COMPUTERISED INFORMATION NETWORKING:
A SURVEY OF INFORMATION CENTRES IN NAIROBI.

BY

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Computerised
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DECLARATION

THIS RESEARCH PROJECT IS MY ORIGINAL WORK
AND HAS NOT BEEN PRESENTED FOR A DEGREE
IN ANY OTHER UNIVERSITY.

EDWARD MUCHAI NG’ANG’A

THIS PROJECT HAS BEEN SUBMITTED FOR EXAMINATION
WITH MY APPROVAL AS A UNIVERSITY SUPERVISOR.

MRS JACINTA WERE
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DEDICATION

I hereby dedicate this work first to my only living and lovely parent, Mrs Martha Wairimu Ng'ang'a for her continued encouragement and support.

Secondly to my fiancee Lucy Njoki Mbugua for agreeing humbly to postpone our wedding for a whole year in order to enable me undertake this course.

Finally to all those who stand for truth, justice and equal treatment of the human kind.
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ABSTRACT

This study sets out to investigate the state of the art concerning computerised networks between information centres in Nairobi. Several information centres were visited and data collected on various aspects of computerisation and computerised networks.

Centres that were found to be computerised were mainly those with international status. Most of the local centres were found to be in the process of being computerised. Micro computer was the only type of computer that was found in all information centres. Even those planning to be computerised were hoping to acquire a micro computer. Many centres had obtained their computer through donation while a few had purchased.

Mini micro CDS/ISIS was the most popular software. Other softwares included Procite, Inmagic, and Smart Library System (SLS). Software, like hardware was also obtained mainly through donation though some centres had either purchased or copied. Hardware and software compatibility as well as standards plays a major role in computerised networks.

Subject headings in use included Library of Congress Subject Headings (SLCH), Sears List of Subject headings (SLSH), Medical Subject Headings (MESH), and Thesauri. All the centres were using
Anglo American Cataloguing Rules (AACR).

Various databases were found to be existing with cataloguing being the most common. Others included circulation, serials, and acquisition. Some centres were in the process of converting their manual database into computer form.

Very few centres were maintaining any kind of computerised networks. Off-line network was more common than on-line. Local Area Network (LAN) was found to be operating in a few centres. Some centres were offering CD-ROM facilities. Several problems were being experienced by those centres with computerised networks. Nevertheless, several advantages were cited that accrue out of the networks.

Several conclusions were arrived at out of the study. Recommendations were made to the following, government, planners and policy makers, information workers, and finally to researchers and scholars.

There is a great need to computerise information centres so as to be able to form computerised networks in order to be in a position to share resources especially during this times of information explosion, dwindling budgets and skyrocketing costs of information.
CHAPTER 1

INTRODUCTION

1.1 BACKGROUND TO THE PROBLEM

Information is a national resource which is necessary for any social economic development to occur. Development in any community depends on the availability of information in all fields. For any community to develop, therefore, it must be in a position to generate its own information, process it, store it, and make it easily and readily accessible to any potential user. For it to be useful as a resource, information has to be delivered at the right time, for the right reason and at the right amount. Otherwise too much or too little information delivered at the wrong time and for the wrong reason is useless.

Information centres are the custodians of information. Their fundamental function is to acquire, process and access information.

The usefulness of information can be realised if all the available information resources can be easily accessed by those who need it. This requires effective coordination to facilitate the sharing of resources between all the available information resources. But it is impossible for any one centre to gather at one particular time and place, all the information that is being
generated in all subjects. This is due to the continued rise of publishing costs, the shrinking budgets and above all, the information explosion factor. Hence, there is a great need to share the available resources between the various information centres. Each centre could even share responsibility of acquiring information by developing a special collection or collections on specified subject(s) and then sharing them.

The need to share resources calls for cooperation between the information centres in their fundamental function. For an efficient and effective resource sharing, it is advisable to form a network which makes the knowledge accumulated in one information centre always available to others since knowledge knows no borders. Such a network is more effective in a computerised/automated environment, since each centre will be in a position to access the databases of the other, on-line. The establishment of network using computer based systems could generate efficient and effective services and products.

1.2 STATEMENT OF THE PROBLEM.

The idea of computerised networking between information centres in Kenya is a fairly new phenomena. This is mainly due to the fact that not many of the information centres are computerised, which forms the basis of computerised networks. The situation is such that not too much appears to be existing in terms of
computerised networking between these centres. This kind of situation could probably be attributed to lack of awareness among the various information managers as to the advantages of computers and computer networks.

This being the case, not too much appears to have been done in this area. Most people tend to concentrate on other common areas. With such background, there is a great need for more work to be done in this area so as to have more information concerning computerisation and computerised networks.

The study was considered necessary therefore, out of the felt necessity, to highlight how the situation is and to gather and accumulate more information in this field. Such documented information is considered useful in creating awareness among information workers. This awareness could facilitate exploitation of the existing computerised networks and even the installation of more.

STRUCTURE OF THE STUDY

The purpose of this study is therefore, to investigate what role the computer plays in the creation and networking databases in information centres. Databases could be created and networked through the use of computers by the formation of a computerised network.

Automation is regarded as the best means of networking
especially for information dissemination. Information centres need to have their databases networked so as to be able to share their resources, for none of them could be sufficient in its information provision. When automating, therefore, they need to consider this possibility.

The following will also be highlighted:

1. What problems are associated with networking information centres through the use of computers.
2. What are the advantages of forming such a network.

There is also the need to look into the compatibility of the computer hardware and software when automating. This is so because if a centre adopts a hardware or software that is not compatible with the others, it stands a slim chance of sharing its resources through a computerised network.

1.3 OBJECTIVES OF THE STUDY

The major and broad objectives of the study is to do a survey of the state of the art of automation in information centres in Nairobi. The computer technology used in each will be analyzed and then compared with the others to see if they can be interlinked or networked. Compatibility of the softwares makes it possible for any two information centres to be networked, otherwise, if the
softwares are not compatible, they cannot be networked.

The study will also examine database structure in various information centres. There has to be a standard way of entering the information so as to make the exchange easier. Exchange of data is only possible when database structures are compatible. Certain standards, therefore, need to be followed to the letter, or created if they are not there, when creating a database. They enable an information centre to be in a position to reap maximum benefits of resource sharing with other libraries through networking.

