adequate" for their needs, while one reported that the files were "not adequate" as can be seen from table (5.7) below:

TABLE (5.7)

How adequate are records kept in your department in enhancing your services?

<table>
<thead>
<tr>
<th>Value</th>
<th>Value label</th>
<th>FREQ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adequate enough</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Barely adequate</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Not adequate</td>
<td>1</td>
</tr>
</tbody>
</table>

5.3.1 SUMMARY OF QUESTIONNAIRE FINDINGS

From the data presented, and the analysis which preceded each chart and/or table, the following conclusions can be made regarding the circulation control system at the Usmanu Dan Fodiyo university library, Sokoto:

1. The existing manual circulation systems at the Usmanu Dan-Fodio university library and other branches have transactions of materials ranging between 5,250 and 400,923 annually, with the number of patrons represented by these transactions ranging from
between 750 and 4,190. There is the likelihood of these figures to continue to rise with the intensive man-power drive of the government, which is reflected in the efforts of the university to broaden its catchment areas. For example, recently, Kano State has been included as a catchment area in addition to the hitherto two main areas of Sokoto and Niger States.

2. The circulation services staff in particular, are finding it difficult to cope with the demands being made on the system. Particular mention was made by the heads of circulation systems of having difficulties with file management and file searching, because the files were too bulky, subject to frequent clerical errors, could not be searched easily, and had unreliable statistics.

3. The present circulation system causes long delays due to some of the problems mentioned in 2 above, with most users from all categories who responded to the questionnaire reporting that they spend between two and five minutes at the circulation desk. These figures were further confirmed by the researcher's personal timing of issues and returns of materials at the circulation desk. This aspect is shown in Fig. (5.8).
4. The responses also show that although the management of the Card Catalogue is not the direct responsibility of the circulation control system, it is nevertheless, a very useful tool for the identification, verification and location of library items, and it is kept in the circulation department.

5. Generally, of the various records kept for the day-to-day running of the circulation system, the heads of the circulation systems who responded to the questionnaire found user register, acquisition list, daily transactions file, reservation request file, recalled items file, items sent for binding file, missing items file, and delinquent user’s file to be very helpful.

6. Information requirements for circulation control systems identified include: whether items are available in the library; out on loan; overdue items; reserved for another reader; kept in permanent reserve; recalled; sent for re-binding; loaned to whom; reserved by whom; due when; missing from stock.

7. The present manual circulation systems barely cope with the increasing workload and information requirements of the system. This can be seen from the responses recorded under the number of minutes respondents reported that they spend in order to borrow or return items (Fig. 5.8) and the responses of heads of circulation systems to question 15, in which two heads of department reported that the system was "barely
adequate" for effective records keeping, while one head thought the system was simply "not adequate". This view corroborates the findings of a survey by Alabi and Elegbeleye (1979), which put the satisfaction level of circulation performance at only 48% at the Ibadan university library.

8. Interviews with the University librarian, Usmanu Dan Fodiyo university and heads of the circulation departments of the university’s main library and branches, as well as interviews with librarians at Bayero University, Kano, Universities of Maiduguri and Port-Harcourt indicate the desire of those libraries to find means of rectifying the problems mentioned above. They all had computerization in mind, but were nevertheless, aware of problems that might come with it, such as: uncertainty of uninterrupted electricity power supply, uncertainty about availability of spares, lack of skilled manpower in the library, uncertain financial support from parent organisation, fear of change, and uncertainty about turn-key systems mainly designed with the developed countries in mind.

Based on the findings above, the work goes on to make comparison between 'what' and 'how', i.e, the transition between doing the analysis in a systems language and debating the outcome of the analysis in the language of the real world.
CHAPTER 6

6. SSM AND THE CREATION OF INFORMATION SYSTEMS

It should be stressed at this juncture that SSM as a problem-solving approach has provided a clear distinction between formal and informal information systems. Wilson (1984), for instance has elucidated the principle whereby information flows that emerge from the systems modelling stages of SSM are based on a consideration of minimum necessary activities and are therefore, critical to the organisation. The reliability of such flows should thus be maintained through formalisation; they therefore present prime targets for computerisation.

The main concern of this chapter is how to fit the methods of computer systems analysis into the framework of our selected conceptual model in chapter 4. This process is not a straightforward one, because SSM by nature places emphasis only on process analysis, not on data analysis. Nevertheless, there is apparently a way to link the process analysis with a form of data analysis if we take into consideration the fact that information systems, by nature, exist to serve activity systems; also bearing in mind the advice given by Checkland (1981) that systems analysis aiming at information system design, if it is to make much impact, must first concentrate on the activity system which the information system is to serve; adding further that:

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1It should also be noted here that SSM is not a methodology whereby, in practice, one must conduct its various stages in a predetermined sequence. The experienced analyst might probably be thinking of several stages at the same time, and depending on what has emerged so far, he/she is free to switch the emphasis from one stage to another. So, as Checkland (in a personal communication, February, 1990) explains, the procedure [of SSM application] is often characterized by moving forward, backtracking and atimes simultaneous processing.
Once the root definition(s) and the conceptual model(s) of the activity system are established then the necessary information flows are easily defined by asking for each activity: what information is needed to do it? In what form? From what source? How frequently? (p208).

A number of authors have expressed concern at the alarming number of reported (and unreported) information systems failures\(^2\). A 70% failure rate for implemented systems is often quoted (Bream, 1987). This is a very common criticism of computer system analysis, which, according to Miles (1988, opcit) has evolved in the 'hard' systems tradition. This has fostered a more or less technical view of information systems which is prevalent today. A way has to be found, therefore to rectify the situation.

Very common type of problem situations in which objectives are problematical, is said to be outside the competence of any methodologies which require an initial statement either of objectives or of future states which are known to be desirable (Checkland, 1981; Wilson, 1984). One way out of this mess is to adopt the 'soft systems thinking which is applicable in such situations' and which 'has to abandon the mean-end model upon which "hard" systems thinking is based' (Checkland, 1978).

This calls for an interface between the soft system thinking and computer systems analysis.\(^3\)

In essence this does not negate the conceptual foundations of SSM, because Checkland (1981\(^a\)) observes that:

\(^2\)See Land and Hirschheim (1983).

\(^3\)For a discussion on this the author is grateful for personal communication with Paul Lewis of the Department of Systems and Information Management, University of Lancaster, who willingly discussed his forth-coming book which touches on this aspect.
in fact the most effective users of the methodology have been able to use it as a framework into which to place purposeful activity during a system study, rather than a cookery book recipe.

Also, regarding the effective and creative use of the methodology, Checkland and Scholes (1990) added that: "those who developed SSM were conscious of its status as mouldable methodology, rather than rigid technique, and they wished to leave 'how, exactly, to do it' as a strategic choice for the user to make" (p291).

Acknowledging this 'mouldability' of SSM, a 'hard' system design methodology (namely, Structured Systems Analysis and Design as elaborated by de Marco) is selected in this research and "combined" with it so that the problem-situation can be studied more broadly, and so that the "messiness" often associated with soft, ill-structured problems could be accommodated along with appropriate methods and techniques from the 'hard' systems thinking which could be manipulated and used to generate ideas for the development of computerized information systems.

In line with this approach, Miles (1988) proposed two different ways of combining 'hard' and 'soft' systems practices: The first entails "grafting" a 'soft' feasibility stage onto the front end of the conventional operating framework of Information System Engineering (ISE); the second entails "embedding" 'hard' systems practice within the systemic framework of SSM, adding that:

The use of 'soft' systems ideas is one means whereby an ISE practitioner can move beyond the dominant design paradigm of the 'hard' systems tradition, enabling analysis to lead design. When this happens, organisational effectiveness takes precedence over technical efficiency. In this sense, each of the above approaches is progressive and of practical utility to ISE (p59).
At this stage, the conceptual model of our third RD is 'translated' into Data Flow Diagrams, because as pointed out earlier, it is often beneficial as part of stage 4 in SSM to support the conceptual model with other systems ideas (stage 4b). As Bream (1987) points out, a DFD derived in this instance would be in the spirit of 'supporting systems ideas' and so would not be considered as modelling the structure that will be ultimately decomposed into an information system. Instead, he adds, it will serve to represent the system from a data flow point of view, thus aiding thinking about future information system design. This, in effect leads us to the question of data modelling and its place in SSM.

6.1 DATA FLOW DIAGRAMS AND CONCEPTUAL MODELS

For the reader to be able to appreciate the role of data modelling in SSM, and hence the 'translation' of Conceptual Models into Data Flow Diagrams it will be helpful to look briefly at the theoretical background of the modelling techniques of the two approaches.

Mingers (1988) has discussed the similarities and differences between them. A DFD consists of blobs and arrows – the arrows showing flows of data and the blobs the processes which convert the input flow into output flow. In constructing a DFD, primary importance is placed on the data flows rather than the processes, thus depicting the situation from the data's point of view. The arrows are seen as pipes through which packets of data flow, and these are laid out first.
Among the significant similarities between DFD and CM discussed by Mingers (1988, ibid) are the following:

(i) Each has a basic diagram depicting input, transformation and output. Both emphasise the need for consistency in the diagrams, i.e., the input must be logically capable of being converted into the output. But whereas de Marco (1980) does not consider this diagram vital by merely stating that:

> Drawing a context diagram may seem like a trivial formality. It serves only one purpose ... to delineate the domain of our study ... I propose, however, that you take the extra five minutes to draw the context diagram (p75),

the SSM places more importance on CM, as it shows the central activity of the conceptual system being developed.

(ii) In the main diagrams, the blobs are activities or processes of transformation and so must be described by verbs. Both emphasise that the logical consistency of the diagram is crucial.

(iii) Both involve the same top-down decomposition approach. Beginning with the top-level diagram, each bubble can be split up into its own set of activities and flows. These can be shown either in different diagrams or the same one.

In SSM this process of splitting up is achieved by defining a root definition for each higher-level activity and then expanding this into its own set of minimum necessary activities.
(iv) Both emphasise developing models which depict what happens logically, rather
than how it happens to be realised in a particular situation. Writing from within the
framework of SSM, Checkland (1981) says:

In order to service this debate [about feasible and desirable changes] it should
be clear that the 'below the line' models of some human activity systems are
not models of 'what is' in the real world. Real world manifestations of human
activity are of a quite extraordinary richness and complexity. 'Below the line,
a model will contain a structured set of activities which express with great
purity a particular view of the system named in the Root Definition (p42).

Similarly, after describing the current situation in a physical DFD, de Marco’s next step is
to:

..."Logicalize" our model of the environment ... we remove the physical check-point
items, replacing each one with its logical equivalent. ... A particular implementation
of policy is replaced by a representation of the policy itself (28).

Nevertheless, fundamental differences exist between the two diagramming methods:

(i) In de Marco’s DFD the flows of data have primacy, the activities are merely those
processes which convert the input flow into the output flows. In the SSM, in contrast,
it is the activities which play the central role. The development of a CM begins by
specifying a list of activities necessary for the named system to be described.

(ii) The DFD is based on a description of the current situation as it is even though it
is expressed in logical rather than physical terms. It appears to take for granted that
it is largely the current system that is to be reproduced, though with some extra
facilities. A CM, on the other hand, is not intended as a model of what ought to exist,
but a model of a concept or notional system that may help in agreeing beneficial
changes. Since the CM is the result of the development of a single concept from a
relevant system through RD to CM, "...it is more likely to produce a much more
coherent and consistent model than the reproduction of the inevitable vagaries of the historical contingencies of the existing system" (Mingers, 1988: 373).

(iii) DFD's, like most data analysis approaches, have a 'unifocal' view of data that is, that data contains its own unique and unambiguous structure. In contrast to this, it can be said that data by itself is meaningless. It only becomes information when it is invested with meaning by people (Checkland and Scholes, 1990). Information, therefore, is not an objective fact, but dependent upon the meanings and practices of the people and organisations which use it.

(iv) In terms of general approach, the Structured Methodologies assume a well-defined problem, perceived in the same way, and agreed on by all involved, which merely requires an efficient solution. Whilst it is admitted that politics and organisational culture are important, de Marco explicitly recognises that they are ignored in this approach:

Of course, analysis is an intensely political subject... But most political problems do not lend themselves to simple solutions... Political problems aren’t going to go away and they won’t be "solved". The most we can hope for is to limit the effect of disruption due to politics (p13).

It is precisely this which is recognised by SSM— an attempt to bring rationality to bear on politics (Rosenhead, 1989).
In his concluding remarks about the differences and similarities between DFD and CM, Mingers, (opcit, 1988) writes:

...DFD's are more specialised towards computer systems, with for example files, sources/sinks and the links into data dictionaries and structured English. This can be very valuable in the more detailed stages of analysis and design, and so a well-constructed and detailed CM might usefully and easily be converted into a DFD (p378).

It should also be added here that Conceptual Models are not a "model" of a system in the sense that a system can be perceived, and the details noted and modelled using the CM; a DFD, on the other hand is a model of something. Therefore, since CM is only an imaginary 'model' and that it does not contain any explicit references to data flows, it is only appropriate for us to bear in mind that the DFD is not a model of the CM, rather, it is a diagram generated from the CM by a combination of logical inference, experience and modelling technique4.

The actual conversion process, therefore, should not be seen as a translation so much as an interpretation. On this, Bream (1987, opcit) writes that 'Conversion' of CM into DFD's will have to start from the assumption that the resulting DFD can only be more or less relevant, as opposed to being completely right. Moreover, it will have to be assumed that the conceptual system could be implemented in practice so that the data flows could be hypothesized in the manner of 'If the system were assumed to exist, then these would be the likely data flow components of it', etc.

4This idea, too is part of my invaluable discussion with Paul Lewis, Department of Information Management, University of Lancaster.
Layzell and Loucopoulos (1987) have given some basic guidelines on making good data flow diagrams. The guidelines consist of the following:

(i) identify the static components within the system; i.e. those objects which contain data

(ii) identify the main processes which consume and generate stored data and the data flows between them

(iii) expand and refine the data flow diagram

(iv) review the diagram.

6.2 DATA ANALYSIS AND INFORMATION SYSTEMS

Miles (1988) and Checkland and Scholes (1990) have all elaborated on the dominance of computers and computing in Computer Systems Analysis. Checkland and Scholes in particular referred to how Information System (IS) as an area of theory and practice has been "dominated by a particular means, the computer, and by the anthropomorphic language about computers which the earliest pioneers of computers, alas, encouraged" (p53). They expressed regret that the thinking which starts from a means (the computer) rather than ends (an organization’s conceptualization of its world) and which adheres to a now less-appropriate model (that of engineering projects) has not been totally dominant.
As pointed out earlier, elements of Structured Analysis are being incorporated into SSM at this point in the study. It is, therefore, in order if we make a brief introduction of some of the terminological devices of Structured Methodology at this juncture.

Generally, in computer-based information systems one often encounters a distinction between logical and physical models. Page-Jones (1980) for instance, refers to logical design as "free of the characteristics or constraints of any particular implementation" (p343), adding that it is the "opposite of physical". Further, FitzGerald and FitzGerald (1987) add that a physical model is a pictorial representation of the system showing how the job is performed physically, including the sequence of the operations, the people, the computer processing, paper forms, and so on. By contrast, a logical model is a pictorial representation of the system that shows what processes must be performed, the flow of data through the system and the data stores that are required. These are shown in the most logical sequence without regard to the actual (physical) real-life processing sequence.

It can thus be understood from the above explanation that logical and physical are related as 'what' is to 'how', respectively. In support of this proposition, Miles (1987) writes:

...the selection of a 'what' level on a what-how (or system-subsystem) hierarchy is itself a rejection of alternative hierarchies that could lead to different forms of implementation at the lowest level. Therefore, in practice, a logical model cannot be entirely free of implementation constraint(49);

he also adds that the practical utility of the division is one of embedding a systemic hierarchy, with a well defined bottom level (the physical model), into both the design process and its output. After all, it is now customary practice for analysts, faced with the task of re-designing a current set of data processing procedures, to first construe these procedures in the form of
a physical model (one particular 'how') and then to remove its implementation dependent features to reveal a logical model that represents the implicit or underlying 'what' (Miles, ibid, 1987). The logical model thus provides a basis for developing a new physical model (or improved 'how').

In essence, the logical-physical division provides a framework for design. However, one of the most fundamental points of departure between the above framework as it stands and that provided by the Soft Systems approach upheld in this research, is that the initial iterations of SSM themselves generate logical information flow models, thus freeing the analyst from the constraints of using a physical model of current data processing as a reference frame (Miles, 1987, ibid).

Moreover, since as pointed out above, the conceptual model developed at stage 4 is not a model of what exists, nor even a model of what ought to exist (rather it is a model of a notional system that may be helpful in agreeing beneficial changes), radical alternative logical models or 'whats' can as well be explored.

As Benyon (1990) has advised, although we are concerned with developing a conceptual data model, we must not lose sight of the fact that the system has to be used by people. He goes further to point out that "most work on data models has been done by people concerned with implementation and hence is quite unsuitable for mere mortals who just want information when, where and how they require it" (p60). Langefors and Sundgren (1975) considered models of information from a user’s point of view.
They identify the *infological* realm of the data model which is concerned with producing a model of the areas of reality which users are interested in, what data should be collected, and how do they view data. Secondly, they identify the *datalogical* realm which is concerned with designing the database so that it can be implemented on a computer. Along the same line, Methlie (1979) suggested two possible perspectives of the problem of changing information systems in organizations. These he named as "datalogical perspective" and "infological perspective", which he defined as follows:

The datalogical perspective regards existing data flows as satisfactory representations of the information needs in the organization. The aim of the change task is to find more efficient way of processing the existing data. A common solution is to computerize manual procedures and data files. The benefits of this approach are primarily of the cost-savings type. This perspective is the traditional computer application view and is still common in current systems work. The infological perspective of information systems design looks at the organization as an information processing system. Thus communication and control aspects are in focus. Information is knowledge, communicated between individuals and groups, needed to perform the tasks. The focus of this perspective is to find an effective information system for the whole or part of the organization to which the information is to give service.