The study will be carried out with the following specific objectives.

i. carry out a survey of the automation levels.

ii. analyze the hardware and software.

iii. study the cataloguing and classification schemes used.

iv. check on the possibility of forming a network.

v. come up with problems that the existing networks are facing and the benefits that accrue out of the same.

1.4 SIGNIFICANCE OF THE STUDY

Networking databases in information centres through the use of the computers, has several uses to the people concerned with
information at any level. This study is therefore believed to be useful in various ways.

The cardinal duty of information managers is to gather, process, store and disseminate information in the most effective and efficient way possible. This can be achieved through creation of computerised databases and then networking them. Through the indication of the role of the computer in networking, the study will be useful to the information managers in showing how they can offer effective and efficient services. In addition, it will also point out to them as to how the computer can be used to enable them offer specialised services like Special Dissemination of Information (SDI) and comprehensive literature searches.

The study will also be of significance to the information managers for it will point out how co-operative acquisition of materials can be realised through computerised networking. Each information centre can opt to acquire what the other has since it can easily access it through the network. There is also the usefulness of facilitating effective inter-library loan between the information centres.

The study will be useful to computer managers and information managers who are considering automating their centres. This is through pointing out the need to computerise and the advantages of computerised networks. Also through highlighting what factors one
needs to consider when automating any information system and which hardware and software to go for.

The research findings will also be useful to a wide spectrum of information centres patrons especially those doing research and require exhaustive literature searches. Through a computer network, patrons can be served at one point by accessing all the other database(s) within the network without physically moving from one centre to the other. The economies of such a situation, is realised through savings on time, energy, and transport.

The study will show what possibility exits in Kenya of achieving the UNESCO’S National Information System (NATIS) programme. The success of NATIS programme depends to a great degree on the quality of the already existing databases and the proper implementation of the intended ones. The databases should be in such a manner that they can be easily and conveniently exchanged. What are the strong and weak points of the already existing situation?
CHAPTER 2

LITERATURE REVIEW

2.0 WHY FORM A NETWORK

The term network refers to any form of interconnection between individuals or organisations through which the participants agree to exchange their resources. In the information world, a network refers to a group of information centres which are interconnected in one way or the other and have agreed to exchange their information resources.

A network could either be manual or computer based. In a manual environment, the centres exchange their information through inter-library loans. In a computerised environment, which is the subject in this study, the exchange of information is through electronic communication channels which connects computerised databases in each centre in such a way that, each centre is able to access the information of all the other participating centres.

The major purpose of forming a network is to facilitate resource sharing. In support of this fact Martin (1980 p.2) stated that;
"in the library world, institutes have traditionally formed networks primarily to achieve better sharing of resources - resources consisting of bibliographic information and of collections and better service to patrons."

A corollary to this is the fact that no one information centre, however large, could be completely self sufficient.

The term "information explosion" has of late become a household term in the information world. There is a lot of information that is being generated which has got to be acquired processed, stored and accessed. It has become impossible as a result for any one information centre to gather at any one time and place all that is being generated.

Martin (1980 p.8) reacting to this problem states that:-

"a combination of economic circumstances, evolving technologies and the need to deal with increased flow of published information has provided the major incentives for libraries and other information processing organizations to seek out new organizational structures for processing materials and providing access to these materials for patrons and customers".

Ismail (1989 p.29) concurs with Martin and says that,

"there are financial pressures as our libraries and documentation centres are confronted with tighter budgets and higher costs of materials, we should naturally look for ways to stretch the value of each shilling we spend. Sharing resources through networks enables a library not only to buy what it needs for its regular clientele, but also to depend on the network for the specialized materials it may need only for occasional users".
The Information centres are left as a result with no alternative rather than to look for ways of stretching their budgets and resources.

Resource sharing can best be achieved through the creation of computerised databases and then networking them. Then it will be possible to know who has what and thus have access to a varied range of materials.

Were (1990 p. 108) observes that,

"Computerized databases can be networked to facilitate information sharing...we cannot handle the present information explosion using our manual systems...To cope with the processing of this information we must use computer and other technical facilities available on the market. Networking computers is the most efficient method of coordinating databases".

According to Muya and Ndegwa (1990 p. 183-184) all information networks must have the following attributes,

1. Marshall resources from its environment to accomplish results beyond the ability of any one of its members.
2. Develop an organisational design and structure that allows individual institutions to benefit from the macrosystem.
3. Ability to utilize information technology.

2.1 FACTORS TO BE CONSIDERED

Certain factors have to be taken into consideration when developing a computerised network. These factors makes it possible for any network to succeed. Critical among them are standards and
compatibility.

Stressing the importance of standards and compatibility, Lee (1979 p. 215) says that,

"To take advantage of machine-readable databases and the opportunity for greater resource sharing through computerized networking, great care must be given to standardization and system compatibility"

The term standard is given various definitions by the Concise Oxford Dictionary, amongst which the following appear relevant here;

1. the degree of excellence etc. required for a particular purpose
2. an object or quality or measure serving as a basis or example or principle to which others conform or should conform or by which the accuracy or quality of others is judged.

The main aim of standards is to bring into conformity, such that, a certain degree of excellency is achieved for a particular designed purpose. Standards should therefore satisfy a certain need that is shared in common by multiple users of a certain service or subject.

In a computerised network, the standards that are required are those that will make it possible for the various databases to be networked. This made Markuson (1980 p.24) to reckon that:
"the standards that concern computerized networking are objective, not evaluative or subjective standards. Thus we are not concerned with standards that restrict the library’s autonomy, for example, by telling the library what to buy, how much to buy, etc. but rather with standards that will facilitate library cooperation in a network environment" 

Markuson goes further and says that; 

"needed standards include hardware and software interfacing standards to facilitate linkage of systems, bibliographic standards, operational standards, and procedural and quality standards".

The starting point for the generation, implementation, and maintenance of standards is mostly economic in nature. Developing and implementing the necessary standards results in long-term benefits and greater economies.

The aims and objectives of standardization as an organized activity is to contribute to overall economy through cost reduction. One of the various ways of doing so is by mass production, interchangeability and rationalization (Mwobahe 1989).

Compatibility on the other hand, refers to the ability of being able to coexist while at the same time maintaining the individual and independent status. In the computerised network environment, compatibility refers to the situation whereby the various computer hardware and software used in each information centre are capable of being used in combination. That is to say they can be interconnected and be able to exchange their
Kamau (1993) defines compatibility as,

"the ability to exist together in harmony or agreement. In the library networking context, compatibility refers to the components of the electronic systems to function together".

Mwobahe (1989 p.146) further stresses the need for compatibility thus,

"because of the nature of the information sharing by users, the need for compatibility and interconnection becomes more and more urgent".

Kamau (1993) goes further and reckons that;

"standardization and compatibility are very closely related, but they are not one and the same thing. Standardization is a method of achieving compatibility".

This stresses the usefulness of standards which, if maintained will enable compatibility to be achieved.

2.2 ADVANTAGES OF NETWORKING

Several advantages accrue out of a network. According to Marcy (1976) and Musana (1991), such advantages include;

1. Improved ability of the participating centres to perform searches.

2. Staff specialization which would enable staff to concentrate on a limited number of tasks, and, therefore,
lead to improved performance, and job satisfaction initially.

3. Better working relationship between cooperating institutions as a result of continued interaction and exposure through staff exchange, visits etc.

4. Facilitation of information technology transfer from one or institution with an array of information technologies such as computers, microfiche, CD-ROMS etc. to one which is only beginning to build up an information technologies awareness environment.


7. Accessibility to some but difficult to get hands on items due to funds limitation.

8. Reduction of wastage and duplication. This point is supported by Munisi and Nguli (1989 p. 88) who asserts that;

"research networking or information networking is the linking of individuals or institutions within shared research of information goals and helps to optimize the use of available resources and to avoid duplication".

Inspite of what Marcy and Musana have said, the major advantages of networking, especially in a computer based environment, are;

1. Information sharing.

2. Cost sharing.

3. Sharing of hardware and software.
2.3 METHODS OF A COMPUTER BASED NETWORK

A computer based network could either be on-line or off-line

2.3.1 On-line network.

An on-line network implies a direct connection to all the computers in the network. In such an environment, one is able to retrieve information from another computer directly into his screen. The user communicates directly with the computer system with no intermediary.

Chen and Schweizer (1981 p. 2) commenting on on-line network, says that;

"the searcher, using a specific set of predefined commands directs the computer in searching machine-readable indexes for certain information. The searcher, by typing the appropriate commands into a terminal, can tap the resources of the entire system".

Lancaster (1978 p. 9) adds that;

"In an on-line system the users are in direct communication with the database they wish to interrogate. They communicate by means of a terminal, which may be a simple typewriter terminal or some type of video display (e.g cathode ray tube of plasma panel) with associated keyboard, connected to the computer by means of communication lines."

The On-line network serves several users simultaneously through time sharing. Each user gets the illusion that he is the sole user of the system since the response of the computer is
prompt. This is what is termed as a multi-user environment. It is very useful for searches where users need the information right away, for example, "a physician needing information to deal with an immediate clinical problem" (Lancaster 1978 p. 10).

On-line networking is interactive in nature which makes it appear to be more or less like a conversation between the searcher and the computer system. The user makes an enquiry, reviews it and if unsatisfied, modifies it and then reviews it again. This process of enquiry, review and modification makes a search more systematic, effective, efficient and above all exhaustive such that the final results fulfil precisely the original information needed (Chen and Shweizer 1981).

Chen and Shweizer (1981) and Lancaster (1978) have given several advantages of on-line systems networking. These include:

1. **Speed.** It takes a very small fraction of time to complete a search.

2. **Flexibility.** There are several added points by which an information source could be accessed. These are like language, type of publication, codes, author affiliation, price, country of publication and abstract. These access points make a search to be tailored to the precise needs.

3. **Comprehensiveness.** An information centre need not regularly purchase, store, and organize large numbers of sources in anticipation of an information need. The accessibility to other databases enables the centre to comprehensively acquire those bibliographic information sources when it needs them.

4. **Currency.** The information is usually more current because the database is updated on a monthly or even daily basis.
5. Convenience. Terminals can be made widely available and far removed physically which makes it possible for on-line networks to be used in a non-delegate mode. The user can therefore conduct his own search at the terminal if he so wishes.

6. Cost effectiveness. A lot of clerical time is removed which makes it to be very cost-effective.

7. Job satisfaction. The information professionals delivers much more information in much less time and with a thoroughness and skill previously impossible.

8. Searching errors are less serious for they can be identified and corrected quite rapidly.

2.3.2 OFF-LINE NETWORK

In an off-line network, there is no direct connection to the computer. According to Lancaster (1978 p.9);

"the term off-line, as applied in information system, refers to the fact that the searcher is not in direct communication with the database or with the computer by which this database is manipulated. That is, the user prepares a searching strategy away from the database and without being able to interact with it. This searching strategy is put into machine-readable form, batched with others, and 'run' when computer time becomes available".

Salton (1975 p.5) further adds that;

"any file changes that occur are accumulated (batched), and all records that require updating are simultaneously treated in a single sweep through the file"

In an off-line networking system, the information is transmitted manually using other means such as diskettes,
telephones, fax machines, telex, etc. (Were 1990).

Lancaster (1978) and Salton (1975) have given the following disadvantages of the off-line processes;

1. Delay. A lot of delay is experienced due to lack of real-time control. The "turnaround time" is usually from one to a few days. A user can ascertain whether the search was successful only after receiving a printout of the search results. If by any chance it is unsuccessful, the user is forced to go through the whole process again, modifying his strategy, the delay not withstanding.

2. The response time is only satisfactory to a user who is involved in a long-term project whereby the response time is relatively unimportant.

3. The exact states of any given record may not always be ascertained since changes are not incorporated into the files as they occur.

4. There is no browsing capability which increases the search error.

5. The searcher operates "blindly" since he cannot develop his search strategy in an interactive, and heuristic manner.

6. The user is unable to conduct his own search forcing him to delegate the responsibility to an information specialist who knows how to interrogate the system. The problem here is that the user may not be able to describe clearly to an information specialist, what he is looking for, or the information specialist may misinterpret the request of the user.

2.4 TYPES OF DATABASES

Information managers in their daily routine of handling information, are always creating databases. Through the creation of databases information retrieval is made much more easier and
convenient, whenever it is required.