Clearly, the distinction between the two different perspectives is a conceptual one, not easy to perceive. Nevertheless, the infological perspective is more useful in this research due to its direct association with the user-oriented model of information system taking into consideration Methiel’s definition above. The infological perspective is thus more directly in keeping with the projected data modelling stage of SSM. Such a distinction allows users the free hand to perceive the database in anyway that they please. Thus from this point onwards in this research, infological models would be used to refer to logical data models. From the agreed conceptual model of RD3 (fig.4.5), therefore, we now have the following conceptual information flow model:
Key:
Activity
Sink/sources
Info. flow

Fig. 6.1 A conceptual information flow model of Circulation system
The main question now is how to choose a suitable way of demonstrating the infological model, taking into consideration the fact that there are many different views and approaches to data modelling. In the words of Benyon (1990, opcit), ..."there have been many conferences, much argument and considerable research into data models" (p59). Nevertheless, in keeping with the goals of this research, a much widely used technique in systems analysis is favoured, the Entity-Relationship model, commonly abbreviated to E-R. The Entity-Relationship model offers a solution to the problems of scale and practicability, by modelling the relationships between groups of data elements rather than individual data elements. It is also a highly flexible and powerful tool for exploring information needs, offering a graphical language for discussing and thinking about what the information system has to deal with. Skidmore and Wroe (1988) describe E-R as:

> a technique for analyzing and modelling the organisation's data requirements. It requires the discovery of the data elements needed to support the information systems and represents their structure in a clear, concise diagram" (p170).

Again, there are numerous forms of such diagrammatic representation. As Benyon (1990) has further pointed out ..."There are many different versions of the E-R model and it has become central to most methodologies of information systems development". A widely used variation, one which this researcher finds useful for this type of work, is that which stems from the work of Chen (1976), which since then has developed into a branch of computer science. It was originally proposed as an alternative to the relational model, but as Benyon (1990), too has noted, in recent years the compatibility of the two have come to be recognised.
It uses three basic concepts, entities, their attributes and the relationships which exist between entities. It is worthwhile to take a closer look at each of the concepts listed above.

**Entity** is the term used to describe something that the enterprise recognises in the area under investigation and wishes to collect and store data about. An entity may vary from a physical object, such as a book, to a more abstract concept such as an overdue.

In all instances the entity should be capable of being uniquely identified. Furthermore, an entity is not a data element, but a collection of data elements given a useful name. Occasionally an entity does not consist of a single data element, but the entity is the concept and not the data element. It is also unlikely to be a document; usually we are interested in the information conveyed by the document not the document itself. For example, 'reservation' is often an entity in a library's circulation control system, but 'reservation form' is not. In other words, in Entity-Relationship modelling, we are interested in the actual thing, the concept of a reservation, not in the piece of paper.

In this regard, Benyon (1990) advises that "The most important aspect of understanding entities is to consider what the enterprise wants to store data about, so that we can identify the data needed to provide information" (p148). Thus we are not concerned with the method currently used to convey information (such as a reservation form).

---

5 The significance of insisting that entities must be capable of being uniquely identified is that the designer can specify a data element which is the entity's primary key, just as a relationship must have a primary key in the relational model.
Attributes are the data elements which have been collected in the data dictionary. In mathematical terms an attribute can be defined as a mapping from an entity or relationship (set) to a domain (value set). It may describe the entity, categorise the entity, identify the entity or express the relationship between entities. For example, Book may have the attributes "book-number", "title", "author", etc., while the attributes of User might include "user-name", "ID number" and "address".

Relationship is what links entities together. The relationship must have a particular significance. There may be more than one relationship between the same entities. So the entity User may be associated with the entity Book by a relationship that can be called, say, Reading. Relationships operate in both directions e.g. A user 'uses' a book; a book 'has' many users. Relationships also have:

(a) *Degree*, i.e. the number of entities participating in the relationship. A binary relationship has degree = 2, ternary has degree = 3. In general, n entities participate in an n-ary relationship.

(b) *Complexity* (or 'cardinality'). This maybe a 1:1 relationship, M:1, 1:M or M:M. A M:M relationship is often referred to as a complex relationship.

(c) *Membership class*, is it obligatory or non-obligatory for the entity to participate in the relationship?
It should also be stressed at this juncture that a particular entity occurrence should be recognised by the values of a particular entity attribute or combination of attributes. For example, a user may be identified by the value of attribute user-name or a specific book recognised form the combination of two attribute values author and title. This identifying attribute or combination of attributes is termed the entity identifier.

The choice of the entity identifier must be guided by its ability to uniquely identify an entity occurrence. For example, in the case of a library user-ID may be preferred to user-name because the library may wish to allow more than one 'HALIRU, S' to borrow. A typical entity-relationship diagram is shown below in order to give a succinct idea of the entities and relationships.

![Entity-relationship diagram](image)

Fig. 6.2 Entity-relationship diagram

Now that we have briefly explicated the concept of Entity-Relationship model, the next task ahead is to use examples from the circulation system study of chapter 4 to construct a data dictionary by examining what data elements are required for all dataflows and data stores and analyzing the documents in the conceptual information flow model in fig. above.
<table>
<thead>
<tr>
<th>Data flow</th>
<th>Data element name</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request</td>
<td>Borrower ID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course</td>
<td></td>
</tr>
<tr>
<td>Borrower Status</td>
<td>Borrower-name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borrower I-D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Home address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Term Address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loan duration allowed</td>
<td></td>
</tr>
<tr>
<td>Verify Registration</td>
<td>As above</td>
<td></td>
</tr>
<tr>
<td>Charging/discharging</td>
<td>Borrower-name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borrower I-D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Title</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Author</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imprint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acc. No.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Call No.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date due</td>
<td></td>
</tr>
<tr>
<td>Renewals</td>
<td>As above</td>
<td></td>
</tr>
<tr>
<td>ILL Order</td>
<td>Borrower-name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Borrower I-D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Term address</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ILL source</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Title</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Author</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imprint</td>
<td></td>
</tr>
<tr>
<td>Data Stores</td>
<td>Data element</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>Borrower Master File</td>
<td>Borrower-name</td>
<td></td>
</tr>
<tr>
<td>Borrower ID No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term Addrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home Addrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date entered system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years on system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected date of grad.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of books damaged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total fines paid last 3 yrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of books lost last 3 yrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of last transaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulation Master-File</td>
<td>Descriptive Record:</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restricted Circ. category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrowing period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date of last inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Branch lib. code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum fine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charge Record:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower-name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower ID No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower Addrs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date charged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date due</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charging period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-due indicator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservation Record:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower-name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower ID No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date last recalled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrower Addrs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Having examined all the documents and explored all the data flows and data stores, we now compile a provisional data dictionary of the data elements involved in the system. This is shown below:

<table>
<thead>
<tr>
<th>Data element name</th>
<th>Domain</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borrower-name</td>
<td>X(20)</td>
<td>Surname + Initials</td>
</tr>
<tr>
<td>Borrower ID No.</td>
<td>N(10)</td>
<td></td>
</tr>
<tr>
<td>Borrower Addrs.</td>
<td>X(30)</td>
<td></td>
</tr>
<tr>
<td>Borrower Course</td>
<td>N(2)</td>
<td></td>
</tr>
<tr>
<td>Borrower Status</td>
<td>N(2)</td>
<td></td>
</tr>
<tr>
<td>Date entered System</td>
<td>N(6)</td>
<td>DD/MM/YY</td>
</tr>
<tr>
<td>Expected date of grad.</td>
<td>N(4)</td>
<td>MM/YY</td>
</tr>
<tr>
<td>Loan duration allowed</td>
<td>N(2)</td>
<td></td>
</tr>
<tr>
<td>Number of books lost</td>
<td>N(2)</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>X(25)</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>X(20)</td>
<td></td>
</tr>
<tr>
<td>Imprint</td>
<td>N(4)</td>
<td></td>
</tr>
<tr>
<td>Acc. No.</td>
<td>N(7)</td>
<td></td>
</tr>
<tr>
<td>Call No.</td>
<td>X(2).N(4).(2)</td>
<td>Letters/Numbers</td>
</tr>
<tr>
<td>Date charged</td>
<td>N(6)</td>
<td>DD/MM/YY</td>
</tr>
<tr>
<td>Date due</td>
<td>N(6)</td>
<td>DD/MM/YY</td>
</tr>
<tr>
<td>Charging period</td>
<td>N(2)</td>
<td></td>
</tr>
<tr>
<td>Over-due indicator</td>
<td>X(2)</td>
<td></td>
</tr>
<tr>
<td>Maximum fine</td>
<td>N(2).N(2)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6.3 Provisional Data Dictionary
6.3 DATA MODEL

The analysis so far, has provided us with a basis for developing a data model. Due to the nature of the system under study, we are clearly interested in:

- Borrowers
- Registration
- Charging/discharging
- Books
- ILL-order
- ILL supplier
- ILL delivery
- Reservations
- Over-dues

and hence these will become entities in our Entity-Relationship model. The E-R diagram is shown below:
Fig. 6.4 Entity-Relationship model
Over-due \((Borr-name, ID, Titl, Auth, Date-due, Amount)\)

Charging/discharging \((Borr-name, ID No., Title, Auth)\)

Borrower \((Borr-name, ID, Addrs, Borr-category)\)

Books \((Titl, Auth, Imprint, Acc, No., Branch, code)\)

ILL-order \((Borr-name, Title, Auth, Imprint)\)

ILL-del \((Borr-name, Title, Auth, Supplier-name)\)

ILL-supplier \((Supplier-name, Title, Author)\)

Registration \((Borr-name, ID No., Course, grd., Date)\)

Reservation \((Borr-name, Addrs, Title, Auth, Date)\)

Fig. 6.5 Circulation system E-R diagram with attributes.

### 6.4 PROCESS MODEL

Our data model can now be said to be completed, and at this point we attempt to review the system model (Fig. 6.1 above) to show in more detail all the processes that have to be undertaken in the system.

The purpose of the Circulation control system is to among others provide information concerning (i) which borrower has what library material, for how long; (ii) all reserves pending; (iii) all over-due items; and (iv) all extended loans. The process works as follows:
CHARGING A BOOK: When a borrower (or library user) wishes to borrow an item, he/she searches the catalogue or browses the shelves. The item (if available) is then brought to the loans desk together with the borrower's identification card to have it charged. The circulation clerk first inputs the borrower and book IDs into the data station, and enters a transaction code to indicate that the transaction is a charge.

The computer verifies that both the book ID and the borrower ID are listed on the file. If one or both is not found, the computer gives a screen message to the circulation clerk, in which case the transaction is either terminated or steps are taken to rectify the situation, depending on the contents of the message.

The computer then searches the circulation record for the item. If there are no reserves, the computer automatically charges the book. If there are one or more reserves on the book, and if the borrower is not the top of the reserve list, the computer prints a message accordingly. Normally such a transaction would be terminated, but the clerk (or an authorised senior staff) may override the sequence on the reserve list.
Also, if there are varying circulation periods depending upon the type of holding or upon the borrower’s status, the computer determines and displays the proper circulation period. This is then stamped on the book. In addition, the computer shall display the dates and amounts of any fines outstanding whenever a borrower requests to charge a book. These need not be collected in order to charge out the book, but the data is available for information and any appropriate action.

Returning/Renewing items: In this case, the clerk enters the book ID into the system’s data station. He/she then keys in the transaction code to identify the transaction as a return. The computer finds the circulation record for the holding on the file and erases the record of the charge. The computer compares the due date in the circulation record against today’s data. If the book is overdue, the computer calculates the fine, adds the fine amount to the borrower’s record in the borrower file, and writes a billing entry, addressed to the borrower, onto a billing suspense work tape or disk.

The suspense tape is processed later to print bills. The computer can also prepare the bill without waiting, or it may be programmed to use either approach as instructed from the console by the clerk.

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6 In the case of Usmanu Dan-fodiyo University library, Staff can borrow up to 10 library books for a period of 30 days; Postgraduates are allowed 5 books for the same period; Undergraduates are allowed 4 books for a period of two weeks, while non-degree students can borrow only two books for a period of two weeks.

7 Renewals are handled in the same way as charging, except that the library clerk keys in the renewal transaction code instead of the charge code. If the book to be renewed has a reserve, the computer can calculate the fine amount on the daily, hourly or some other basis.
If there is a reserve on the book, the computer writes on the suspense file a notification-of-
arrival record, addressed to the next person on the reserve list. This file is later printed so the
notices can be mailed.

**Placing Reserves:** Here, the circulation desk clerk must determine the proper identification
of the item, e.g class mark. This can be done by looking through the circulation master file
or in the catalogue master file.

The clerk enters the document number and the transaction code for creating a reserve into the
computer, using the console typewriter. The computer then finds the record for this item and
displays title and author. This information is examined to verify that this is, in fact, the record
for the requested document, and then the reserve request is entered.

The computer places the borrower’s name in the reserve wait list at the end of the list, unless
the user has priority when the reserve would be placed in the proper place in the priority list.
If there are multiple copies of the volume, the computer will search for the copy which has
the fewest requesters.

In either case, each requester already on reserve list is compared with the borrower number
of the requester. Should the computer find that the requester is (deliberately or by accident)
attempting to place two reserves on the book, it displays a message to this effect. The
computer shall also display the number of requests ahead of this requester. Reserves should
be cancelled or released whenever an item has been returned and is ready for circulation to
another borrower, or whenever the requester cancels the reserve prior to receiving them.
Provision should also be made to allow a lecturer to place multiple reserves, e.g. for class use. If this requester happens to be the first one, and the item is on extended loan or overdue, the computer writes onto the suspense file a note addressed to the borrower, requesting immediate return for use by another borrower.

**Overdue items:** Whenever the circulation control file is updated with new charges, returns, reserves, etc. the computer checks all items in circulation to identify any which are overdue. For each overdue item, the computer prints an overdue notice addressed to the borrower. The computer can be programmed to have different overdue periods, by type of borrower or borrowing category, e.g. extended loans can be made to print overdue only after a term.

The computer also prepares a second notice if the book has not been returned within a certain number of days of the first overdue notice.

Since the library charges fines for overdue books, the computer shall be used to compute the fine when the book has at last been returned and to bill borrowers with formal invoice. A clear policy should be established by the library concerning maximum fine, as this is a real area where the results of the user survey has revealed some dissatisfaction. The computer may be programmed to charge fines to some classes of borrowers but not others, or to charge at different rates for different categories of books, etc. Also if a borrower has more than one book which is overdue, all such overdue appear on the same page.

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8See Chapter 5, Analysis and Presentation of Data.
At this juncture, we can illustrate the final version of our information flow model, showing the boundary of the computer system, i.e., specifying the human-computer interface. This model is shown below:

Fig. 6.6 Boundary of the Suggested Computerized Circulation System (Showing human-computer interface).
6.5 THE DATA PROCESSING MODEL

In this type of model, data and processes are cross referenced in what is normally called the data/process matrix. This process enhances the analyst’s understanding of a system’s data. The data/process modelling should, therefore, be conducted in parallel so that knowledge from one type of model is used to construct and refine the other (Layzell and Loucopoulos, opcit, p90). Here, too, it should be pointed out that various methods exist of building the data/process model, although they all aim at the same goal — i.e., to relate data to processes. The result of relating data to processes from the Process Model explicated above can be seen as documented below:
So far, an attempt has been made in this and the previous chapters to illustrate how, using 'Soft' Systems Methodology as a guiding principle, an analyst can investigate the information requirements of an organization (or in this case an organizational sub-system) with a view to perceiving possible weaknesses, and consequently recommending feasible and desirable changes.
It should be added here though, that one of the constant complaints regarding data modelling techniques is the horrendous amount of documentation involved, such that it is often difficult to cover all the details of design. In this regard, Benyon (1990) writes:

> Information system design is complex and it is one of the major problems of current approaches to system design that documentation is so time-consuming and fraught with errors and oversight (p229).

This, nevertheless, should not be our major concern here because our guiding principle being SSM, we only use any appropriate tools as and when required so as to support the "other system thinking" aspects of stage 4b of the methodology.

The elements of "design" analyzed and discussed in this and the previous chapter are compared with what is known to be taking place in the existing system so as to generate debate about feasibility and desirability of changes.
CHAPTER 7

7 Comparison

7.1 Introduction

In this chapter parts of the problem situation analyzed in chapter four are examined alongside the selected conceptual models. Where a mismatch is found between the model and the real-world, there could be potential for improvement. Questions are posed about the effectiveness and efficiency of the real-world activities, and whether there is evidence of system characteristics, such as good communication channels, measures of performance, and processes for decision-making and control. The relevance of the models to the particular situation is also discussed in order to tease out the mismatch and make necessary modifications. In other words, it is a comparison between what exists in the "real-world", and what is in, or at least suggested by, the models of systems thought to be relevant to the problem.

The sole aim of the comparison is "to generate a debate about possible changes which might be introduced in order to alleviate the problem condition" (Checkland, 1981). This is done by carrying out a critical examination of the organisation to determine how it compares with models constructed during systems thinking exercise in chapter 4.

The rationale of the comparison stage of the methodology can be seen more clearly by looking at the operational procedure of the entire methodology: the perception of a problem situation is recorded in the first two stages of analysis; root definitions and conceptual models then use systems ideas to explore and maintain certain selected features of it; these features,
in the form of systems models, are then compared with the perceived realities in the problem situation itself. The models from stage four provide a means for perceiving reality afresh and initiating a discussion from which changes to improve the problem situation can be sought. This, as mentioned earlier, is achieved by focusing on the differences between the models and perceived reality. In the words of Checkland (1981):

The comparison stage is the point at which intuitive perceptions of the problem are brought together with the systems constructs which the systems thinker asserts provide an epistemologically deeper and more general account of the reality beneath surface appearances; it is the comparison stage which embodies the basic systems hypothesis that systems concepts provide a means of teasing out the complexities of "reality".