Databases can either be manual or computerised. Computerised databases are the ones that are of concern here. As were (1990 p. 108) asserts that;

"The most effective and efficient way of developing databases is through application of new technology, particularly the use of computers. Computerized databases can be networked to facilitate information sharing."

Databases of interest to information workers fall into two major categories.

a. Bibliographic
b. Full text.

2.4.1 BIBLIOGRAPHIC DATABASES

They give the bibliographic citations that help the user to locate the actual material which carries the required information. The actual information is, therefore, not provided, but rather, documents are indicated from which it will be found.

Rowley (1980) describes bibliographic databases as a series of linked bibliographic records, with each record containing some combination or permutation of the said citations.
An ideal example of a bibliographic database is the library catalogue. It contains such citations or components like, the author, title, translator, illustrator, editor, edition, place of publication, publisher, year of publication, subject tracings, call number etc. of any specific material.

According to Rowley (1980 p.54);

"these components then constitute a document reference, which if used in appropriate databases, may contribute to bibliographic control by facilitating the retrieval of relevant documents when they are needed."

2.4.2 FULL TEXT DATABASES

These databases store the actual information, rather than the bibliographic citations. Commenting on this type of databases, Rowley (1980 p.58) says that;

"the majority of machine-readable databases comprise series of records which though formatted in a similar fashion to bibliographic databases store actual information rather than references. Sometimes referred to as databanks, these databases provide answers, facts and data."

These databases therefore provide the actual text as it is in any information carrier say a book or a journal. A user does not need to refer to any other source(s) unlike in the bibliographic databases.

Databases therefore, either refer the user to the material
from which the required information is carried or they provide the real or actual information.

2.5 NETWORK TOPOLOGIES

A network topology, also known as network models indicates the way the information flows within the participating institutions in any computerised network. The flow of information from one centre to the other is dictated by the type of topology adopted in setting up the network.

There are various topologies of computer networks. Tee (1979), Were (1990), Franta and Chlamtac (1981) and Tonenhaum (1981) have described the following topologies of network.

2.5.1 Non-directed (mesh) network

In such a network, all the participating institutions or nodes communicates directly with one another and to the host computer due to the decentralised nature of the network.

2.5.2 Bus Network

All the nodes in a bus network are connected directly to a linear transmission medium which is called the bus. Transmissions from any of the nodes propagates simultaneously in both directions.
through the medium thus providing a bi-directional transmission to all other model. The information thus flows in a straight line across the nodes. In this kind of network, there is no intercepting host computer.

2.5.3 Star (Composite) network.

In a star network, there is a special node or hub termed the host, to which all participating institutions are connected. Any of the participating institutions communicates with any other institution via the central node which may also be called, the switching centre. The central node acts as a protocol converter or gateway. One of the most significant feature of the star network is that, much of the intelligence required to control the network can reside in one place, the host.

The participating institutions here, are free to create their own databases without any interference or control from the host computer or any other network member. However, no communication exists between the members of the network. The only communication that exists is between each member and the host. When members want to communicate to one another, they have to go through the host.
2.5.4 Tree (Hierarchical) network

It is described thus since the host computers or nodes are arranged in a hierarchical or tree-like order. Several smaller stations, which are themselves stand alone computers that can process and store information independently, are connected to a host computer (in a star format). The smaller stations can only access the information stored in the host computer or node to which they are connected, but not the other computers to which their host computer or node is connected. To access the information on the other host computers, the smaller stations have to go through their host computer, otherwise, no direct link exists between the individual stations.

2.5.5 A Ring (Loop) network

It consists of a series of nodes or computers connected to each other to form a closed loop or ring. There is however, a host computer which is also part of the loop. The nodes are arranged to accept data transmitted to it from an immediate neighbouring node to which it is connected and to forward the data bit by bit to its other connected node. It can only do this in one direction only. Thus, although communication is two way, it is restricted to the immediate next door neighbour only. In this kind of network, only two computers are directly connected to the host computer
The problem with this structure is that, there is the possibility of unwanted data or data fragments circulating around the network indefinitely. Because the ring network is a closed loop, the data will circulate indefinitely unless specifically removed.

2.6 TYPES OF NETWORKS

Networks are categorized according to the area they cover. Beauchamp (1987) and Were (1990), discusses the most commonly used types of networks as follows;

2.6.1 Small Area Network (SAN)

This is the one that serves a fairly small area like a room. The computers are networked just within the room. Technically, this type of networking is easy and more efficient.

In such an environment, there is a common computer storage called a server with several computers connected to it which are called workstations. The workstations can however function independently.

Small Area Network is also in a way a Local Area Network.
2.6.2 Local Area Network (LAN)

This one serves a limited geographical area, thus going beyond the room. It provides interconnection between a variety of data communication devices. Computers within a building or an organization could be networked as long as it is within a reasonable area, for example, a university library with several branches at the faculties.

2.6.3 Wide Area Network (WAN)

It is designated to communicate information over large distances through very many intermediate nodes generally operating in form of a mesh network.

Were (1990 p. 113) gives an example and says that;

"...all computers within the major towns of Kenya could be networked using WAN facilities"

SAN and LAN involves connections through the use of real computer wires while WAN operates in a wireless environment.
CHAPTER 3

METHODOLOGY

3.0 INTRODUCTION

The study intends to investigate the current state of automation in some selected information centres in Nairobi. The aim is to see how far they have computerised their services and whether the same are or could be networked. Problems they face in networking will also be investigated.

3.1 SAMPLE IDENTIFICATION AND CHOICE

There are several information centres in Nairobi. A preliminary survey was carried out to identify them. This helped in knowing what the total population could be, which in turn, helped in knowing the size of the sample in order to make it representative.

Information centres of interest here are the libraries (academic, public, and special) and documentation centres. The following seventeen information centres were visited but data was obtained from fifteen of them;
1. American Cultural Centre Library,
2. British Council Library,
3. International Centre of Insect Physiology and Ecology (ICIPE) Library
4. International Council for Research in Agroforestry (ICRAF) Library,
5. International Laboratory for Research in Animal Diseases (ILRAD) Library,
6. Kenya Agricultural Research Database (KARD),
7. Kenya Agricultural Research Institute (KARI),
8. Kenya Medical Research Institute (KEMRI) Library,
9. Kenya National Archives (KNA),
10. Kenya National Library Services (KNLS),
11. Kenya Technical Teachers College (KTTC) Library,
12. Kenyatta University (K.U),
13. Macmillan library,
14. Premier Academy,
15. United Nations Environmental Programme (UNEP) library,
16. University of Nairobi (U. O. N.) Library, and
17. World Bank library, Nairobi.

3.2 SUBJECTS

The people who were used to supply the information were the staff who were incharge of automation. These are the people who have knowledge on the various aspects of the computer. As a
result, they were the right people to give the right information. They were expected to even shed more light in some cases if certain aspects of the computer or computerised networks were not clear.

Though this was the intention, the person in charge of the information centres in most cases ended up answering the questionnaire.

3.3 DATA COLLECTION METHODS

The main method of collecting data was the questionnaire. It was constructed in such a way that it included both closed and open questions where it was deemed appropriate. For those questions with certain specific answers, closed questions were preferred. Where the respondents were expected to give their own views, the questions were left open in order not to restrict the answers. The questionnaire gathered the largest bulk of the data.

The questionnaire was hand delivered to the information centres. The respondents were then requested to fill it. Where the concerned respondent(s) were not present it was left behind and collected another day.

The questionnaire was accompanied by two introductory letters, one from the department and the other from the author himself.
They indicated who the researcher was and the purpose of the information being gathered.

Interviews were also carried out with the respondents. This was to help in clarifying anything that was not clear and might have come about in the process of filling the questionnaire.

Personal observations were carried out as well. This was to help in getting a personal experience of the system(s).

3.4 DATA ANALYSIS

The collected data was then sorted out and them tabulated. This was to indicate what was in which centre, what was common or rare and the existing situation in general.

Through descriptive and analysis procedures of the sorted and tabulated data, it was possible to tell how the situation is as concerns computerisation, computerised networks, the types and the existing problems.
CHAPTER 4
DATA ANALYSIS

4.0 INTRODUCTION

This chapter presents the analysis of the data that was collected from the field. Due to the nature of the data, descriptive analysis methods, tabulations and percentages will be used. The analysis will show the state of computerisation in the information centres visited, the common hardware and software, the existing computerised networks plus the problems and benefits that accrue out of the networks.

There were plans to visit and collect data in certain information centres, but due to some technical problems, the questionnaires were never filled.

4.1 LEVELS OF COMPUTERISATION

Computerised information networks between information centres or any other institutions, can only occur in situations whereby the said centres or institutions are computerised and the information is in an electronic form. Otherwise, in an environment whereby there are no computers and the information is not in an electronic form, computerised networks cannot exist.
This was the reason behind the collection of data on the current levels of computerisation in the information centres that were sampled to participate on the project.

The above information was obtained through asking questions on when the centre was established, whether it is computerised in any way and if so, when. The answers obtained were either,

1. computerised in one way or the other.
2. not computerised but planning to do so in the future.
3. not computerised with no plans of doing so in the future.

The answers given were as shown in the following table I.

<table>
<thead>
<tr>
<th>STATUS</th>
<th>CENTRES</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computerised</td>
<td>11</td>
<td>73</td>
</tr>
<tr>
<td>Not computerised</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

From the table, it can be seen that almost all of the 15 centres that participated in the project were computerised with
only a few that were not. Out of the 15 centres, 11 were computerised which represented 73 percent. The remaining 4 were not computerised which represented 27 percent.

Among those that were not computerised, three were planning to do so in the future with only one that did not have any plans at all.

There seemed to be no relationship between when the centres were established and when they were computerised. Some were established earlier and they are not computerised while others were computerised as soon as they were established. For example a centre like Macmillan was established in 1931 during the colonial days, and taken over by the Nairobi City Council in 1962 and yet it is not computerised and it has no plans to do so in the near future. On the other hand, ICIPE was computerised as soon as it was established.

However, some centres, though they could be said to be computerised in a way, they were actually in the process of inputing their manual databases into the computer. That is to say their operations are not still manual.
4.2 HARDWARE

The 11 information centres that were computerised all had acquired micro computers. None had any other type of computer. Even those planning to be computerised in the future have decided on acquiring micro computers, like Premier Academy. The World Bank already had purchased one micro computer which it intends to make operational soon. KARI libraries have also acquired 8 micro computers, some printers and Compact Disks Read Only Memory (CD-ROMs) through donation.

4.3 SOFTWARE

Several softwares were being used for the various information databases. These are as shown in table II.

<table>
<thead>
<tr>
<th>Software</th>
<th>Centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS/ISIS</td>
<td>11</td>
</tr>
<tr>
<td>Inmagic</td>
<td>2</td>
</tr>
<tr>
<td>Procite</td>
<td>1</td>
</tr>
<tr>
<td>SLS</td>
<td>2</td>
</tr>
</tbody>
</table>
As shown in table II above, micro CDS/ISIS was the most commonly used software among other softwares. It was being used in all the centres that were computerised. Others included Inmagic, Procite and Smart library System (SLS). These softwares were being used mainly for cataloguing databases except SLS which was used for handling circulation. Inmagic was being used hand in hand with micro CDS/ISIS in ICIPE and ILRAD. However, these two centres were in the process of converting the databases that they had developed using Inmagic to micro CDS/ISIS. The reasons given for the conversion were,

1. compatibility with other softwares.
2. CDS/ISIS is more common and as such, it is easier to obtain maintenance support, training, and backup.
3. CDS/ISIS, starting from version 3.0 has the capability of networking.

This element of conversion of database from using Inmagic to using CDS/ISIS further emphasises the popularity of the latter.

Procite was only being used in UNEP library where CDS/ISIS was also in use.

Smart Library System (SLS) was being used in KTTC and ICRAF for circulation purposes.
Premier Academy and KARI intends to install CDS/ISIS software to run their databases. World Bank on the other hand intends to install a World Bank approved software in order to be in harmony with other World Bank information centres in other countries.

The eleven centres that were computerised obtained their softwares through either donation, purchase or copying. This is as shown below.

<table>
<thead>
<tr>
<th>TABLE III: MEANS OF OBTAINING THE SOFTWARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Means</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Donation</td>
</tr>
<tr>
<td>Purchase</td>
</tr>
<tr>
<td>Copying</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

It is evidenced from the table that most of the centres obtained their software through donation which represents 55 percent. The centres that got the software either through purchase or copying were more or less equal. This represented 27 percent and 18 percent respectively.
Other softwares found in use for various purposes included, Lotus and wordprocessing softwares (Wordperfect and wordstar).