The four most commonly used methods of conducting the model/real-world comparison have been discussed in chapter four. No matter which approach is adopted, the initial comparison is usefully done at the level of the Root Definition itself i.e., how does it reflect current perceptions? For example, the perception of an academic library by, say, a professional librarian might differ remarkably from that of an ordinary library user: whereas the ordinary user perceives an academic library as a place to borrow and use educational materials, the professional (academic) librarian might view the library as part of the entire academic programme. The way each of them would define the role of the library would reflect his/her perception of its role. Moreover, since human situations are diverse, the method of comparison chosen would depend upon the nature and background of the organization in question.

For the purpose of this research the method of comparison found to be more helpful is the 'scenario-writing' approach, otherwise referred to as "Historical Reconstruction" method, whereby the activity system is "operated" on paper, to reconstruct a scenario describing how things might happen given the RD in question and the resultant conceptual infological model.
This method of comparison is thought to be most appropriate in this situation because: (i) The researcher has been employed by the organisation under study for a period of over a decade, and is thus very familiar with most of its operations; (ii) the distance involved between London (where the study is conducted), and Nigeria, where the organisation involved is based makes this the best approach; and (iii) that the amount of data gathered during the ten-week period of study visit by the researcher was sufficient to permit the use of scenario building.

This scenario is then compared with historical happenings known to people in the problem situation\(^1\). As pointed out by Checkland (1972) the comparison may be in general terms: how does the mode of operation and structure of the conceptual model compare with what exists in the real world as it emerged from the analysis? Or it may be highly specific\(^2\). In the comparison stage, conceptual model helps tackle the problem solving in a structured way, not to prescribe what 'ought' to exist.

It must be pointed out at this juncture, though, that the comparison carried out here is only a fairly high-level appraisal of the differences between the model and the actual situation. Conceptual models tend to be what Checkland calls "ahistoric", unless the RD can capture something of the previous history situation, adding that ..."implemented conceptual models would require inhuman beings to operate them".

\(^1\) I owe this to my valuable discussion with Peter Checkland and Sue Holwell, both of the department of systems, University of Lancaster.

\(^2\) In a project involving a textile company, reported by Checkland (1972), a conceptualisation was used to define a written set of detailed specific questions which were then answered by reference to present arrangements.
It should be stated here, that only the most basic components or elements, and sets of elements necessary for a general conceptual model of the role and mission of the circulation subsystem within its immediate environment were identified in the conceptual model built in chapter 4. These elements encompassed those within the library’s environment referred to in chapter 1.

The Root Definition and the resultant conceptual model are primarily based on the following assumptions reached during the course of the discussions with users:

(i) The library exists to support the university’s overall academic activities;

(ii) The objectives, resources and activities of the circulation subsystem are there primarily to assist and guide students and staff in the fulfilment of their individual academic, instructional and research goals;

(iii) The primary concern, therefore, of the circulation subsystem is with making it possible to tap the total store of recorded information efficiently and effectively.
7.2 OPERATIONALIZATION AND EXPLICATION OF THE CONCEPTUAL MODEL

When fully operationalized, the conceptual model chosen (i.e. conceptual model of root definition 3) should enable the system under investigation to work as follows:

The first element of the model appreciates the characteristic nature of the environment, being an academic community. This implies working towards the realisation of the academic ideals of the university. All goals and objectives of the system should gear towards assisting the university to achieve its fundamental objectives of teaching and research. This in turn means that all library materials purchased and put into circulation, as well as all human and material resources must reflect the teaching and research needs of the users of the system. The library as a whole can be viewed, thus, as an open system, affected by contingencies placed on it by its own environment\(^3\). With such an open system, the organization is capable of bringing in resources to modify its own internal work-flows, structures, and procedures.

If the library is studied as a system interacting with its environment and bringing resources (human, financial, and material) into the library, the dynamic aspects of the library’s internal organization, design, and structure can be better understood.

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\(^3\) An open system is one in which some kind of exchange takes place between the system and its environment. The general perspective of the open system is that the organization obtains its resources and energy from its environment, transforms these resources into products, and exports the finished product or services back into the environment.
There is also the need to appreciate modern information technology and its consequences, as shown in element 3 of the conceptual model for root definition 3. This appreciation needs also to be updated from time to time (element no.4) in order to be up-to-date due to the rapidly changing nature of the technology. The significance of this element in the model can be seen from the result of the analysis of the existing system, which reveals in part, the level of frustration that both the users and the operators of the existing system reported⁴. Such a need cannot be expressed any better than the way it has been put by Markuson (1978: 205) in a rather generalized remark when she states that:

Librarians have almost never been satisfied with circulation operations; users are perhaps even less happy. The reason is readily apparent. As more and more flexibility 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.

This view was amplified by Boss (1979:10) where he states that:

Libraries are labour intensive organisations 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.

It is clear then, that the advantages to be gained from modern technology by libraries include speed of access, control of operator over the course of search, and access to several computer capabilities.

⁴See the concluding section of chapter 5 which summarizes the findings.
However, as with all changes, the application of the digital computer to library operations and transition from manual to computerized systems can be either rewarding or it can be a nightmare. Jackson (1974: 180) gave a concise historical account of the emergence, development, and the influence of modern technology in today's organizations, arguing that the electronics industry is perhaps unique in the degree to which it succeeded in persuading customers to share the burdens of its private economic and technical growing pains. Much of this, according to Jackson, is because of the influence of military research and development.

For the military, it is mandatory for weapons with long development lead times to embody the most advanced technology available when the development begins if they are to yield a season of military superiority during their service life. This desire for a clear and continuing technical superiority has stimulated a defense research and development industry which works in the iffy world of technical possibility in which it is often said, only partly jest, that "if it works it's obsolete".

The nonmilitary customer has, in many cases, been bitten by the bug of technical superiority and has been persuaded to watch scientific and engineering developments with the same intensity as the military. As in business systems, so in librarianship and information science: effectiveness will be utterly dependent on how well the individual firm has come to understand its operations and how well it is able to translate that understanding into systems designed to express the tactics and strategy of management.

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5 This and other aspects are discussed in Allan M. Rees. "Libraries and Information Centers" College & Research Libraries. 25 (May, 1964):200.
In Jackson's (1974) words: 
"the practice of intelligent choice in the matter of what we want technology to supply for our purposes can only come through a widespread increase in technical literacy".

This brings us to the controversial issue of the transfer of technology. In the developed countries technological innovations have been part of their total historical experience. Benge (1979) refers to economic, social, religious and political factors which have combined with "accidents of geography" to produce a new world (p40). But the developing countries have to import technology from the outside, and in consequence a large part of this transferring process is beyond their control, so that nobody can predict the consequences.

Within the new countries the political decisions consist of choices not about their own research but about what technologies to adopt and where they should come from. But whatever form this activity has taken, the difficulties have usually been more apparent than the successes.6

It is in view of these difficulties that McKee (1989:130) raised four key questions concerning the role of information technology in organizations as follows:

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6Benge also noted that in making these choices various economic strategies have been adopted. At an earlier stage ex-colonial countries continued to rely on export of primary raw materials for their survival. This meant importing manufactured products and the technology stayed where it was ... in the metropolitan countries. Later attempts at importing substitution were made by manufacturing goods within the countries concerned, although the machines for this purpose had still to be imported. A more recent development has been the use of foreign capital, and setting up of subsidiaries by the multinational corporations to promote indigenous production. This does mean that the industrial production does take place within the developing countries for the international market. It leads to an increased use of local capital to finance joint ventures, and governments have required that companies should be "indiginised" by local majority share-holding.
(1) How can a coherent Information Technology development strategy be produced and implemented, given the wide range of technologies and the rapid pace of development?

(2) How can organizational structures and technological systems be brought into line, given, on the one hand, the need for (some) centralized computer networking?

(3) How can the knowledge and expectations of new generations of Information Technology-literate staff be incorporated and supported in organizations where resource constraints limit progress in IT applications?

(4) How can technological change be accommodated without dislocation and disruption within the organization?

His conclusion is that the successful harnessing of Information Technology to organizational goals requires much more than technical 'know how'.

Information Technology raises strategic questions about organizational structure, management style, the nature of services offered, and the internal processes by which those products/services are being created and delivered. It raises a number of important 'human' considerations relating to attitudes, behaviours, and applications for staff and customers in the way the technology might be used. It raises significant operational issues if a decision is taken to install, say an automated circulation system. Technology is a catalyst for change. But organizations evolve more slowly than do technologies, and the pace of change within organizations needs to be judged with care.

The fifth, sixth, and seventh elements of the conceptual model call for identifying the actual and the potential users of the system, their capability in using information technology, and their requirements for information. From the assumptions underlying the model, the primary intended users of the system are the students and members of staff.
It follows, therefore, that effectiveness of the system is primarily and directly related to the
degree to which its services are beneficial to these groups in the accomplishment of their
respective academic and research goals and purposes.

As mentioned elsewhere in the literature review, we are now in an era in which the client,
or customer is being perceived less as a recipient and more as a participant. Many have
referred to the present period as the day of the client, or consumer, or the participant citizen,
all expressing opinions and needs, of even at times demanding rights. It is also noted that
in academic librarianship, as opposed to most other professional service fields, the primary
intended clients or users, i.e. students and staff members, are more informed, more highly
educated, often more mature, and generally less beset with special problems and deficiencies
than are users in the other areas concerned with evaluation of programme effectiveness and
which include user input in the evaluation.

Elements 1 through 7 in the conceptual model give rise to activity No.8, "organize to be able
to meet information requirements". This involves acquiring and retaining the basic human,
financial,and material resources necessary for the system to perform its mission. In particular,
it calls for the employment and/or training and retraining the staff required to perform the
needed services, purchase and maintenance of required equipment for rendering the services,
as well as creating and maintaining a sound organizational basis for managing the resources.
This activity, though very essential, seems to be an area in which librarians have lapses.

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7 See Betty Marie Sell. Towards a general open system model for effective management
and research of the academic library in its setting. Ph.D dissertation, The Florida State
University School of library Science, 1981.
Activity 8 in the model is therefore, simply a means of ensuring that the right course is followed in our attempt to organize and satisfy the service requirements — after all, management is essentially about decision taking — which course to follow, given all the constraints we know and anticipating some which we do not know, to achieve our objectives. This calls for defining realistic goals which contribute to the achievement of the overall objectives and which are achievable in weeks rather than years, as well as using our staff resources as economically as possible to achieve our limited aims. This could be achieved by, first, identifying the problem itself: its causes, its complexity, its scale and its interaction with other problems, and of the cost of resolving the problem. We must equally assess the supposed benefits from resolving the problem; i.e., what benefits will be achieved. Can we quantify the benefits? If so, is it worth the cost, or is an alternative exercise to be preferred?

This will then lead to activity 9 which calls for investigating the depth and breadth of the user education that the organisation would prepare its resources for. This is compared with the level of users’ capability to use the generated information technology resources with a view to deciding on more effective approaches of educating the users on their searches. By so doing, we shall be able to know the level of preparation required on our part in terms of appreciating the technology itself, and the level of preparation we should give the user who intends to benefit from the system.

Activity 11 is preparing the user. This implies the necessary instructions that the user needs in order to get around the system as efficiently as possible. This is important because as Oyewale (1983) has revealed, "most academic library clientele in Nigeria hardly read books or seek information not directly relevant to their curricula needs". He quotes Fafunwa, saying:
"We are yet to devise effective means of guaranteeing that the human persons we are attempting to develop must be sustained and reinforced through and be further developed after schooling through study. We have not helped them develop natural reading habits, to read for pleasure, to read for further development and seek knowledge voluntarily. We have only succeeded in stimulating them to read for examinations, and once the examination Goliath is conquered, little David retires to his camp and awaits the next Philistine if he ever comes at all".

Another dimension to this problem can be seen from the findings in chapter 5, where among the undergraduates surveyed, 64% reported that they never attended any library orientation programmes when they joined the university. Among staff users of the library, the figure for non-attendance of such programmes was found to be more than 80%, while it was 85.7% among post-graduates. The findings also revealed that the library users had not been responding positively to the library’s orientation programmes. It is in view of this that the conceptual model includes activity 13 (preparing the user) so that more effective methods of library instructions could be designed.

In his Mission of the librarian, published in 1934, Jose Ortega Y Gasset (1931) refers to the librarian as: "a filter interposed between man and the torrent of books". Commenting further on this, Asheim (1982) revived the metaphor to describe the librarian’s special contribution to society in the contemporary world. Given increase in publication and communication through a variety of channels, what is needed is a device for filtering information: for preventing information overload, for seeing that the right information reaches the right person at the right time, and for protecting him from information which is irrelevant and distracting. This is to be achieved through selecting information to be stored ready for future use, and by acting as an intermediary, releasing information or withholding it.
This in turn involves first "refining and extending the interpersonal exchange by which the user's need can be focused on the usable part of the total information available" and second "redesigning library processes and procedures so that users themselves can more easily accomplish access to or protection from information". In Asheim's words:

The function of the librarian ...is not only to act as a filter but also to make it possible for the users to act as their own filters... The librarian's goal should be to use our special techniques of sources, content, retrieval techniques and bibliographic control inventively and imaginatively in each case to help the individual to find his or her way ___ not ours ___ through the complex and many-faceted store of information. (Asheim, 1982: 215-226)

As regards preparing the user, Marsterson (1986) enumerates three roles for the librarian to hold concurrently: custodian, communicator and educator. In the first role he collects recorded information, in the second case he uses the collection to give answers to clients' questions and in the third he offers the collection as an ordered and accessible set of information objects for the client's benefit in terms of increased understanding and ability. The custodial role implies the ordering of the collection, but the educational or instructional role includes active attempts to promote its use. The communicating role involves use of the collection but does not necessarily require active participation of the user, beyond making request for information. When however the communication of information and the ordering of the information collection are designed to allow people to increase their understanding of a subject in the process of using the service, the librarian may be said to be fulfilling an educational role. This supports the working of the conceptual model in chapter 4, which implies that as an educator, the librarian has amongst his aims that the client should be capable of using information sources and have some appreciation, too, of information retrieval.
Finally, within the inner system model, activity 12 implies providing direct services after taking activities 1-11 fully into consideration. These services include:

a. Charging (loan) of library materials.
b. Maintaining currency in information about total transactions
c. Discharging of returned library materials.
d. Making renewals.
e. Making records of the items on loan, reserved, or sent for rebinding.
f. Being able to make records of library materials requested while out on loan, and flagging them automatically for prospective users on return.
g. Prepare recall notices for library materials urgently needed back, and treating them promptly on return.
h. Providing statistical information on the use of the library stock.
i. Signal and deal promptly with over borrowing.
j. Calculate fines on return of overdue library materials.
k. Update and amend book and borrower personal information when such needs arise.

Activities 13 through 16 constitute monitoring and control. As can be seen, activity 13 defines the yard-stick for an efficient service. To achieve excellence, Martell (1989) identified a number of basic factors. First, there are basic operational factors, such as how many, how fast, how good. Second, there are some factors which can be regarded intermediate regarding performance in an organization: how effective, how efficient. Finally, there are other factors which relate to the basic mission and the place of the library.
They place the library within an encompassing social context which includes the social utility of the library's circulation subsystem as an institution; the degree to which the system enhances our democratic process and skills and aptitude of our population; the benefits of the system's services to the process of scholarly communication; and the contribution of the system to the creation and application of knowledge.

The measures of performance as laid down by activity 13 must be used in activity 14 to monitor what takes place in the operational system (activities 1 through 12).

The arrow from the combination of activities 1-12 going into activity 14 implies a reporting relationship, which should enable activity 14 to perform its monitoring role. Likewise, activity 15 lays down the parameters for defining an acceptable level of satisfaction in order for activity 18 to evaluate how satisfied the users are with the information services provided to them, and also take appropriate control action (activity 16). However, whatever control action is going to be taken, it is to take into consideration the human and financial (resource) constraints within the entire system. Activity 21, in turn, monitors the findings resulting from activity 18 in order to make recommendations to the higher authorities. These recommendations might be in the form of making internal adjustments to improve services, or seeking the assistance of the higher authorities.
It should be noted after comparing figures 4.5 and 6.1 that some of the elements of figure 4.5 have dropped out completely. Some of the replaced elements of fig. 4.5 were those included in the model for the benefit of the users during the initial discussions in order to enhance their insights of the modelling technique in SSM.

Results of the findings reported in chapter 5 have revealed that under the existing system, the operational procedures differ from what is proposed in the conceptual model. If we model the existing system and how its procedures are performed, we shall have the following:
Fig. 7.1 A conceptual model of the existing system
The circulation of books and other materials constitutes an important part of the mission of any circulation system. Users visit the library, among other things, to be able to consult and/or borrow materials for predetermined periods of time.

Circulation records, therefore protect the library’s investment in its collection by fixing the responsibility and date for the return of borrowed library materials. Added to this, the circulation records contain information which, when extracted and properly analyzed, can serve as an aid to collection management.

As described in chapter 4, the master circulation file of the library under investigation consists of paper cards, each containing information about a particular circulation transaction. It is this master file that reflects the library material in circulation at any given moment. Cards are filed by accession number and due date for simplified identification and reprocessing of overdue items.

A number of operational problems have been identified with regards to the record-keeping aspects of the existing circulation system. One important aspect is the characteristically labour intensive nature of the operations, involving such time-consuming work routines as filing single-copy book cards, checking card files to determine the circulation status of specific items, identifying overdue items and subsequently preparing borrower notices, and computing fines.

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8 See the summary of findings at the end of chapter V.
Taking the average of two working minutes associated with filing, removing, and otherwise handling each card\textsuperscript{9} in the master file, then the main library (with an annual circulation transaction reported at about 400,000 items) must expend almost 7000 hours in file maintenance alone each year. Even at the relatively very cheap labour rate of a Developing Country (about £2 per hour including fringe benefits), the annual cost of file maintenance will be about £14,000, which will come to nearly N210,000 in Nigerian local currency (using the official exchange rate of Fifteen Naira to one pound sterling). In some cases, this required labour commitment is increased by a high volume of circulation activity, continued demand for longer service hours, as well as characteristic multiple service points.

Another finding of chapter 5 of this research is the clerical rather than professional nature of the circulation transactions routine. This contributes to the errors in filing reported, as well as errors in other related record-keeping tasks --- not even to mention low employee motivation and high staff turnover with its associated retraining costs.

The barely clerical nature of the circulation transaction routine is perpetuated by the nagging problem of staff turnover, which means that most of the circulation desk staff are recruited from the rank of young men and women graduating from post-primary schools. Such cream of young people rarely find careers in librarianship "challenging" enough to maintain their interests, and they mostly use the library as a "waiting wing" for launching themselves into other careers or into further education. As a result, they make errors or require considerable supervision, which in turn increases total system costs.

\textsuperscript{9} See fig. 8 on Time spent at the circulation desk by users to perform transactions.
Errors and staff turnover aside, the scope of the existing system is necessarily limited to activities which are directly related to the charging and discharging of library materials. As shown again by the findings of chapter 5, accurate circulation statistics such as explicated under the conceptual model (which are essential to the informed management of collection development activities) are very difficult or impossible to derive.¹⁰

A closer look at the main features of the conceptual model as well as the features of the existing model, and the summary of the findings in chapter 5 reveal other fundamental differences. It can be seen that under the model of the existing system, appreciation of modern technology and its consequences are non-existent, although all parties concerned were convinced about the potential benefits that it could bring.

It can be seen under the existing system, for example, that the system’s ability to satisfy users’ requirement for information is weakened by its inability to process a simple recall notice with despatch as suggested under the conceptual model. A factor of satisfaction in any circulation system is its ability to know the whereabouts of an item, and recall it if necessary for the next user. However, under the present arrangement, a circulation desk staff has to fill out a sample of the form illustrated below, writing out the particulars of the item being recalled, and addressed to each 'delinquent' or negligent borrower:

¹⁰ Properly prepared and presented, circulation statistics can assist bibliographers and other librarians in determining when additional copies of a given item are required and identifying portions of a library’s collection which are infrequently utilized and may consequently warrant a reevaluation of prevailing selection policies. Given the high prices the library pays for books and other materials, the ability to avoid inappropriate purchases is of obvious importance.
RECALLING OF BOOKS

USMANU DAN FODIYO UNIVERSITY LIBRARY

Could you kindly return the following Book/Books which you borrowed from the library. The Book/Books are needed very urgently.

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Class Mark</th>
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To: ____________________________

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.........................
Circulation Librarian
As it can be observed, this sample form does not even contain the date the item might have been borrowed from the library, nor does it contain an indication of how many days the item has been overdue. This makes the calculation and collection of overdue fines more difficult. Moreover, the fact that particulars of each item has to filled out tediously by pen makes the circulation desk clerks less interested in pursuing overdue materials, since with the staff shortage the free time has to be spared for such a task. Table 5.7 of chapter 5 also reflects the inadequacy of the working files under the existing system, where two heads of circulation departments reported that the files currently maintained in their departments were bare adequate for answering the queries put to them, while one head of department reported that it was not adequate at all.

Activity number 8 exists both in the conceptual model as well as in the existing system model. The major difference, however, is that under the existing system model, the level of preparation for the interlibrary lending arrangement does not seem to be adequate enough. It is very important to begin by appreciating and assessing what can be obtained from similar organizations outside, taking into consideration the isolation and remoteness of Sokoto town from most major urban areas in the country, as indicated by the map on page.... Apparently, the management of the university has recognised this problem, since a vehicle had been allocated to the university library purposely for interlibrary loans trips to secure urgently needed materials from other sources outside. Nevertheless, the apparent lack of satisfaction with, or even sheer ignorance about the existence of the scheme is an indication that it is not popularized adequately enough11.

11Fig 10 (chapter IV indicates the poor patronage in terms of interlibrary loans utility, with only 35% of the members of staff reporting that they knew about or have ever utilized the scheme. As reported in the chapter, too, only 8% of the undergraduates who responded to the
As mentioned earlier in this chapter, the main purpose of the comparison is to use the
differences between models and reality to discuss changes which could bring about
improvement in the problem situation. "The models are not necessarily thought of as designs,
as happens in 'hard' systems engineering. Here the thought may be to make reality either
more or less like the model: the purpose is to make the debate (for improvement) a coherent
one" (Checkland, 1989).

By this, we look for possible changes which appear to those managing the system to
constitute potential improvements worth trying. Such changes, as argued by Checkland (1989,
ibid) have to meet two rather different criteria simultaneously. Firstly, the comparison of a
fecund reality with a number of models (which are simply logical machines) will generate
ideas for changes which are systemically desirable, such as instituting mechanisms for
assessing effectiveness, making sure resources are appropriate, ensuring that logical
dependencies are reflected in real-world sequential actions, etc.

But this logic is not enough. People will not always be motivated to implement change which
is justified merely by logic! The debate must also find its way to changes which are also
culturally feasible in the particular human situation in question\textsuperscript{12}. This is one reason why
it is so important in SSM to think carefully about the Weltanschauung of each RD and
model: CATWOE's \textit{W} is a way of ensuring the cultural aspects cannot be completely ignored.

\textsuperscript{12}The history of the situation, its myths and meanings, for instance, will always affect this
issue.
It is this need for cultural feasibility as well as systemic desirability that differentiates the 'Soft System' Methodology from other so-called 'Hard Systems' methodologies as practised by engineers and scientists, ..."who tend to overemphasize the importance of logic, and fail to notice cultural aspects which in fact determine whether or not change will occur" (Checkland, 1989, ibid). If both logical and cultural criteria are not kept in mind, then the chance of achieving change will be much reduced. Cultures are never completely static, and SSM can be seen as a way of exploring them and enabling them to change.

So far, this chapter has attempted:

1. To make a fundamental assessment of the circulation system's role in its wider environment, i.e. the academic community.

2. An attempt has also been made to examine a 'system' thought to be relevant to the library based on the purpose and mission of the wider system.

3. The selected Root Definition upon which the discussed conceptual model was built has been found to hold promises for beneficial changes. That definition is:

A University library-owned system run by professional and support staff, employing technical and other skills, assisted by modern information technology to process and provide lending and other bibliographic and/or referral services to users (including the keeping and periodic update of the records of such transactions) within statutory, local and organisational constraints.

4. The conceptual model derived has been compared with existing operations, making expansions where necessary in order that the differences identified can "generate" discussions about desirable and feasible change.
5. Fundamental differences (with broad implications) have been identified through the comparison as follows:

(i) the system implied by the conceptual model will enable the circulation system to play a more crucial role in the wider system.

(ii) a more active instructional role is implied for the circulation control system staff in particular, and the library in general by a more thorough method of preparing the user to appreciate the need for him not only to wait for assistance, but to assist himself.

(iii) The necessary need for the system to emphasize training and retraining of staff.

(iv) The modelled system also implies a more effective monitoring and control activity.

(v) Finally, the most important factor upon which any desirable and feasible change can effectively take place is the ability of the system to appreciate modern technology and its consequences.

As pointed out earlier, the comparison carried out in this chapter is only concerned with making a fairly high-level appraisal of the mismatches between the selected conceptual model and the actual situation as a first round of the soft systems study.
In most cases, after further discussions with the client it is possible to expand the analysis, whereby each sub-system of the first-level model is decomposed by developing a root definition for the sub-system, and then constructing a second-level model. The process is then repeated for each model, etc until the lowest level is identified. However, it is felt that unless the client fully understands and accepts the amount of time and effort involved, it will be fruitless to go beyond what has been done so far.

The subsequent chapters will examine in some detail possible ways for the creation and implementation of a "desirable" and "feasible" information system relevant to the circulation department as well as its structural, procedural and attitudinal implications, bearing in mind the findings of chapter 5 as well as the modelled system discussed above, within the framework of SSM.
8. THE SEARCH FOR FEASIBLE AND DESIRABLE CHANGES

If you want to go places, start from where you are.
If you are poor, start with something cheap.
If you are uneducated, start with something relatively simple.
If you live in a poor environment, and poverty makes markets small, start with something small.
If you are unemployed, start using your labour power; because any productive use of it is better than letting it lie idle.
In other words, we must learn to recognise the boundaries of poverty. A project that does not fit, educationally and organizationally, into the environment, will be an economic failure and a cause of disruption.

E. F. Schumacher

The previous chapter attempted to compare the selected conceptual model with a model of the existing operations and structures so as to use the differences to introduce discussions about desirable and feasible changes. In particular, the comparison has helped to identify some fundamental differences, which include the following:

(i) the ability of the system to make relevant appreciation of computer technology and its consequences.

(ii) the ability of the modelled circulation system to play a more crucial role in the wider system, through an enhanced Management Information System;

(iii) a more effective monitoring and control activity;

(iv) a more effective instructional role for the circulation control system staff in particular, and the library in general by a more thorough method of preparing the user;

(v) an emphasis on training and retraining of circulation system staff and;

(vi) a more realistic cooperation scheme as well as making the user more fully informed about its operations.
8.1 SYSTEMICALLY 'DESIRABLE' AND CULTURALLY 'FEASIBLE' CHANGES

This chapter examines in some detail the differences identified between the existing system model and the selected conceptual model in order to discuss their implications in bringing about feasible and desirable changes. The role of modern information technology in the developing country library in general, and the Usmanu Dan Fodiyo university library in particular is discussed, taking into consideration the responses given to questions 10 and 12 of the questionnaire to the heads of circulation analyzed in chapter 5, as well as the potential role it is shown to have during the comparison of the existing system model with the selected conceptual model in chapter 7.

It should be noted here that whereas in 'hard' systems work the change envisaged is the creation and implementation of a system, in most cases the eventual action resulting from 'soft' system work is more likely to be the introduction of a more modest change although sometimes, appropriate action might entail, say, the implementation of a planning system, or an information system to serve existing functions. As mentioned earlier on, changes of three kinds are possible: changes in structure, in procedures, and in 'attitudes'. Structural changes may be organisational groupings, reporting structures, or structures of functional responsibility. Procedural changes are changes in the dynamic elements: the processes of reporting and informing, verbally or on paper, all activities which go on within the (relatively) static structures (Checkland, 1981: 180). Changes in attitude include many other crucial, but intangible characteristics which reside in the individual and collective consciousness of human beings in groups.
The term is intended to include "such things as changes in influence, and changes in the expectations which people have of the behaviour appropriate to various roles, as well as changes in the readiness to rate certain kinds of behaviour 'good' or 'bad' relative to others" (Checkland, ibid).

The changes sought for in 'soft' system work are changes which meet two criteria. They must be arguably systemically desirable as a result of the insight gained from selection of the root definitions and conceptual model buildings, and they must be culturally feasible given characteristics of the situation, the people in it, their shared experiences and their prejudices.

8.2 IMPLICATIONS OF THE CONCEPTUAL MODEL ELEMENTS

As Wilson (1984) has pointed out, prior to any study, some appreciation of the situation will need to be acquired and issues such as the following will need to be considered:

(a) What is taken to be the boundary of the area under study?

(b) What interactions are assumed to exist in relation to this particular boundary?

(c) What kind of activities are likely to be present within this area?

Of the elements contained in the conceptual model presented in chapter 4 and discussed in chapter 7, "appreciation of modern information technology and its consequences" seems to touch on all three aspects of change mentioned above --- structural, procedural and attitudinal

1Once changes have been agreed, implementation of them may be straightforward. Or their introduction may change the situation so that although the originally perceived problem has been eliminated, new problems emerge. Or the activity of implementing changes may itself be problematic ____ and this new problem may also be tackled by means of the methodology.
and as such deserves a more thorough discussion and explication both in terms of logical and cultural criteria because "...if both logical and cultural criteria are not kept in mind, then the chance of achieving change will be much reduced" (Checkland, 1989: 97).

Along the same line, Kleinjans (1975) states that:

Science and technology can be borrowed, imported and adapted from abroad. But ultimately creativity from within is the only answer. For development, essentially, is not a matter of technology or GNP, but the growth of a new consciousness, the movement of the human mind, the uplifting of the human spirit, the infusion of human confidence.

The main concern in the literature of transfer of technology has been with the role, often negative, of transnational enterprises. Sufficient evidence exists however, which indicates that the restrictions and control placed by transnationals on the technology they 'provide' are basically similar to those restrictions placed by most suppliers of technology, regardless of size and global interest. Cooper and Hoffman (1978) outline three forms of control which are employed in technology transactions. The first and most straight forward is the 'direct' sale of technology. Here firms purchase techniques and technology directly from capital-goods producers and technical consultants. They add:

Firms in developing countries buy in this form, either because it will give them a competitive advantage in their product markets through a degree of monopolization or in order to survive against competitors who obtained the technology before them.

A second form of control referred to is 'process packaged' sale of technology. Included in this package is the 'innovated component' for which the seller has monopoly control, along with

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additional non-monopolized components designed to complete a system; in this way, suppliers:

...try to maintain the system by engineering the non-innovative components to match up precisely with the innovated one. This differentiation of non-monopolized components makes it difficult for a buyer to make price comparisons for any component in the line.

The third category of technology control is 'project packaging'. Here the seller, often a transnational firm, is engaged in both 'production of goods as well as the production of the technology'. The seller, therefore, has a greater interest in the way this technology will be employed and will attempt direct control of its use.

Also, Rush (1981,) noted that the introduction of pre-existing technology into Third World nations has been seen as being unsuitable. A number of reasons are cited, including technical ones and problems of consistency between foreign technology and development objectives. Part of the solution to this problem has been the adaptation (incremental changes in existing technology) of technology to local conditions in order to make it more 'appropriate'. The development of the skills necessary for the adaptation of technology, skills which may be different from those required in making appropriate choices, can enable both the appropriate choice of technique and the development of a national capability for creating appropriate technology. Incremental changes are made necessary by the various differences between advanced industrialized nations and the Third World, such as environmental conditions, the availability of certain skills and management and work-force attitudes, composition of local raw materials, infrastructural facilities, the size of the market, and preferences in product characteristics.3

3 See Giral and Morgan, 1974, for more discussions on this.
These varying conditions influence the form of adaptation required, which can be categorized as being to the product or to the process. This leads us to the question of technological appropriateness.

8.2.1 APPROPRIATE TECHNOLOGY

Technology has been defined differently by different authors. For example, Susskind (1973) calls technology ..."man's efforts to satisfy his material wants by working on physical objects".

However, this definition is quite restrictive since it implies the use of machines and physical objects to achieve a particular goal. A better and simpler definition would be that of Fuller (1971) who said that technology simply means getting "more out of less".

This definition is more all-embracing and would include not merely the physical tools, but also the techniques, procedures and systems which are used to increase productivity. In a sense, therefore, the term "new technology" implies new systems and techniques of doing things, and within the library and information science field, this means the use of technology to facilitate information retrieval and generally to expedite the routine housekeeping operations of circulation, cataloguing, serials control, etc. There is an abundance of new technology available for exploitation by libraries.
If, as widely believed⁴ the essential problem is not technology itself but the management of technology, then we would realize that there is a tremendous amount of technological know-how to be oriented towards the different needs of each country, according to the quality and rhythm of growth desired for the society we are considering. This, therefore, gives rise to the problem of "appropriate technology".

For, as Haustein (et al., 1980) point out, "...not that we believe that technological modernization can automatically solve the problems faced by these countries, we must also recognize that technological strategies which are inappropriate to the needs of developing countries can create more problems than they solve".

The problem is, what kind of technology is needed to cope with the present situation in these countries? They add:

To propose that these countries should hold their technology, economy, society ... at their present stage is an irresponsible underestimation of their real problems. Preservation of the status quo is out of the question. The demand for technological, organizational and social innovation in the developed countries is too great.

The idea that developing countries should resort to appropriate technology in order to promote development is in the process of becoming an accepted fact, both for national policy makers in these countries and for aid-giving organisations in the industrialised countries, and appropriate technology is progressively entering into the mainstream of development aid (Je’quier, 1976).

The most conspicuous origin of the concept of appropriate technology is the realisation, shared by aid-giving and aid-receiving countries alike that development aid and a Western style of industrialisation have neither fulfilled the initial hopes which were placed in them nor been fully capable of solving the basic problems of development.

The disillusion with foreign aid, which several studies have fully documented⁵, is not much due to inefficiency, lack of money, ignorance or the importation of inappropriate technology, as to the fact that we know quite a lot about the reasons why a particular society has developed, we know very much less about the ways in which a process can be deliberately and successfully engineered ___ which, again, leads to the issue of management raised earlier.

The Appropriate Technology method attempts to recognize the potential of a particular community and tries to help it to develop in a gradual way⁶. A technology is considered 'appropriate' when its introduction into a community creates a self-reinforcing process internal to the same community, which supports the growth of the local activities, and the development of indigenous capabilities, as decided by the community itself. A community can be described in terms of people, activities they perform, and environments from which they are surrounded. Chestnut (1972) gave a general block diagram which shows two feedback loops in the behaviour of the community as follows:

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⁶This idea was first introduced by Dr. Schumacher as Intermediate Technology, a new route to development, as a self-help approach at a seminar on "Technologies For Small Industries in Rural Areas" organized by the Indian Planning Commission at Hyderabad in March 1964.
The first loop is connected to activities for which the inputs are the three basic resources of each society: materials, energy and information. The second loop is connected to people whose inputs are conditions, expectations and aspiration. Number and capabilities of people as well as their ideas and actions are the transforming factors of the three basic resources of the first loop. The final outputs of both loops are products, services and new ideas, which together on their turn influence activities and people environments.
"Growth (of a country) defined as the increase of its production of material goods and services, can be measured on quantitative criteria in terms of products and services by universally accepted economic indexes: it must therefore be analyzed with the response of the first loop.