4.4 COMPATIBILITY OF HARDWARE AND SOFTWARE

The information centres that participated in the research have all acquired micro computer. But this fact does not necessarily mean that they are compatible.

Compatibility on the side of software appears possible. All of the computerised centres were using micro CDS/ISIS. Even those with plans to do so intends to install it for their database management. Even some centres are converting their databases which they had developed using other softwares, into micro CDS/ISIS. This indicates that software compatibility can be achieved easily. The fact that network can be established using micro CDS/ISIS (starting from version 3.0), further emphasises this point.

4.5 STANDARDS

There were only two centres, University Of Nairobi (U.O.N.) and International Laboratory for Research in Animal Diseases (ILRAD) who identified the kind of standards they were using in their networks. The former uses Machine Readable Catalogue (MARC) records while the latter uses Common Communication Format (CCF).
Most of the interviewees in other centres could not identify the kind of standards that they were using. Some did not even seem to understand what was meant by standards.

4.6 CLASSIFICATION AND CATALOGUING SCHEMES

Table IV shows the classification schemes being used in the information centres sampled.

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Centres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>UDC</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>DDC</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Others</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100</td>
</tr>
</tbody>
</table>

The classification schemes mostly used in the centres included library of Congress, (L.C.), Universal Decimal Classification (UDC), and Dewey Decimal Classification (DDC). Among the three none appeared to be more common than the other. All the three had more or less the same percentage in their adoption. L.C. was used in 23 percent of the centres, UDC in 38 percent and DDC in 31
Among the others category, was the World Bank Information Centres Classification Scheme which was only being used at the World Bank Information Centre.

KARD and UNEP did not indicate the classification scheme they were using.

Several reasons were advanced as to why any information centre adopted a particular scheme. Among others, the reasons for adopting UDC were,

1. its more specific.
2. its suitable for special centres.
3. its more convenient to use.

These probably explains why it is more common in special centres like ICIPE, KEMRI, ILRAD, ICRAF and KARI. All these are special centres dealing with certain specific subjects or areas of research.

DDC on the other hand was adopted in some centres because of the following reasons,

1. suitability for small centres.
2. flexibility of the numbers (notation) used.

3. usage simplicity.

The suitability of DDC for small centres explains why it was adopted in small libraries like Premier Academy while its simplicity explains why it was adopted in public libraries like Macmillan and KNLS due to their wide spectrum of clientele.

The Library of Congress (LC) classification scheme was only found being used in academic centres like universities (U.O.N & K.U.) and Colleges (KTTC). The reason given was that it was very detailed in its subject coverage hence its suitability for academic centres.

The World Bank Information Centres Classification Scheme is being used in all World Bank Information Centres worldwide. The Nairobi Centre therefore, had no other choice so as to be in harmony with the other centres in other countries.

4.7 SUBJECT HEADINGS

The subject headings used tended to conform with the classification scheme in use. However, in some centres, they were quite different.

The subject headings used included mainly library of Congress
Subject Headings (LCSH), Sears List of Subject Headings (SLSH), Medical Subject Headings (MESH), and Thesauri like CAB, AGROVOC and AGRIS. This was as shown in table V.

TABLE V:
SUBJECT HEADINGS IN USE

<table>
<thead>
<tr>
<th>Subject Headings</th>
<th>Centres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCSH</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>SLSH</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>MESH</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Thesaurus</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The Library of Congress Subject Headings were only used in those centres that have adopted Library of Congress Classification Scheme. These were the centres in academic institutions. The reason was that these subject headings are used together with the Library of Congress Classification Scheme.

Sears List of Subject Headings (SLSH) was being used in those centres that have adopted both DDC and UDC. The reason given was that, like Library of Congress List of Subject Headings, Sears List of Subject Headings is used together with the two classification schemes. Furthermore, the two schemes, DDC & UDC, are related.
schemes. Furthermore, the two schemes, DDC & UDC, are related.

Medical Subject Headings (MESH) was only used in KEMRI. The reason given was that it is a medical centre and MESH deals with medical literature.

Thesauri were being used mainly in special centres. The reasons advanced were that they are subject specific and as such they are very exhaustive in that particular subject. They are therefore more comprehensive, relevant and convenient to use.

Some of the thesauri being used included, CABI, AGRIS and AGROVOC. These thesauri cover mainly agricultural literature. The centres that use them, ICIPE, KARI, ILRAD and ICRAF deal with one aspect of agriculture or the other. ICIPE conducts research in insects including agricultural pests, ICRAF in agroforestry, ILRAD in animal diseases and KARD documents information in agricultural research.

These thesauri are also useful for standardisation purposes in indexing and abstracting. This makes exchange of information between related centres easier.

Most of the people interviewed could not however, tell why their information centres chose that particular subject headings in use.
4.8 CATALOGUING RULES

The centres that participated in the research all use Agro American Cataloguing Rules (AACR). This means that descriptive cataloguing of materials is expected to be the same in all if the rules were strictly followed to the letter. The different will only be found in the call number, and subject cataloguing which depends on the classification scheme and the subject headings in use respectively.

4.9 COMPUTERISED DATABASES

Computerised databases are those databases that are in electronic form. The ones of interest here are the 4 main information centre databases which are very important for the function of any centre. These are acquisition, cataloguing, circulation and serials. The situation was as shown in table V.
TABLE VI:
DATABASES CREATED

<table>
<thead>
<tr>
<th>Databases</th>
<th>Centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataloguing</td>
<td>10</td>
</tr>
<tr>
<td>Circulation</td>
<td>4</td>
</tr>
<tr>
<td>Serials</td>
<td>4</td>
</tr>
<tr>
<td>Acquisition</td>
<td>3</td>
</tr>
</tbody>
</table>

Catalogue database was the most common and almost all centres appeared to have started their computerisation at this point. It was found in almost all centres computerised except university of Nairobi. Even those centres that have recently acquired a computer were actually in the process of inputing their manual catalogue into the computer.