"Development", defined as the capacity to solve one's problem using one's resources, is linked not only to tangible resources but even more to the conditions, expectations and aspirations of people, that is to cultural, social and economic situation of the community: therefore it must be studied including qualitative criteria which can be found analyzing the response of the second loop.

8.3 SELECTING THE RIGHT TECHNOLOGY

A design problem requires for its solution: (i) Resources, i.e certain disposable factors to be used as inputs; (ii) Technology, i.e, certain knowledge or ability to combine resources in order to achieve objectives.

Resources are the disposable factors which can be used to achieve objectives. The concept of disposability involves three properties: (i) disposability means physical accessibility. For instance, to make furniture, wood would be a resource, if it is physically accessible. (ii) disposability means an appreciation of the existence of resources. For instance, if a country has mineral resources but no one knew it, then they are not resources for that country at the present. (iii) disposability means knowledge about how to use resources. The concept of resources is therefore a relative one and varies. So, what is a resource for some people, for another people it may not be a resource at all.
This relativity of resources implies the possibility for each society of creating own new resources for more effective problem solving. This is a process known as innovation. Therefore, one of the requirements of appropriate technology is appropriate innovation, that is the development of new resources based on local low cost ones.

It is from a representation of reality and a resource inventory that one must define the design problem, comparing the present perceived situation with a more desirable one. Thus, when the problem and a set of resources (including technologies) have been defined, we select the technology to be applied according to some optimal criteria derived from our subjective values and objectives.

8.4 INFORMATION TECHNOLOGY AND THE DEVELOPING COUNTRIES: HISTORICAL BACKGROUND

On December 20, 1968 the General Assembly of the United Nations passed a resolution (2458 [xxxiii]), calling upon the Secretary General to prepare a report dealing with the computer and its role in international cooperation. This report was duly produced and recognized as "...the first comprehensive study of this important question in the United Nations..." (UN, Economic and Social Council, Resolution 1571(L) 1971) but there was still a concern that it did not "...cover all aspects of the question, particularly as regards data concerning the developing countries" (ibid).
Consequently, the United Nations Economic and Social Council, where these concerns were being expressed, in May 1971 passed Resolution 1571L on international cooperation with a view to using computers and computational techniques for development, calling for a new report and increased international cooperation. In the preamble to the resolution the Council expressed the opinion that "...during the Second United Nations Development Decade the application of science and technology should make a vital contribution to the economic and social advancement of all countries, particularly the developing countries, and ... computer technology is destined to play a leading role in this process."(ibid).

Later in the year the United Nations General Assembly adopted Resolution 2804(xxvi) asking for an update of the 1968 report; they indicated that they were "convinced that the utilization, on a world-wide scale, of electronic computers and computation techniques may make an important contribution to accelerating the progress of vital economic and social sectors..."(UN General Assembly Resolution 2804 (xxvi), 1972).

The report was published in January 1973, together with a series of agenda and annexes. Data used in the compilation of the report came from a variety of sources, including a questionnaire sent to member states which revealed that both the number of computers and the range of applications for which they were being used in developing countries were increasing significantly. It was concluded that during the Second Development Decade this trend would continue at an increasing rate. In the preamble to the General Assembly resolution quoted above a conditional "may" was used in relation to the potential application of computers; the Secretary General’s report was more conclusive — "Computer technology, wherever appropriate and through sound application, can significantly contribute
to accelerate the rate of the economic and social development desired in the developing countries" (UNESCO, Report prepared in response to General Assembly Resolution 2804 (xxvi), 1972). A series of specific recommendations was made. Each developing country was urged to formulate a broad national policy, consistent with its national goals, on the application of computer technology in five main areas: social, economic, environmental, scientific and technical, and management and administrative. The need for integration with plans in all fields, and the need to establish ordered priorities and goals, both short-term and long-term, were stressed. It was argued that the situation in each country was affected by a number of variable factors that should be carefully examined before decisions were taken. These included the desirability of using computers as opposed to manual methods, the need to develop technology internally and control imported technology, the shortage of skilled manpower, the shortage of foreign currency, and the vital problem of need for employment creation. It was recommended that each country encourage an indigenous supply of services, both in the field of software and hardware, and that computers be used in management only where benefits could be assured.

Governments were urged to give strong administrative and resource backing to the policy they adopted and ensure that resources were adequate to meet proposed developments. The user was to receive priority, and, in acquiring technology, countries were urged to consider factors other than cost.
The problem, as stated by many authors is one of 'achieving an appropriate balance between foreign and local supply of the required technological inputs'. This balance will change over time as local capabilities are developed and replace imported capabilities. Many commentators⁷ are agreed that in principle the NICs have the relevant economic strength and technological capability to adapt reasonably well to shifts in the world economy. However, this is still a relatively small 'club' for, as Hoffman and Rush (1980) point out, only 12 NICs account for nearly 80% of total manufactured exports from the Third World.

In order to incorporate these technological issues it is necessary to go beyond a simple North-South view of international relations. In the South, for example, some discrimination is required between at least three different categories of countries: large, newly industrialized countries, (e.g Argentina, Brazil, India); medium-sized economies, (e.g Egypt, Kenya, Nigeria, Pakistan); and small economies which could be further differentiated into those relying on primary products (such as Guatemala) and those relying on 'runaway’ industries or sub-contraction (e.g Singapore, Taiwan) (Rush, 1981).

Libraries and information centres in the Advanced Industrial Countries (AIC) are primary agencies for identifying, selecting, acquiring, processing, storing, retrieving and disseminating knowledge in all its ramifications. Advances in modern technology and the ease of access to such technology provided the necessary impetus for this new operational concept. Thus computer, telecommunications, micrographs, etc are a common feature in the information transfer environment in most Developed Countries.

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Indeed, libraries are a microcosm of the whole predicament of such a country seeking to introduce new systems copied, adopted or modified on the advanced models. As Massil (1983) puts it ..."information services themselves are a crucible for testing the intentions of countries grappling with the problems of national development and hoping to harness some of the world's resources to their drive to participate more fully in it".

Advanced information systems will rely upon, and exploit very comprehensively all the models of electronic aids and switching mechanisms for the support of a network. The pattern of the future is referral and exchange of information, conservation of materials in whatever form for the storage and manipulation of data by electronic means. Libraries and information centres that are not geared to participate in these will be by-passed in favour of those that are.

Developing Countries are faced with numerous difficulties in their attempts to provide a modern information service. Libraries in many of these countries are presented with a number of problems because of their geographical location and prevailing social, economic and political conditions. Frequently, telecommunications are poor, and the lack of a packet switching network means that on-line searching of remote databases is either impossible or prohibitively expensive. Additionally, such items of technology that are bought by the Developing Countries from the Developed Countries are often sold as packages with little direct transfer of technology: after-sale service and maintenance is carried out by the supplier. Although this is a broad oversimplification⁸, it is clear that the trend has been to foster a dependent relationship between North and South because this helps to create and preserve markets.

⁸See Kaplinsky, 1979; and Jacobsson, 1979 for a thorough treatment on this issue.
The extent of the disparity between North and South can be seen in a comparison of research and development (R & D) expenditure. The Organization for Economic Cooperation and Development (OECD) figures for 1973 indicate that Developing Countries only had 13% of all researchers, and spent only 3% of the worldwide total R&D budget of around $100 billion (Bessant, 1989).

The question of technological relationships across the North-South divide is a complex one, but in essence is characterized by inadequate transfer of technology. Many authors have drawn attention to the large amounts of ill-considered and inappropriate information technologies which have in the past been "forced" on the Developing Countries by the Western World. In some instances, the cost of proposed large computer systems has exceeded the entire higher education budget of many Developing Countries.

The extent of dependency in Africa in terms of hardware, software and manpower is great, and is compounded by the fact that until relatively recently the training of computer personnel was largely in the hands of the manufacturers. IBM and ICL share the market in Africa. The actual share of the market is difficult to assess accurately, but an official UN document suggests that control was "...predominantly in the hands of one company which had a 70% share in the market in almost all these countries replying to a questionnaire passed round by the UN Secretary General (UNESCO, Resolution 1571L, Annex I, p3). The company is not named but is quite clearly IBM.

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Some countries are further on in the development process than others and can cope better with new technology; new technology may exacerbate some problems while eliminating others. Its adoption, therefore, is a question of national strategy. To take decisions regarding the adaptability of new technology, devise national plans, to utilize available information most effectively requires a strong 'information' component and effective services in the areas of document provision, access and retrieval.

The main consideration of the introduction of new and advanced technology must reflect the extent to which it can be integrated into the everyday operations of the organization concerned. The application must be local, the process needs to be internalised such that the systems to be adopted can be rendered independent of their source, presumably in a developed country.

This way, an imported technology can be harnessed and made to serve an intrinsic local purpose using imported equipment perhaps and original software, but acquiring new skills in the process as well as directing new tools to local ends. Automation is not a static thing nor is it an isolated one; its introduction should bring about necessary redeployment and restructuring.

8.5 MODERN INFORMATION TECHNOLOGY AND THE UNIVERSITY LIBRARY
Some people might question the need for a university library in a Developing Country to make use of an advanced technology for information processing and housekeeping operations. The real question is not whether this technology should be used but whether or not this technology is appropriate in a Developing Country.
Following Lim (1983), when we speak of appropriate technology we usually imply that there is a wide range of available technology to choose from, and the choice of a technology which suits a particular circumstance would be the "appropriate" technology. The choice is, therefore, not between a labour-intensive technology and one which is capital intensive, but between a variety of technologies that will enable a library to serve its clientele effectively. In the context of a university library's operations, the use of computer technology is "appropriate" because all university libraries, whether in the Developing or Developed countries, are faced with the multifarious problems associated with the information explosion, increased demands for services and availability of new types of materials which cannot be treated by conventional methods. Salton (1975) has pointed out that these developments have led to "... a breakdown of established operations, an intellectual crisis among the people responsible for library management, and a deepening space and budget problem" (p3).

As the costs of library operations soar it becomes inevitable that concerned librarians will begin to look at the possibility of reducing costs through the use of modern technology and through new organizational structures and procedures.

Another reason for the use of the new technology is that university libraries in the Developing Countries are usually better endowed than other types of libraries. They have larger and better collections, more and better trained staff and relatively superior facilities.

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10 This and other aspects had been discussed in Chapter one
While standards and provision of services may vary, many nevertheless provide services and have resources which are comparable to those provided by small university libraries in the Developed Countries.

Furthermore, a university library exists in an environment which can be described as 'innovative'. Conventionally, universities are viewed as the seat of learning and the fountain of knowledge. They are frequently also producers of technological innovations and technical expertise apart from being disseminators of knowledge on new technology and its associated gadgetry.

In such an environment, it is virtually inevitable that the library will soon adopt and adapt many of the more advanced technologies which are taught at the university and also used to manage the university more efficiently.

8.6 IDENTIFICATION OF OBJECTIVES, FUNCTIONS AND SYSTEM PRODUCTS FOR A DESIRABLE CIRCULATION CONTROL SYSTEM

From data gathered on the type of management information and the functions and objectives which they expected their circulation control systems to serve (Questions 10 and 12 respectively of the questionnaire to heads of circulation) the following could be said:

8.6.1 Management Information

All three libraries that responded to the questionnaire have indicated that either their management or the library users normally approach them to ask for information of one type or the other. This implies that such information should be carefully considered in recommending any new measures to alleviate the situation.
These include the ability of the system to indicate which items are:

i. available in the library.

ii. Out on loan/when due back.

iii. Overdue.

iv. reserved for another user.

v. kept on permanent reserve.

vi. recalled

vii. sent for re-binding.

viii. more heavily used.

ix. missing.

x. loaned to whom.

xi. reserved by whom.

8.6.2 Functions and service objectives

According to the priority ratings of the heads of circulation who responded to question 12 of the questionnaire to heads of circulation (see chapter 5) as well as from the informal debate with a number of library staff members, a system that they thought could assist them better in the efficient discharge of their duty is one that could handle at least the following:

i. charging/discharging (loan) of library materials.

ii. renewal of loans.

iii. updating files.

iv. recalls/reservations of materials.

v. giving accurate information to users about the status of any circulating material.
vi. tell whereabouts of items with minimum delay.
vii. ensure that items leaving the library are duly charged.
viii. compiling relevant statistics about use of collection.
ix. processing a returned library material within the shortest possible time.

Other objectives not listed in the questionnaire, but which two out of three heads of circulation added under "any others" were:
i. to signal over-borrowing.
ii. to calculate fines on overdue library materials when returned.
iii. to ensure that only legitimate borrowers able to borrow.
iv. to detect and trap delinquent borrowers at point of issue, as well as to spell the reasons for trapping (e.g fines owing, over-borrowing, etc).
v. to trap materials reserved.

8.6.3 Functional Requirements

Based on the functions and objectives discussed above, as well as from the data models of chapter 6, and discussions held with senior members of staff of the university library used for this study the computer-based circulation system’s requirements are categorized below. Fayen (1986) differentiates between "requirements" and "specifications" where she says the former reflect an analysis and understanding of what the system is supposed to do: for example, "Allow patrons to renew books by telephone" is a requirement; "Provide four-character codes for library locations" is a specification. It is only after understanding these differences that librarians can evaluate how best a system can meet a library’s needs.
A requirement, therefore, will describe a need that must be met; a specification will describe how that need must be met. However, a requirement may become a specification if it is so restrictive that the system must be "designed" or implemented to accommodate it: for example, "For each patron the system must provide a unique, numeric identifier that may be scanned automatically or entered on a keyboard" is a requirement. "For each patron identification number the system must provide a nine-digit bar code using Code 39" is a specification.

The main requirements of a modern information technology-based (computerized) circulation system are two-fold: it must be reliable and complete. As far as any computer-based circulation system is concerned, reliability is an uncompromising requirement.

In general, the computer is meant to speed up user services. To be able to do this, the machine has to be available most of the time. A computer-based library circulation system should, therefore have the following functions and features:

a. A **Borrower Master File**: where all information about the borrower is maintained, such as full name, address, bar code, phone number, borrower's status, etc. The library should able to tailor the borrower record format to suit its needs, and this could be reviewed by a library staff member with proper authorization.

b. **An Item File**: where all information about the item is stored such as: the title, author, subject, and bar code. Other information may be included depending on the amount of storage one has, such as number of copies, publication date, ISBN, etc.
c. **Circulation Master File**: where the computer attaches the borrower ID and the item ID together with the current date as an item that is checked out by a patron. In other words, the system should be able to link library items, borrower and date information speedily and with accuracy. Towards this, the delinquent borrower should be identified automatically. Due dates should be calculated automatically by the system, taking into account holidays, weekends, and other days when the library is closed. Items may be checked out to a dummy location such as "Bindery".

All evidence of borrower association with any particular item will disappear from the system and from all records at the time the item is returned.

d. **Recalls, holds, overdue notices and fines**: whereby the system indicates whether an item is available for reservation. The system should be able to produce a listing of materials on reserve by course number, lecturer, author, title, and call number. It should also allow recall and placing holds on items. A library staff with proper authorization may override hold queue. Overdue notices should also be available, since another common reason for implementing a circulation system is to improve the overdue notification and collection. The overdue notices should be easy to create and should be able to be displayed on the screen for visual checking, as well as printed for mailing. Fines may vary by borrower category, item type, and collection within the library. Another important feature should be the ability of the system to allow a library staff with proper authorization to forgive or change amounts of fines.
e. **Selected Borrower File Search**: One should be able, as a minimum, to search by borrower name or bar code. Other searches, such as by phone number or address should also be possible. Searches should not require exact spellings of names, but should either have a phonetic look up or a partial key. If one wants to find "HALIRU", one should be able to enter "HAL", have the file search for all names starting with that partial key, and then page through the file until one finds the desired name.

f. **Activity Statistics**: The system should report on the circulation statistics by various borrower categories and various item categories. These statistics should be easy to recover and must be able to be displayed on the screen or the printer. Such statistics should include: the previous days circulation transactions, the number of returns, the number of reserves placed, items out on loan, etc.

### 8.6.4 Data Base Structure

The development of a computer-based circulation system calls for the creation of a data base to handle the systems functions. A Data Base Management System is a special program controlled by the operating system that maintains and organizes data. It does this in such a way that different types of functions, such as cataloguing or circulation, can use this data without the program being specifically dependent upon where or how data is physically arranged or stored\(^\text{11}\).

\(^{11}\)Grosch, 1979 has discussed this aspect briefly.
In the same vein, Saffady (1989) defines a data base as 'an integrated accumulation of computer-processible information organized for use in a wide range of applications'. The information itself may be numeric, textual, or even graphic in nature.

In many data processing applications, individual data files are specifically designed to meet the requirements of particular application programs. Thus a library which has computerized both circulation control and acquisitions will typically have separate bibliographic data files, each with record formats suited to the requirements of programs written to support those applications.

Saffady (1989, ibid) states that this approach, which dominated data processing through the mid-seventies, poses several problems, the most obvious being data redundancy and its resulting wasted storage space and higher storage costs.

It is unlikely, for example, that much of the same bibliographic data — author, title, and edition number, will be stored in both circulation and acquisition files. In addition, the potential for inconsistencies and inaccuracies is increased when identical data is stored in separate files, since change made in one file will not necessarily be duplicated in other files. Moreover, the separate data file approach ignores relationships between applications and activities. If the data maintained in separate files is integrated, the information captured by a computerized acquisitions system at the time an item is ordered can later be used and enhanced by computerized cataloguing and circulation activities.
Similarly, the same bibliographic data which supports computerized circulation control can serve as the basis for an on-line catalogue. This integrated approach is now a major focus of various library automation systems.

The integration of separate files eliminates redundancy, reduces storage costs, and improves data integrity. Because data bases are program independent, changes can be made in their organization and content without requiring corresponding modifications in application programs. Similarly, changes in existing programs need not necessarily be accompanied by data base modifications.

Fig. 8.2 An integrated data base.

In large-scale and minicomputer installations, the typical data base management system includes programs which organize and load a user’s data onto disks or other direct access storage media while establishing and maintaining various indexes to this data.

Such data base management systems are properly classed as examples of system software. While they can be custom developed to meet the requirements of a specific data processing installation, they are usually acquired as pre-written software packages.

Examples of such pre-written products include the IMS and DB2 data base management systems from IBM Corporation, ADABAS from Software AG of North America, IDMS from Cullinane Corporation, ORACLE from Oracle Corporation.

While some vendors treat their data base management systems as operating system components, most design them as optional software packages to be purchased at an often substantial extra cost.

An attempt has been made in this chapter to debate the desirability and feasibility of using modern information technology in creating an information system which is thought to represent a potential improvement in the problem situation discussed in the earlier parts of the work (and worth giving a trial), based on the views of people in the organization under study and those of others affected directly or indirectly by the activities of the organization.

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12 In SSM (according to Checkland, 1990: 53) information systems in this sense of the word are "created", rather than simply "designed", because the connotations of the "design" activity are that what is required has been specified, and design is concerned with the question of how to realize the specification. Creating something implies a broader perspective.
In particular, a number of requirements have been identified as a result of the series of discussions, questionnaire interviews, review of related literature, operational observation of the case study in question, as well as observing other systems similar to the one under investigation, in the spirit of 'Soft System Methodology' adopted. The next section of the work discusses the options available for deciding what type of "creation" approach should best be adopted taking into consideration the financial, manpower and spare parts constraints common in a developing country as mentioned earlier in the chapter.
CHAPTER 9

9. IMPLEMENTING FEASIBLE AND DESIRABLE CHANGES

The previous chapter has debated on changes which are thought to be culturally feasible and systemically desirable regarding the problem situation identified and analyzed. In particular, it has been shown through the discussions in chapter 8 that modern information technology, in the form of computing has a crucial role to play in any envisaged changes or improvement in the procedural aspect of the problem situation. However, the application of any computerised changes is bound to bring along with it other changes, as this chapter intends to show; these changes are likely to offset the present organizational structure. In the same vein, whatever change is adopted has to be understood and properly appreciated by members of the organization. This calls for what is known in the 'Soft' System Methodology framework as 'attitudinal' change.

It is the purpose of this section of the work, therefore, to discuss and analyze how, using the methodological framework of SSM, computer-based improvements can be conceived and more effectively realized. It should be added here that it may be difficult to agree and implement changes that are culturally feasible and systemically desirable, more especially changes that are culturally feasible; but the mere exercise of considering them should, in itself, lead to a better awareness of possible human reactions, and could assist with deciding the best manoeuvre for proceeding. As Patching (1990) has noted, pragmatically, it is also worth taking account of other factors, such as the economic feasibility of proposed changes, given current financial situation of the organization, or whether such changes are technically feasible, particularly when considering automating existing processes.
Also, because SSM encourages a *holistic* view to be taken, and many influencing factors will have already been considered during the analysis, the analyst is well placed to give advice about the overall effect of certain courses of action, and whether they could be acceptable to the organization as a whole (Patching, ibid, p113).

9.1 COMPUTER-BASED PROCEDURAL CHANGES

The potential benefits resulting from computerization have been predicted to be many and varied (Lucas, 1982; Hirschheim, 1985). These range from increases in productivity, to reduced costs, to improvements in the quality of working life of personnel. Other benefits include the ability to obtain information hitherto unavailable, and the ability to obtain information on a more timely basis. Cotta-Schonberg (1989) has summarized the situation thus:

> Only a few years ago librarians were hotly debating whether computers had any place in the libraries, just as they discussed ___ in the beginning of the century ___ whether typewriters had. Today the library community as a whole is realizing that apart from the immediate practical advantages, computers and information technology in general are the tools of a new information era, just like the printing machine with movable types was a tool of an information era which started with Gutenberg and lasted until the middle of this century. ...thus the important question is no longer whether to use the computer or not, but how to use it well, that is in accordance with its own logic and with its own full potential (p 47)

Abraham (1981) asserts that the major gains may well occur with managers and other office professionals. He sees productivity enhancements occurring in five areas:

(i) Better utilization of human resources _____ by reducing the number of employees or by having the same number perform more work
(iii) Increased quality of decisions, work, products, and services through improvements in the handling and dealing of information

(iv) Increased efficiency through the performance of tasks in less time

(v) Increased effectiveness through, for example, improved organizational communication

The above range of benefits can be used as applicable guidelines in exploring computer-based improvements to a problem-situation. We shall, therefore, look at them in more detail vis-a-vis our circulation control system case study.

Items (i) and (ii) will be treated together because they both touch on the same issue, i.e., employment. The issue of employment (particularly how it is affected by new technology) is a topical and controversial one. Two views of the likely impact of modern information technology upon jobs have been advanced. The first is the *deskilling* hypothesis which says that computers take work from people, rob them of the opportunity to use their skills and leave them performing routine, monotonous duties. The second is the *enrichment* hypothesis in which the computers take the routine aspects of the work and leave the people with the creative work and a powerful information handling tool to help them with their work. Each of the two hypotheses has evidence to support it.
However, most studies of the impact of information systems upon job satisfaction report increases. Bjorn-Andersen et al. (1979), for example, reporting a multi-national survey of the impact of computers upon bank clerks, concluded that the dominant effect was an increase in job satisfaction because their jobs had been enriched.

Other studies have shown that the most common characteristic of systems which have this effect is that they are perceived by their users as a tool to help them engage in their work and their work takes them beyond the system to serve the customers of the bank, to arrange holidays for customers, to handle the accounts for clients, etc. Where the system serves as a tool in this way it usually offers users a choice of service and method, does not pace them and provides no performance monitoring (Eason, 1988). In this regard, Grindley and Humble (1973) stress that one of the fundamental misconceptions about the computer is the erroneous belief that the computer's main job is to replace human beings. They point out that the important contribution is not that computer procedures necessarily replace men but that computerisation releases them to undertake the more important discretionary control.

Also, Fayen (1990) has pointed out that one of the implications of computerisation for staff of the library is that they are more likely to spend their time more productively. They will need to spend less time writing overdue notices, for instance, and more time and better information, to do other important tasks. In chapter one of this work examples have been given of circulation system staff spending precious time performing unnecessarily boring clerical tasks, such as the sorting, writing and mailing of overdue notices and reminders. With effective computerisation, staff effort will no doubt shift to more productive pursuits.
Library circulation is generally an extremely labour-intensive activity. A staff member must handle each item as it is charged in and charged out to users. Someone must check periodically the files of charged-out materials to determine overdues and to send notices to get them back. Also, someone must attend to users’ needs to renew materials and to place them on hold. As anyone familiar with the operations of circulation system knows, these obvious functions are just a few of the most visible operations, and there are countless other small jobs all of which have to be done on a very regular basis to keep any circulation operation running. This is an example of where effective computerisation can assign such tasks to the computer so as to release the staff for more creative tasks.

Items (iii) through (v) all border on improved services to the library user. These improved services are of the following kind:

(a) The speed of checkout: A manual checkout can often take from 30 seconds to about three minutes\(^1\), whereas the checkout time on a micro-based computer circulation, for example, is typically no more than 2 or 3 seconds.

This, in effect, means shorter queues at the check-out desk and improved customer service with positive signs from the circulation system that everyone can see, understand, and appreciate.

(b) Reducing 'delinquency': there will be tremendous improvement regarding the identification and tracking of overdue library items with any computerised circulation over a manual system because of faster and more efficient methods.

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\(^1\)See chapter iv, *Presentation and Analysis of Data*, where data is given on the amount of time it takes to borrow or return materials under the manual system.
It has been stated elsewhere in this work that library clerks often become overburdened so much that they hardly have time to attend to the issue of overdue items. This, coupled with the fact that all the reminders and recall notices have to be tediously filled out manually makes it easy to allow them to pile up.

This way, some users are deprived of the opportunity to make use of the items they needed at a specified period.

(c) Bibliographic searches: A computerised system searches by author, title or subject in a matter of seconds and typically can be done faster than one could walk to the card catalogue, in addition to the advantage of completeness of the search.

This contrasts sharply with what currently exists, whereby a reasonable percentage of the users were found to prefer ignoring the card catalogue because they did not find it much helpful.

(d) Activity statistics: can be used to improve service. By analyzing the activity of the library, information can be acquired to assist in, say, buying additional selections in response to users’ need. This could make an important contribution because as Runyon (1981) has noted, one of the persistent problems in academic library planning and decision making is obtaining an accurate picture of exactly what is going on within the library. He writes: "We are used to keeping counts of our operations, but we are seldom comfortable with the accuracy, timeliness, or completeness of this data once assembled".
It must be added however, that activity statistics do not automatically improve user service, but they do provide the basis for further analysis that can lead to improved service.

9.2 COMPUTER-BASED STRUCTURAL CHANGES

Generally, an organisational structure results from two processes: one is a process of differentiation (or division of labour) in which the organisation is divided into parts responsible for different tasks. This process may be called departmentation. The second process ensures the coordination of the different parts, or departments, and may be termed integration. Though the total organisational structure is dependent on departmentation and integration simultaneously, usually only departmentation is reflected in the organisational charts. One other structure is the functional structure in which the various departments perform different functions.

A typical structure in academic libraries is a functional one based on a division of the library into departments of acquisition, cataloguing, classification, physical preparation of books, circulation, etc. With the exception of the circulation department these departments form a group of internal departments or processing departments, each occupied with a discrete function in an assembly line procedure for processing new materials (Cotta-Schonberg, 1989, opcit). It could be argued on the other hand, that in actual practice most libraries have hybrid structures mixing the principles discussed above. So, looking at the general level of library structuring one can say the trend is for the processing of new materials to be performed by

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2Many different organisational structures are indeed available, but here only those more usefully applicable to libraries are mentioned because, as Cotta-Schonberg advised, the more specific they are the less they seem applicable to academic libraries, and it therefore preferable to use a more general typology.
structural units working on the books in succession, and with little or no personnel overlap between these units and those responsible for direct user services (Cotta-Schonberg, ibid). This indeed, is the case at the Usmanu Dan Fodiyo University Library, Sokoto, where the functional structure is predominant, as can be seen from the organizational structure.

The functional structure has two main advantages as far as book processing is concerned: (i) individual members of staff may develop a high degree of expertise on isolated parts of the total process. Thus Processing staff tend to become a pool of specialists each in a rather limited field of work. Secondly, there could be a certain economy of resources connected with a system where one individual performs one type of function only, but for a large amount of units.

However, there are disadvantages to this kind of structure as well. One is that the flow of books is impeded or stopped every time the capacity of a given working unit is diminished due to absences of personnel.

Another is that the various processing units might tend to develop objectives and standards which may not be consonant with the overall objectives and standards of the organisation. In the absence of genuine user awareness the work in internal processing departments tends to lose its urgency. Books passing through the internal system become units in an endlessly flowing stream, and cease to be experienced as relevant information to be made available to the user as soon as possible. The internal process becomes sluggish as librarians get more obsessed with technicalities than with efficiency.

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3 See Appendix.
This situation still happens at the Usmanu Dan Fodiyo University Library, where often, lecturers have to personally go into the processing department to select titles they wished to be processed urgently.

9.3 THE EFFECTS OF COMPUTER-BASED CHANGES ON THE LIBRARY'S STRUCTURE

A number of studies have recently been published dealing with the new information technology and its impact on organisations and organisational structure. Concerning this aspect in general, Burton (1988) has listed a number of major questions around which the relevant literature revolves:

(i) Will information technology lead to a more centralised authority function in the organisation?
(ii) Will it be restricted or liberalised?
(iii) How will it affect middle management, especially in its role as summarisers and filters of information up and down the hierarchical pyramid?
(iv) Will it increase or decrease employee participation?
(v) More generally: will organisational structure change at all, or will information technology rather cement the structure?
(vi) Will job satisfaction increase or decrease?
(vii) Finally: will capital be consumed or put to work?

It has to be appreciated here, again, that there seems to be no consensus among writers on these issues or questions. Nevertheless, few, if any today challenges the assumption that new information technology alters organisational structure, or at least provide the opportunity for
change. One important issue however, is whether it is the information technology which due to some internal logic or structural force of its own changes organisations or whether organisations are changed by management using information technology and organisational structure as optional tools for larger strategies.

Among the proponents of the latter view are (Bjorn-Andersen, Eason and Robey, 1986) who have studied the management of computer impact in 8 organisations of various types. On the basis of their empirical data they reject the notion of a causal relationship between computer systems and organisational structure. The important determinants of structural change are design objectives for the computer systems and the organisation, arguing that the computer system can be designed to support almost any type of organisational structure.

The work of Bjorn-Andersen, Eason and Robey is an important empirical and theoretical contribution in this field. It allows for a more complex and sophisticated formulation of the problem than is often found in the literature and it stresses that just like structure the computer is a tool. It may be argued however, that even if the computer system may be designed to fit any organisational structure, it may have to be done at such cost and loss of potential advantage that excessive organisational energy and resources are wasted in maintaining a fit between the old structure and the new technology, resources which might be better and more productively used if the structure was adapted to the new technology. Truly, structural changes are ultimately dependent on organisational design objectives, but the computer makes them possible, desirable and sometimes necessary.

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4 See Burton, 1988 for further discussions on the issue.
9.4 TOWARDS FUNCTIONAL INTEGRATION

The first move in appraising the relationship between computerisation and organisational structure may be to study changes which result directly from computerisation and which have immediate structural implications. In preparing for change within the target user organisation there is a natural tendency to concentrate upon the effects within that unit. As Eason (1988) warns, this unit does not exist in isolation and therefore the preparation also has to look at the impact upon external relations and establish policies about any changes that may be necessary.

A first result of library computerisation is the amalgamation of all catalogues into one place. This makes the total set of library catalogues, registers and indexes into one integrated system which is directly accessible to everyone everywhere in the library, and moreover that it may be used by many people simultaneously. This approach is in line with the increasingly prevalent view-point that "much traditional structure derives from the requirement to structure job domain, functions, and even whole departments around the availability of information" and that information technology "increasingly provides the capability to place the information where the user is rather than require the user to go or be where the information is. The implication of this is that information technology enables rather major changes in the structure of organisations" (Keen 1981).

Another important implication is that when different people in different places can perform the same tasks at the same time, and when the same people in the same place can perform different tasks at different times, the traditional rationale for functional differentiation disappears.
9.4.1 THE MERGER OF ACQUISITIONS AND CATALOGUING

A good example of functional integration will be the merging of acquisitions and cataloguing functions. This is because both units or departments create bibliographic records, with more or less the same contents although in some cases acquisitions record may not be as comprehensive as that of cataloguing. In both cases the data is presented in the final version as catalogue cards. In fact, there were times when the Usmanu Dan Fodiyo University Library amends and uses the acquisition record in the catalogues. Computerisation makes it possible to do with only one catalogue, common to the acquisitions process and the cataloguing function.

We can see from the above examples that computerisation can create real opportunities for functional integration across departmental boundaries. Afterall, the library structure is an organisational tool which should be moulded and remoulded as a flexible framework for concrete strategy to obtain the particular objectives of the library (Cotta-Schoneberg, opcit).

9.5 FEASIBILITY STUDY

In computer systems analysis, when complex problems and opportunities are to be defined it is generally desirable to conduct a preliminary investigation or feasibility study. A feasibility study is conducted to obtain an overview of the problem and to roughly assess whether feasible solutions exist prior to committing substantial resources to a project. Wetherbe (1984) describes the objective of a feasibility study as follows:
The primary objective of a feasibility study is to assess three types of feasibility.

1. Technical feasibility. Can a solution be supported with existing technology?

2. Economic feasibility. Is existing technology cost effective (i.e., will the cost be offset by the benefit(s)?

3. Operational feasibility. Will the solution work in the organization if implemented? (pp 122-23)

adding that by intent, the feasibility study is a very rough analysis of the viability of a project. It is, however a highly desirable checkpoint that should be completed before committing more resources. It simply answers the question: *Is it realistic* to address the problem or opportunity under consideration?

Taking the question of technical feasibility first, it can be said that *serious* computer application to library processes is comparatively a new development in Nigeria. Until a few years back many Nigerian librarians assumed that computer technology was not viable for them. This can be seen as highlighted by Greeves (1972) when she wrote:

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

This observation was valid only for some time, for things began to change soon after. Librarians, especially those in the universities and higher institutions realized that the university libraries had to turn to automation for answers to some of their problems, particularly the volume of demand for specialized services (Akinyotu, 1977). By 1975 a number of university librarians began to make louder calls for the introduction of computer technology as a way of easing the problems of data processing and bibliographic control (Amaeshi, 1975; Ifidon, 1976; Olaosun, 1977; Olufeagba, 1977).
The first use of computer technology in the field of librarianship in Nigeria was at the Ibadan University library. The serial records from this library were placed on the computer in April, 1973 (Ibadan University library, 1977, p7). A print-out of 1225 pages of its serial records was delivered to the library by the university’s Computer Centre in 1975. From 1976, the Catalogue of Serials in the university library is computer-based. The university library has projected a computer-based Union of Serials for all the university and research libraries in the country, the automation of reserve book collection and circulation control, and the production of a machine-readable catalogue.

Each existing university in Nigeria has a computing centre. The oldest at the University of Ibadan has been operational since 1964. Of course, they are relatively small by Western standards but adequate for current use pattern. Many are in the process of updating their systems or installing more powerful ones at the moment.

The Usmanu Dan Fodiyo University, Sokoto, on its part has computerised the processing of student records and the handling of course enrolment and examinations data, as well as salaries and wages. Major human constraints still remain, though. There is the usual diffidence about the introduction of new systems that may upset present bureaucratic structures. Nevertheless, in the ten-week period of study-visit that this researcher spent in Nigeria between July and September, 1988 the then university librarian, Mr D O Agidee has stated during an interview that the university library was high on the list of the institution’s departments and units to be computerised.
Looking at the question of technical feasibility, therefore, it can be stated that the necessary computer technology is generally available. One major limitation, however, still remains, i.e., complaints by users and computer centre staff that the systems are out of operation too frequently. Three main reasons contribute to this: Power cuts and voltage fluctuations, machine breakdowns and poor servicing. The most serious of these is the power supply problem, which is common not only to Sokoto, but the country as a whole.