Circulation and serial databases were the next common. Circulation was found in 4 of the centres, which had created catalogue database as well. Serials database was found in 4 of the centres. Amongst these, ILRAD had also created catalogue as well as circulation databases. KEMRI had only created catalogue database while U.O.N. had only this kind of database. ICIPE was actually in the process of creating the serials database.
Acquisition database was only found in 3 centres, ICRAF, KTTC and ILRAD. ICRAF had also catalogue as well as circulation databases on top of acquisition. KTTC had only catalogue database in additional to acquisition while ILRAD had all the other three databases (circulation, cataloguing and serials).

However, U.O.N. had other databases which included Thesis, Union list of periodicals, Institute of Development Studies (IDS) research papers, on-order file (World Bank) and short loan. Thesis database contains all the thesis produced by students of the U.O.N. Institute of Development Studies (IDS) research papers are those papers produced in the institute which is a constituent institute of the U.O.N. On-order file (World Bank) is a list of the materials that have been ordered under the World Bank materials acquisition programme. Short Loan are those materials that have been placed on short time lending due to their great demand or scarcity. They are loaned out on short time basis so as to facilitate wider circulation among users.

4.10 COMPUTERISED NETWORKS

On the question of whether the centres maintained any kind of computerised networks with other centres the answers were as follows, table VII.
TABLE VII:
EXISTING NETWORKS

<table>
<thead>
<tr>
<th>Status</th>
<th>Centres</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network systems</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>Non network systems</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

There were very few centres that maintained any kind of computerised network with other centres within Nairobi. Only 5 centres (ILRAD, ICIPE, U.O.N., KEMRI & ICRAF) indicated that they maintained any kind of computerised network with other centres. This represents about 33 percent of the centres sampled. These were mainly international centres. The methods used were either on-line or off-line. The rest 10 of the centres did not have any kind of computerised network.

Some centres, however, had a local area network (LAN) operating within the parent organization. Others had also a wide area network (WAN) operating within countries.

ICIPE maintains an off-line computerised network with other centres in Nairobi which mainly deal with agricultural oriented literature. Such are like KADOC, ICRAF and KARD. It also
maintains an on-line network with other centres in other countries under PESTNET. These other centres also deals with pests. PESTNET is an organ of specialists working in pest management who came together and decided to form a forum through which they can be able to share effectively information on pests between themselves. It has its headquarters in ICIPE. This resulted to the formation of Pest Management Documentation and Information System and Services (PMDISS) with their headquarters also in ICIPE. Other coordinating PMDISS centres are in other Eastern and Central African countries like Uganda, Mozambique, Somalia, Tanzania, Rwanda and Zambia. These centres send their information to ICIPE, where they in turn get information from other centres.

There is also a Local Area Network (LAN) operating within ICIPE as an organization whereby messages and information is exchanged on-line between members of staff. Plans are underway to extend this facility to cover all other ICIPE research stations throughout Kenya.

KEMRI operates an on-line computerised network under the healthnet. Among the centres that it connects with are ILRAD, U.O.N., WHO regional office Nairobi, WHO Headquarters, and National library of Medicine (United States).

ICRAF operates an on-line computerised network with over 20 centres both local and in other countries. Among the local ones
are ILRAD, ICRAF and ICIPE, while those in other countries include ILCA (Ethiopia), ISMAR (the Netherlands), CIAT (Columbia), CIP (Peru) CIMMYT (Mexico), IFRI (U.S.A.) and CGIAR (U.S.A.). Local Area Network (LAN) had already been installed to operate within the organization. It is expected to start operating before the end of the year.

ILRAD has an on-line computerised network with 16 other centres. Some are within Kenya while others are in other countries. These 16 centres make up the Consultative Group on International Agricultural Research (CGIAR). They include ICRAF (Kenya), ILCA (Ethiopia), IBPGR (Rome), and CIP (Lima) among others. This could be described as a Wide Area Network (WAN). There is also a Local Area Network operating within the organisation.

University of Nairobi on the other hand operates an Off-line computerised network with 10 information centres all in Kenya. They include ILRAD, ICRAF, ICIPE, AMREF, and the public universities.

KARD maintains a CLUSTER which is usually mistaken for a network environment. What exists are several terminals which are connected to one computer, the SERVER. The terminals are not able to store any information or data themselves. The terminals acts as user interfaces for accessing the database which is common and
stored in the server. There is however one computer which is complete with its own harddisk though connected to the cluster and it can stand alone.

4.11 CD-ROM FACILITIES

This is the compact Disk Read only memory. It is a disk with information but one can only read. There is no facility of putting or altering the information in it.

CD-ROM is an off-line computerised network. This facility was being offered in several of the centres. They contain commercial databases whereby a centre has to subscribe for continued supply of the same. The centres that offer this facility included ICIPE, KEMRI, ICRAF, ILRAD, U.O.N. and KARD.
The databases offered on CD-ROM in these centres included the following:

**TABLE VIII:**

**CD-ROM DATABASES AVAILABLE**

<table>
<thead>
<tr>
<th>CENTRE</th>
<th>CD-ROM DATABASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICIPE</td>
<td>AGRIS, CAB and CIARC</td>
</tr>
<tr>
<td>KEMRI</td>
<td>MEDLINE</td>
</tr>
<tr>
<td>ICRAF</td>
<td>AGRICOLA, AGRIS, CABCD, TROPAG, TREECD, SESAME, BOOKS in Print and OED</td>
</tr>
<tr>
<td>ILRAD</td>
<td>CAB, Science Citation Index, Current Content life Sciences, Veterinary Science and animal health care.</td>
</tr>
<tr>
<td>U.O.N.</td>
<td>Social Science citation index, Science citation index and engineering databases.</td>
</tr>
</tbody>
</table>

Thus, each centre appeared to be availing CD/ROM facilities in database(s) of special interest to its primary clientele or one that serves its purpose.
4.12 NETWORK PROBLEMS

The centres that were offering any kind of computerised network stated that they were experiencing some of the following problems:

1. **Staff turnover.** There was a feeling to the effect that the rate of staff turnover of the experienced and trained staff was very high. It takes time and lot of funds to train a member of staff and if the same member decides to quit, it takes quite sometime to get a suitable replacement.

2. Some of the interviewees in some centre felt that others don’t have much to offer. This made these centres feel that they were not benefiting much from the network.

3. **Frequent breakdown of computers which cripples the network** was not uncommon.

4. **Transmission of limited amount of information.** Some people felt that the amount of information transmitted was sometimes inadequate.