9.5.1 POWER SUPPLY IN NIGERIA

Electricity supply in Nigeria is the responsibility of the National Electric Power Authority, NEPA, which supplies the country from a number of thermal and hydro-electric plants. The country’s total installed generating capacity was 4500 MW in 1987 (Africa South of the Sahara, 1989, p796). More than 80% of the capacity is thermal. Apart from the Igbin Power Station, other major plants include Kainji hydroelectric plant with a capacity of 760 MW; the gas and oil-fired plants in Afam with 742 MW; Sapele, 696 MW; Lagos, 60 MW; and the coal-fired plants on the Oji river, 150 MW.

Demands for power supply (which continued to outstrip capacity), inadequate plant maintenance and poor coordination between NEPA and government and private concerns have meant a congenial inability to deliver power accurately and reliably, and power cuts have become a regular feature of daily life. This has very serious effects. Power cuts put the machine out completely and results in loss of data if there are no stand-by generators installed. Almost as serious and even more frequent is supplying power at less than specified voltage and any input of less than 210-220 volts causes automatic shutdown.
Improvement of existing facilities has been made a priority rather than expansion of existing
capacity, although plans are under way for the construction of new plants in various parts of
the country. As part of Nigeria’s privatisation programme, a private company, The Nigerian
Electricity Corporation (NASCO) has taken over the supply of electricity to seven major
towns and 13 villages in Plateau and Kaduna States. If this proves successful, it could
encourage a widespread privatisation of electricity supply for the better.

9.5.2 UNINTERRUPTIBLE POWER SUPPLIES

One way of handling the power supply problem mentioned above is by acquiring and
installing Uninterruptible Power Supply systems, commonly referred to as UPS. This section
of the work briefly discusses UPS systems, their rationale and how they work. It is not the
intention here to go into the technical details and intricacies, though.

UPS systems are typically designed to provide power to computers for five to thirty minutes
after all the main power supply has failed. In addition to providing blackout and brownout
protection, many UPS systems also protect against spikes, surges, sags and noise (Price,
1989). The protection period has been kept at between five and thirty minutes because most
UPSs employ rechargeable batteries to supply power during utility failure. Batteries cost
money; the longer the protection period, the more batteries will be needed and the higher their
cost. Moreover, there is little practical reason to keep a computer running during a blackout.
The terminals connected to a multi-user machine will have gone dead, users will be stumbling
out of the stacks by feeble lights of emergency lanterns, and, with all lights off, users of
personal computers are likely to have problem seeing their keyboards.
Thus a UPS with about fifteen or twenty minutes of backup power protection affords three main advantages: (i) when utility power is available but fluctuating, most UPS systems will clean it up and regulate it. Outages lasting several milliseconds to one or two minutes will become relatively trivial to the computer system. (ii) when an outage extends beyond a few minutes, a UPS permits a computer operator to bring a system down gracefully: to close and save files, to complete transactions and store checkpoint data, and to manually turn off disk drives and park magnetic heads (if the system has no automatic parking device). All these will make restarting the system simpler and faster once power is restored. (iii) Even if no operator is around a UPS can help obtain a clean system shutdown. Typically there are broad fluctuations in voltage and frequency just before a total outage. Such fluctuations cause head crashes and stress electronic components. Most UPS systems filter out such aberrations until their batteries are exhausted; then they cleanly and abruptly shut off power to the data processing equipment. Such a shutdown is not as neat and clean as one preceded by operator intervention, but it is a considerable improvement over the "dirty" outage caused by electricity supply failure.

Other main issues to be tackled under the question of technical feasibility include locating, selecting and entering into negotiations with a computer supplier(s) capable of meeting the agreed requirements of function, design characteristics and financial constraints. A major argument here is that this should not be done without the full participation of the client, preferably in the form of a study team. Here, too, SSM can be employed once more to address the tackling of the problem.
Kavanagh, Gueutal and Tannenbaum (1990) discussed in detail how to conduct needs analysis, and went further to describe how to design/acquire a system. As the process of design/acquisition begins, the project team will be faced with a number of key decisions that will have long-term effects on the system. The first decision deals with the purchase/development option selected. The second focus is on issues relating primarily to software rather than hardware. This is because finding software that will fit the needs of the organization is typically much more difficult than finding hardware to run the software. In addition, software is becoming increasingly compatible with a variety of hardware systems.

At this juncture, this work will focus on the question of software assessment as it introduces another dimension to the sixth stage of SSM when used for the creation of information systems.

A number of authors (e.g. Boss, 1979a; 1979b; Boss and McQueen, 1982; Matthews 1983) have written extensively about automated circulation systems, giving up-to-date reports on circulation systems. There are three established means of providing application software:

(i) Turn-key system approach: in which programmes are designed, marketed and maintained by vendor, which supplies a complete system of software and hardware to perform a defined application. This is currently the trend within most minicomputer system users.

(ii) Custom system approach: in which programmes are specially designed and provided by the vendor. This approach can be further divided into two: (a) which is oriented toward developing software for system configurations from a single
manufacturer. In addition, some companies may offer their customers assistance in setting up systems involving product line of systems in which they specialize. (b) involves specialized hardware regardless of manufacturer of each component to support a specific application area. Software is provided on an as-needed basis to meet these applications.

(iii) In-house development approach: here, the library or its parent institution develops software internally.

Although the three approaches listed above are not the only approaches for design/acquisition of software they tend to be the most established means. There are other possible forms of system creation such as using internal services within one's own parent institution (Grosch, 1979). However, these alternatives are variations of either obtaining services under contract or in-house development.

Comparing the three approaches discussed above, Grosch (1982) gave some of the advantages of turn-key systems to include the following:

(a) A library need not acquire permanent specialized data processing personnel
(b) Existing library staff can be trained to operate the system and provide liaison to the vendor
(c) Software and hardware maintenance usually are provided by the turn-key vendor
(d) A library can benefit from the experience of a vendor that has handled other installations of the same system
(e) Considerable consulting experience is available from the vendor in the special application involved

(f) System acquisition cost is known and system operation cost can be more accurately estimated for budget purposes

(g) System enhancements may be ordered as they are developed by the vendor.

Another added attraction for turn-key systems is fact that they are:

attractive to those libraries that have not had prior computerized support, have had management problems with previous system efforts or only require automating simple applications (Grosch, 1979, P21).

In terms of economic feasibility it is worth noting that the introduction of inexpensive and powerful mini and microcomputers and dramatic decreases in the costs of online storage, are a welcome development in the field of software/hardware. In this regard, Fayen (1986) points out that decreases in the cost of computer hardware, especially as a result of the introduction of much less expensive mainframe computers and high performance minicomputers (commonly called the super minicomputer), have extended the cost-effective range at both ends (p389). Micro-based systems now can handle collections of up to about 20,000 volumes, and minicomputer-based systems can accommodate collections of up to about 500,000.

It is not easy at this stage to conduct a comprehensive cost/benefit analysis. The cost/benefit analysis, concerns questions asked about whether it is worthwhile to invest money in the proposed project or whether something else should be done with it instead.

Two steps are usually followed for this. One is to produce the estimates of costs and benefits. The other is to determine whether the project is worthwhile once these costs are ascertained. Cost/benefit analysis is always clouded by both "tangible" and "intangible items."
"Tangible" items are those to which direct value can be attached (e.g. the purchase of equipment, time spent by people writing programs or items such as insurance costs or the cost of borrowing money). Some tangible costs often associated with computer system development are listed by Hawryszkiewycz (1988) to include:

1. Equipment costs for the new system (including such things as accommodation costs and furniture costs)
2. Personnel costs. These include personnel needed to develop the new system and those who will subsequently run the system when it is established
3. Material costs. These include stationery, manual production and other documentation costs
4. Conversion costs.
5. Other costs. These might include consultants' costs, travels, management overheads, secretarial support, etc.

"Intangible" items on the other hand are those whose values cannot be precisely determined and are the result of subjective judgement. For example, how much is saved by completing the project earlier or providing new information to decision makers?

The sum value of costs of items needed to implement the system is known as the cost of the system. The sum value of the savings made is known as the benefit of the new system. Once we agree on the costs and benefits we can evaluate whether the project is economically viable.
Suffice it to say here that the question of cost\benefit analysis though a very important one, will depend largely on the outcome of selecting and negotiating with a supplier(s).

Regarding operational feasibility, it can be said that this is mainly what SSM as an approach is after. It is in terms of operational feasibility of any emergent changes that the methodology keeps stressing systemic desirability and cultural feasibility, which have become the factors of on-going concern for the analyst. Consequently, the computer-based proposed changes have been thoroughly discussed with the various levels of management concerned, it is from the discussions that requirements were jointly analyzed between the researcher and management.

9.6 ATTITUDINAL CHANGE

This type of transformation comprises, at an individual level, changes in Weltanschauungen and, at a group level, changes in climate. Checkland (1985b) maintains that "Any culture will only take purposeful action which seems 'obvious' to the people who constitute that culture" (p831). If fully implemented, the research conducted here will fundamentally transform the library’s organisational structure as well as radically revise its internal procedures.

As shown throughout the work, exhaustive discussions and consultations preceded most of the recommendations put forward about the desirability and practicability of which the management and other staff concerned expressed little, if any reservations. This implies that they see the proposals as culturally feasible and "obvious actions to take."
CHAPTER 10

10. THE RESULTS OF THE WORK

The research has been concerned with a practical problem that every library encounters in its efforts to improve services to readers. The main aim is to find methods that will enable those concerned to discern the problem from a more effective viewpoint than is currently the practice. This is what action research is all about, which Checkland and Scholes (1990) describe as requiring "involvement in a problem situation and a readiness to use the experience itself as a research object about which lessons can be learned by conscious reflection" (p16), adding that in order to make this possible it is absolutely essential to declare in advance an intellectual framework which will be used in attempts to make sense of both the situation and the researcher’s involvement in it. The action researcher thus has two hopes: that the framework will yield insights concerning the perceived problems which will lead to practical help in the situation; and that experiences using the framework will enable it to be gradually improved.

A number of findings have emerged from the study which can prove to be useful for professionals in the field and/or those who are interested in furthering the investigation. In the words of Stowell,(et al. 1990) "there is no substitute for using SSM in real problem situations". This section of the work presents the outcomes as they relate to the general principles of SSM, with the hope that they might be profitably applied to similar situations. The findings will prove helpful in situations where SSM is adopted as the problem-tackling methodology, with the potentiality of introducing computer-based information system.
10.1 THE INTRODUCTION OF DATA MODELLING INTO SSM

In its original form, SSM does not include a precise structural bond from primary task to supporting information systems. Nevertheless, it is possible to include within the system thinking strand of SSM, another modelling stage, in this case one that is concerned with information systems. In particular, this is done at the stage 4 of SSM, whereby an established data analysis strand from computer systems analysis with appropriate suitable modelling tools is assimilated. This is the approach utilized in this research.

The actual incorporation of data modelling activity into the established systems thinking stages of SSM is achieved by further "refining" the process of conceptual activity modelling to obtain conceptual infological model. Although a conceptual infological model is not what can be called a 'system', it is nevertheless concerned with producing a model of the areas of reality which users are interested in. This is necessary in order for the users to understand the models so that they can verify that the system meets their needs.

The stage four conceptual model was transformed into a data flow diagram. Discussions stemming from comparing this model with real-world information processing procedure resulted in identifying entity types and relationships. This model, which, as pointed out earlier is capable of being understood by the users was then compared with real-world data structure. These stage 4b models serve to augment an investigation of information requirements which can be undertaken jointly by the analyst and users. This way, the spirit of the 'soft' methodology regarding the inclusion and encouragement of users to contribute their respective view points is preserved.
In this study, for example, the model in fig. 6.1 was found to be beneficial in enhancing the debate with the library management and library users. Here, logical dependencies of the selected conceptual activity model have been replaced by what the analyst, following the discussions and debates considered to be the minimum necessary information flows, thereby deriving a conceptual information flow model. Also from the discussions which emanated in the process of comparing the information flow model with real-world information gathering processes, entity types and relationships were arrived at, which in turn formed the basis for a conceptual infological model.

It must be pointed out here, though, that the extended form of stage 4 modelling activity has been augmented with real-world debates and discussions in order to enable it to be expressed in a way capable of being understood and agreed upon by the users taking part. In other words, it served to enhance the joint investigation of user requirements conducted by both the users and the researcher (analyst) in such a way that it could make sense to the users in particular. This approach, will thus help to remove (or at least minimize) the often common misunderstanding and consequent aloofness by users, who might otherwise feel cut off from the project.

The difficulty encountered by this researcher during the ensuing discussions following the comparison of the flow model with real-world information generating procedures can clarify the above comments better. It became glaringly clear during the discussions that there were certain discrepancies in terms of information requirements between the main library and each of the two branch libraries, and as a result each branch wanted its own set of requirements to predominate without considering the implications for other branches. Put differently,
branches. Put differently, the delegates from each branch left everyone in no doubt that they were there primarily to discuss their specific requirements without compromise. The meeting turned into a forum for each branch to put forward and defend its information requirements. This is, indeed, a common situation of inter-branch dispute encountered in every-day committee meetings in the university. By sorting out these inter-branch complications, however, the information flow modelling process can promote better understanding of one another’s set of requirements and working to harmonize them. One branch library, for instance, has a policy of not providing out-of-library-use loans due to the nature of its collection. As a result, its delegates to the discussions were so uncompromising that the discussions had to be adjourned on two consecutive occasions, after which the university librarian had to join the researcher in convincing them that simply because their branch was not interested in a particular set of requirements it did not mean that other branches, too were not... a kind of rigorous consultation almost unprecedented in a hard methodology. It is important, however, to add at this juncture that efforts to arrive at a consensus during the discussions were fraught with frustrations and difficulties. Controversies and haggling persisted almost all the way through the project discussions. There was very little that could be done about this because, after all, SSM does not claim to be a conflict resolving methodology; rather, it strives to accommodate contentious issues, while making progress. This process of accommodation among participants is very necessary before a problem focus can emerge on which there is agreed resolution to take action. A hard methodology, for example, would insist that an agreed organizational objective is required in order for analysis to take off.
Also, by striving on accommodating issues through negotiations, the minds of the participants were put at ease by reassuring them that the problem-situation being investigated was being treated as a human activity system, consisting of individuals and groups possessing conflicting interests — a framework common to SSM which marks a major point of departure from the traditional hard systems approach whereby everything is treated in machine-like manner.

Moreover, the added advantage of incorporating the data modelling stage as encountered in this research is its ability to further enhance the comparison process. After all, all the procedures of the Usmanu Dan Fodiyo university library are currently manual; so in effect it was fairly straightforward to match documents meant to serve manual procedures with the conceptual infological model. Possible, computer-based desirable changes can easily be picked out in this manner of comparison through the occurring mismatches.

10.2 SSM AS A 'NEVER-ENDING' LEARNING PROCESS

The work has shown how SSM can be used to 'assimilate' methods and techniques from computer system analysis and programming. This approach is similar to the "embedding" technique suggested by Miles (1988) whereby 'hard' methods are deployed at one level, but in a subordinated manner to operations at a meta-level at which iterations of SSM take place. In essence, SSM is used as the methodological means of undertaking an exploration of the problem situation, whereby purposeful human activity system models are used to structure a debate in which different world outlooks, needs, interests, etc. of various individuals and groups concerned are analyzed and discussed.
It is at this meta-level that systemically desirable and culturally feasible changes to the real world situation are identified and agreed. Those changes of a computer-based procedural nature, if they are to be efficiently undertaken and completed, will usually demand the deployment of 'hard' methods. Such changes constitute design goals for the operations at the subordinate level. We now have a fairly structured problem-situation, the proper tackling of which can be used by employing SSM in further cycles. 'Relevant systems', for instance, can now include a system to implement the defined changes, which can be achieved using more Root Definitions and modelling. Thereafter, SSM can continue to be used in iterations, i.e., stop/restart according to the wishes of the investigation participants, thus making the process a 'never-ending' one. In other words, SSM is a systemic process of enquiry which also happens to make use of systems models. It thus subsumes the hard approach, which is a special case of it, one arising when there is a local agreement on some systems to be created. This is very important, because when needs are agreed the only remaining issue would be how to do it, not what to do.

10.3 IMPLICATIONS OF THE WORK ON TRADITIONAL SYSTEMS ANALYSIS

One common criticism of the computer systems analyst/designer is that he/she is more interested in the sophistication or intricacies of the computer system than in the problem-owner's needs. As discussed earlier in the work, the literature in the field of computer systems analysis is saturated with the erroneous concept of computers as an end in themselves rather the means. The analyst is always obliged to operate within problem situations that are structured according to a means-end schema—i.e., the problem has to be definable as a set of achievable objectives.
However, many projects conducted within the last decade have concluded that it is the social rather than the technical aspects of a technology which are responsible for its effects\(^1\). Nevertheless, it is the social domain that has been largely ignored, with more and more attention being focused on the technical.

The biggest problem facing the contemporary analyst is the fact that political or social problems consist of an array of differences in views and values, such that single off-the-shelf definition is not easy, if at all possible\(^\_\_\_\_\) yet the 'hard' tradition does not have any provision for handling this "peculiar" problem situation. Politics, nevertheless must be found wherever humans interact.

One of the major contributions of a study of this nature undertaken under the umbrella of the 'soft' methodology is the effect it has on the discipline of systems analysis. This effect is likely to result in traversing the widening disparity that currently exists between systems analysts and systems users, which has led to many problems in planning and implementing changes. This concept is based on the idea that change needs to be planned by those who must live with the consequences. In the Usmanu Dan Fodiyo university library study, for example, the use of SSM has provided an avenue for the analysts to participate actively in debating jointly with the users to contribute in tackling political issues ___ another form of user participation which the analysts cannot ignore. Moreover, the approach has enabled analysis to be conducted while at the same time addressing matters of politics and interpretations.

\(^1\)See Hirschheim (1985), for example
For this the analyst needs to accept the fact that if a definition has to be forced upon a problem situation then there is the tendency to oversimplify the situation and shove problems under the carpet, only to germinate at a later stage.

Another advantage that a study of this nature using the framework of SSM can bring is that it will prevent the organization from committing huge sums of money on projects that may later be found to be ineffective. The Bursar's office of the Usmanu Dan Fodiyo university, Sokoto, for example, embarked on a project to computerize some of its operations, especially the pay-roll. Contract for the project was awarded to an outside computer firm in 1986. The firm was more or less given a free hand to perform the work without involving any of the staff in the department. Shortly, several microcomputer terminals were set up in various offices in the department. When the system was finally installed in 1987, the computer company asked for one or two nominees of the department to be given an "intensive" two-week training at its head office in the United Kingdom. However, a few months after installing the new system, the department had to resort to its earlier manual system because the staff had realised that either the system did not reflect their true requirements or they had no idea how it all began. To make matters worse, the two persons nominated and sent for the "intensive" training were very senior persons with whom the less senior members of staff could not feel free to discuss much less voice out their grievances. On a number of occasions, a member of staff had to be sent to the local branch office of the computer firm that carried out the project (located in another town) to process the salaries for the month before returning to Sokoto.
If the above mentioned project was carried out in the framework of SSM as suggested in this work, such problems might not have arisen, because issues would have been thoroughly discussed with the members of the department concerned. They would have had the opportunity to be in the picture of it all, and contribute to the discussions of their requirements.

As pointed out in the earlier portions of this work (see chapter one) the university library was next after the academic office in the university management’s effort to computerize all major departments and units of the institution. It is hoped that a serious consideration would be given to the issues raised in this work so that the type of mistake mentioned above is not repeated.

A major aim of this work is to provide a way out of this type of difficulty facing the analyst by adopting the methodological framework of the 'soft' system methodology. Reflecting on the implication of the study on the library’s management it can be stated that at least it will enable them to comprehend and contend new, obvious perceptions surfacing as a result of it. i.e, libraries as organizations primarily involve a mixture of tangible and intangible services in the form of human activity. Hard systems analysis is best at addressing those parts of an organization that have tangible form. Soft systems thinking, on the other hand, considers the systems that can be discerned throughout. By employing the use of soft systems thinking, aided by some techniques from hard systems analysis as has been done here, the way has been paved for the computer specialists to understand the situation further, which was hitherto complex and messed by humans and their individual perspectives and beliefs. Such an overview can never be addressed using a hard methodology.
Essentially, a 'soft' methodology framework like the one this study has attempted to use calls for a change in orientation from the traditional "goal-seeking" approach to "learning". Rather than seek an optimum solution, what we wish to achieve through SSM is continuous learning from the problem-situation: apart from the knowledge gained during the analysis exercise, the models developed will go a long way in providing profound insight into the multifarious relationships that exist at the time of the analysis, which can have a lasting utility. This point is more so in the case of this researcher who is permanently employed by the object of the research. SSM as a process is, therefore, not merely pertinent to a specific aim, as the models can survive several years unless a major functional reorganization takes place.

It must be pointed out here that the use of SSM in any system study is something rather subjective; i.e there is nothing like a permanent solution — a trait which is difficult for those in the hard tradition to appreciate. SSM as used in this work, unlike the hard tradition, repudiates the idea of solution seeking in favour of accommodation and never-ending exploration. For example, the computer-based proposals put forward in this work are only temporary suggested improvements in an on-going process of analysis. This is what gives the methodology a flavour of an enquiry process.
Dear Sir/Madam,

QUESTIONNAIRE ON CIRCULATION POLICY:

Further to our earlier open discussions of issues concerning the theme of my research on the topic: "Towards a Soft Systems Model of Computer-based Circulation Control System: A Case Study of the Usmanu Dan Fodiyo University Library, Sokoto, Nigeria".

In recognition of the potential value of the 'Soft' Systems Methodology in the area of information systems development, the research attempts to formulate guidelines for designing computer-based information system within the framework of the soft systems methodology.

The attached questionnaire is designed in order to obtain an additional overall picture of the circulation system and its operational structure, as well as to seek your professional opinion about any other consideration which might be helpful in determining the main issues involved in the circulation control system (to supplement the discussions). As a key person in the circulation control department, your response is highly valued towards the improvement of the circulation control system for the library.

I shall be very grateful if you could complete and return the questionnaire to me by June 30th, 1989 at the above address.

Yours sincerely,

S Haliru
QUESTIONNAIRE TO HEADS OF CIRCULATION

1. NAME OF CIRCULATION LIBRARIAN: ................................
2. LIBRARY (e.g, Main, Law, Medical) ............................
3. YOUR POST/POSITION ............................................

4. WHAT WAS YOUR TRANSACTION TOTAL IN THE LAST ACADEMIC YEAR?

.................................................................

5. HOW MANY REGISTERED USERS DO YOU HAVE? .................

6(a). CONSIDERING THE NUMBER OF TRANSACTIONS YOU HAD IN THE LAST 
ACADEMIC YEAR, DO YOU ANTICIPATE MORE, THE SAME, OR FEWER 
NUMBER IN THE NEXT ACADEMIC YEAR? (INDICATE WITH AN "X" 
WHERE APPROPRIATE):

i. More ( ) ii. The same ( ) iii. Fewer ( )

6(b) IF YOU ANSWERED 'MORE' IN 6(a) ABOVE, CAN YOU ESTIMATE THE 
PERCENTAGE OF EXPECTED INCREASE? ..........................

7. MARK WITH AN "X" IF YOU PRESENTLY KEEP ANY OF THE FOLLOWING 
RECORDS OR WORKING FILES IN YOUR DEPARTMENT:

1. Patrons Register .........................................( )
2. Acquisitions list ...........................................( )
3. Daily transaction file ....................................( )
4. Reservation request file ...............................( )
5. Recalled item file .........................................( )
6. Items sent for binding ..................................( )
7. Missing items file ........................................( )
8. Delinquent users file ...................................( )
9. Patrons head count file ...................................( )
10. Any others(Please be specific)............................
8. WHAT PROBLEMS IF ANY, DO YOU ENCOUNTER IN MANAGING AND/OR FULLY UTILIZING THE FILES YOU INDICATED IN Q.7 ABOVE? MARK WHERE APPROPRIATE.

(a) File management: Yes ( ) No ( )
(b) Searching file: Yes ( ) No ( )

9. WHICH OF THE FOLLOWING ADEQUATELY DESCRIBE THE NATURE OF THE PROBLEM(S) YOU INDICATED IN Q.8 ABOVE?:

(i) Files too bulky to manage well ( )
(ii) Frequent clerical (filing) errors ( )
(iii) It takes too long to search through files ( )
(iv) Unreliable statistics ( )
(v) None of the above ( )
10. MARK WITH AN "X" THE TYPE OF INFORMATION YOUR CLIENTELE, MANAGEMENT STAFF OR OTHER RESEARCHERS NORMALLY ASK ABOUT AN ITEM.

(a) WHICH ITEM IS:

(a) Available in the library ( )
(b) Out on loan ( )
(c) Overdue ( )
(d) Reserved for another user ( )
(e) In the reserve collection ( )
(f) Recalled ( )
(g) Sent for re-binding ( )
(h) More heavily used ( )
(i) Missing from stock ( )
(j) Due when ( )
(k) Loaned to whom? ( )
(l) Reserved by whom? ( )

11. IN WHICH ORDER DO YOU NORMALLY FILE YOUR DAILY TRANSACTIONS?
(Please mark with an X" WHERE APPLICABLE):

(i) Status of user(e.g., Staff, U.G. P.G, etc) ( )
(ii) Class mark ( )
(iii) Author/Title ( )
(iv) NONE OF THE ABOVE ( )
12. THE FUNCTIONS AND OBJECTIVES OF EVERY CIRC.SYSTEM INCLUDE ASSISTING LIBRARY USERS TO MAKE THE BEST USE OF THE COLLECTION. CONSIDERING THE ACADEMIC BACKGROUND OF THIS LIBRARY, INDICATE WITH AN "X" WHICH LEVEL OF PRIORITIES YOU THINK SHOULD BE GIVEN TO THE SERVICE OBJECTIVES LISTED BELOW.(ONLY ONE COLUMN PER ITEM, PLEASE)

<table>
<thead>
<tr>
<th>Service objective/functions</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Charging/discharging of library materials</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Renewal of loans</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) Updating files</td>
<td></td>
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<td></td>
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<tr>
<td>(d) Recalls/reservations</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>(e) Giving accurate information to users about the status of any circulating item</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(f) Tell whereabouts of items with minimum delay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(g) Ensuring that items leaving the library are duly checked out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(h) Compiling relevant statistics about use of collection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Reshelving items as soon as they are finished with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(j) Tracing and handing back a user's library card in less than sixty seconds from the time he/she returns item</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(k) Minimizing long queues at the loans desk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(l) Teaching the use of library</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(m) Any other (Please specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. WHAT OTHER SERVICE(S) WOULD YOU SAY ARE IMPORTANT BUT WHICH FOR SOME REASONS YOUR LIBRARY CANNOT AFFORD TO PROVIDE IN THE MEAN TIME?

14. ARE YOU FULLY SATISFIED WITH THE PRESENT MODE OF OPERATION IN YOUR DEPARTMENT?

1. YES ( )
2. NO ( )

15. IF YOUR ANSWER TO QUESTION 14 IS "NO", WHAT TYPE OF SYSTEM WOULD YOU HOPE TO SEE OPERATING?

16. WOULD YOU SAY THE STAFF UNDER YOU ARE BEING EFFECTIVELY UTILIZED?

1. .................. YES ( )
2. .................. NO ( )

17. HOW ADEQUATE ARE THE RECORDS KEPT BY YOUR DEPARTMENT IN ENHANCING YOUR SERVICES?

1. ............... ADEQUATE ENOUGH ( )
2. ............... BARELY ADEQUATE ( )
3. ............... NOT ADEQUATE ( )

18. IF YOUR ANSWER TO QUESTION 17 IS "BARELY ADEQUATE" OR "NOT ADEQUATE", WHAT ADDITIONAL RECORDS OR FILES WOULD YOU WISH FOR THE DEPARTMENT TO KEEP?

........................................
........................................
........................................
........................................
19. FINALLY, FROM YOUR EXPERIENCE WITH THIS LIBRARY'S CIRCULATION CONTROL SYSTEM WHAT SUGGESTIONS OR ADVICE WOULD YOU GIVE A RESEARCHER WHO WORKS ON IMPROVING THE EFFECTIVENESS OF ITS SERVICES? (USE AN ADDITIONAL SHEET IF YOU NEED TO).
APPENDIX (B) QUESTIONNAIRE TO LIBRARY USERS
Dear Sir/Madam,

I am conducting a survey among the library users as a basis for developing the requirements for a computer-based circulation control system in the university library.

The questionnaire attached is intended to find out what your opinions are regarding various services of the circulation department. Your response will go a long way in helping to better understand the situation of the department so as to make adequate plans to meet your needs.

It is important that all questions are answered; your responses will be treated with absolute confidentiality and what ever answers you give will only be used for the purposes of the research.

Please hand in your completed questionnaire at the circulation desk. Your prompt response will be highly appreciated.

Yours sincerely,

S Haliru.
LIBRARY USE SURVEY

1. STATUS OF USER
Staff ( ) 1
Postgraduate ( ) 2
Undergraduate ( ) 3
Other(Please specify) ( ) 4

2. (a) DEPARTMENT.........................
(b) MAJOR SUBJECT.........................

3. HOW OFTEN DO YOU USE THE LIBRARY?
Rarely ( ) 1
Once in a month ( ) 2
Once in a fortnight ( ) 3
Once in a week ( ) 4
Daily ( ) 5

4. MAIN PURPOSE(S) OF USING THE LIBRARY (You may fill more than one options)
To consult recommended texts ( ) 1
For current awareness ( ) 2
To meet friends ( ) 3
To use library as a quiet
reading place ( ) 4
For general interests ( ) 5

5. DO YOU THINK THE LIBRARY'S STOCK IN YOUR SUBJECT(S) IS:
Seriously inadequate ( ) 1
Inadequate ( ) 2
adequate ( ) 3
Excellent ( ) 4

6. DO YOU ENCOUNTER ANY DIFFICULTIES IN GETTING THE INFORMATION
YOU NEED FROM THE LIBRARY?
No ( ) 1
Sometimes ( ) 2
Yes ( ) 3

7. HOW DO YOU LOCATE MATERIALS IN YOUR SUBJECT AREA IN THE
LIBRARY?
By asking the library staff ( ) 1
By asking fellow colleagues ( ) 2
By browsing directly on the shelves ( ) 3
By going through library catalogues ( ) 4
By other means(please explain) ( ) 5
8. HOW WOULD YOU DESCRIBE THE USEFULNESS (TO YOU) OF THE LIBRARY'S CATALOGUES?

Seriously inadequate  ( ) 1
Inadequate  ( ) 2
Useful  ( ) 3
Very useful  ( ) 4

9. IF YOU ARE NOT SATISFIED WITH THE CATALOGUES WHAT ARE YOUR REASONS?

10. DO YOU CONSIDER THE NUMBER OF ITEMS YOU ENTITLED TO BORROW FROM THE LIBRARY:

Adequate  ( ) 1
Inadequate  ( ) 2
Seriously inadequate  ( ) 3

11. HOW MANY MINUTES WOULD IT TAKE ON THE AVERAGE FOR YOU TO BORROW AND/OR RETURN AN ITEM IN THE LIBRARY?

Up to a minute  ( ) 1
Two to five minutes  ( ) 2
Seven to ten minutes  ( ) 3

12. RECALL THE LAST TIME YOU WENT TO THE LIBRARY TO SEEK REFERENCE ASSISTANCE OR MAKE AN INQUIRY FROM THE STAFF

(a) What was the nature of your query? (e.g. wanting a book on a subject, trying to find a particular piece of information, etc)

(b) Was your query answered to your satisfaction?

No  ( ) 1
Partially  ( ) 2
Yes  ( ) 3

(c) If your answer to 12(b) above was NO or PARTIALLY what in your opinion was the reason for not satisfying your query?

Staff in charge not available  ( ) 1
Staff at hand too busy to assist me  ( ) 2
Staff did not know the answer, either  ( ) 3
Library did not have needed information  ( ) 4
Info. was in foreign language that I do not understand  ( ) 5
13. HOW OFTEN DO YOU APPROACH LIBRARY STAFF FOR ANY REFERENCE QUERIES?

At least once in a week ( ) 1
Once in a fortnight ( ) 2
Once in a month ( ) 3
Rarely ( ) 4
Never ( ) 5

14. DO YOU CONSIDER THE AMOUNT CHARGED AS OVER-DUE FINES BY THE LIBRARY PER ITEM:

Lenient ( ) 1
Adequate ( ) 2
Harsh ( ) 3

15.(a) HAVE YOU EVER UTILIZED THE LIBRARY’S INTERLIBRARY LOANS FACILITY?

No ( ) 1
Yes ( ) 2

(b) IF YOUR ANSWER TO 15 (a) ABOVE IS "YES", HOW LONG DID IT TAKE BEFORE THE LIBRARY SECURED THE MATERIAL FOR YOU?

Over one month ( ) 1
Between two and three weeks ( ) 2
Less than two weeks ( ) 3
About one week ( ) 4
Less than one week ( ) 5

16. (a) DO YOU MAKE YOUR PHOTOCOPIES IN THE LIBRARY?

No ( ) 1
Yes ( ) 2

(b) HOW MUCH DO YOU PAY PER COPY?
(Please indicate)..........................

(c) DO YOU CONSIDER THIS AMOUNT:

Realistic ( ) 1
Unrealistic ( ) 2
Too exorbitant ( ) 3

17. WHEN YOU FIRST USED THE LIBRARY WERE YOU GIVEN AN INTRODUCTORY TOUR AND/OR TALK?

No ( ) 1
Yes ( ) 2
18. DO YOU ENCOUNTER ANY SEATING PROBLEMS WHEN USING THE LIBRARY?
   No  ( ) 1
   Yes ( ) 2

19. HOW WOULD YOU DESCRIBE THE ATTITUDE OF THE LIBRARY STAFF?
   Below average  ( ) 1
   Average       ( ) 2
   Above average ( ) 3
   Excellent     ( ) 4

20. FINALLY, PLEASE WRITE DOWN ANY OTHER PERSONAL REMARKS / OBSERVATIONS WHICH YOU HAVE ABOUT THE LIBRARY SERVICES OR THE LIBRARY STAFF THAT HAVE NOT BEEN TAKEN CARE OF ABOVE. YOUR REMARKS WOULD BE CAREFULLY CONSIDERED UNDER STRICT CONFIDENTIALITY.

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Rich picture of the problem situation
Map of Nigeria, showing the location of Sokoto
ORGANIZATION CHART OF THE UNIVERSITY LIBRARY'S EXISTING STRUCTURE

University Librarian

1. Office of the University Librarian
   - H.E.O. (Gen. Admin.)
   - P. Secretary to the University Librarian

2. Collection Development Division
   - Acquisition
   - Documents
   - Gifts and Exchange
   - Research
   - Serials

3. Processing Division
   - Card Production
   - Catalogue Maintenance
   - Cataloguing
   - Classification
   - Labelling

4. Readers Services Division
   - Arabic/Islamic
   - Circulation
   - Information and Statistics
   - Inter-Library Loans
   - Reference and Bibliographic

5. Medical Veterinary Science Library
   - Medical Veterinary Science Library
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