5. **Teething problems which are mainly to do with compatibility.**

6. **Too many softwares.** There are many softwares in the market.
which makes it rather difficult to decide on which software to acquire.

7. The users are not keen on learning to do searches for themselves. Thus the network is not utilized to the maximum. Searches are as a result delegated to the information workers which sometimes overloads them with a lot of work.

8. Availability of information

9. Logistics and maintenance

10. Printing problems

11. Inefficient telecommunication problems in some of the countries especially in Africa and Asia. Networks rely wholly on telecommunication facilities in any one country and if these are not efficient it automatically follows that the networks will experience communication problems.

4.13 NETWORK ADVANTAGES

The following were cited as some of the advantages that accrue out of the networks.

1. Access to databases by researchers hence providing them with
a chance to do the searches themselves.

2. The assurance of getting the information is increased since one can access several databases.

3. It is easier to collect grey literature (unpublished materials) since the databases contain information on on-going research.

4. Communication between researchers is facilitated especially those carrying out research in the same fields from other institutions. That is to say, researchers in the same field are connected and as such, they are able to corroborate their research.

5. Document delivery is assured since one can identify the institution holding a certain document.

6. Rapid communication and easy exchange of information plus instant replies to enquiries.
5.0 INTRODUCTION

The cardinal duty of information managers is to gather, process, store and finally disseminate information to possible users. Considering the amount of information to be handled, information managers have found it almost impossible to achieve their goals. This is especially so when using the conventional methods. They are as a result left with no choice rather than to search for alternative methods of coping up with the growth of the information. This is where computerisation and networks comes in.

5.1 DISCUSSION

5.1.1 COMPUTERISATION LEVELS

Information managers in Kenya have come to appreciate the usefulness of computers in information handling. This could be attributed to the various advantages of the computer systems over the manual systems. The number of information centres that have had their systems computerised is good evidence.

Among the centres that participated in the project, about 73 percent of them were either wholly computerised or were in the
process of doing it. The rest, which were not computerised maintained that they had plans to acquire and instal a computer in the near future. Some had even acquired the hardware and were waiting to instal the software. Nevertheless, there was one and only one centre among them that did not indicate any plans of being computerised.

The above situation clearly shows that the use of computers in handling information have gained great acceptance in Kenya. Many information centres are computerising their systems so as to utilize this technology. However, there are problems here and there which needs to be tackled in order to enhance computerisation process.

It is only after the centre's systems are computerised that it will be possible to form computerised networks. Otherwise if the information is not in electronic form, computerised networks cannot exist. Thus, if a centre is planning of forming computerised networks, the first step is to computerise its systems.

5.1.2 HARDWARE AND SOFTWARE COMPATIBILITY

Computerised networks can be achieved in an environment where the hardware and the software being used can "talk". That is to say they are compatible. The various hardware and software installed in each information centre could be interconnected and be
in a position to exchange the information. Where this is possible, the hardware and software are said to be functioning together in harmony or agreement.

In the centres that participated in the project, micro computer was found out to be the only computer hardware in use. Inspite of this fact, other factors need to be taken into consideration before it can be said with certainty that the existing hardware is compatible. Such include, like whether the various micro computers themselves like, ICL, IBM, APRICOT, NCR, OLIVET, etc are themselves compatible. It is only when they are compatible that they can be able to exchange information in a computerised network environment.

Micro-computer has several advantages over other types of computer. This probably explains why it is the most common type in use.

There wasn’t a wide range of software being used in the centres visited. This was inspite of the fact that, among the network problems, too many softwares in the market was cited as one of them. Most of the centres were found to be using micro-CDS/ISIS. This is a database management system software specifically designed and developed to handle information databases which are textual in nature.
Micro CDS/ISIS has several advantages over other softwares in handling textual data. These advantages have been outlined by Were (1991 p. 88-89) thus;

1. The package is available free of charge to non-profit organisations of the UNESCO member states. With the present financial constraints in developing countries, we couldn't have a better offer.

2. It is a very flexible software. Once database is designed you can make any type of changes you want at any time. It is possible to produce any type of report (output) with minimum effort.

3. The size of the database is only limited to the size of the disk storage facility available on your computer and by the power of the operating system. The earlier versions of MS/DOS for instance, supports only upto 32,000 records.

4. It has variable fields, meaning that the storage space for any field will adopt the size of that field at the particular time and will automatically change as the size of the field changes. Thus variable fields do not waste disk space. Furthermore it offers a facility for unlimited number of fields. The maximum number of characters for a field is over 1600 which is more than what information centres require.
5. CDS/ISIS is easy to master. You do not have to be a programmer to use it effectively. The format language is very easy to master.

6. The software was designed specifically for libraries and documentation centres. It therefore answers about 99 percent of database problems in these centres.

Other additional advantages of CDS/ISIS include:

7. Availability of training facilities. KENISIS a CDS/ISIS package user group in Kenya, with over 30 members, trains users of this package (Mutula 1994 p.13).

8. The CDS/ISIS capabilities can be enhanced further through the usage of programmes written in CDS/ISIS pascal (Karei 1994 p.8).

9. Starting from version 3.0, CDS/ISIS has a multiuser facility in a network environment using NOVELL network, Banyan Vines etc. (Karei 1994 p.8).

However, inspite of the aforementioned advantages there is a problem with CDS/ISIS in that it is not an integrated system. It therefore does not have ready made functions to handle house keeping processes like issuing of materials. For one to be able to
handle these areas, one has to acquire and instal an integrated package.

Nevertheless, the advantages greatly outweighs the said problem. Furthermore, the element of circulation does not play a significant role in computerised network.

These advantages offers an explanation as to why CDS/ISIS is the most common database management software. That is even why some centres are converting their databases from running on other softwares to CDS/ISIS. It is therefore apparent that the idea of software compatibility among information centres in Kenya cannot be a major problem and can thus be achieved. However, it must be borne in mind that, the data entry format need to be considered as well (the worksheet). Otherwise, if it is not the same, the data cannot be exchanged effectively in a computerised network environment. This is because different things will have different meanings to different people (see appendix II which displays various worksheets from some selected information centres using micro CDS/ISIS).

Other softwares being used included Procite, Inmagic and Smart Library System (SLS). Procite was a rare software and where it was being used, micro CDS/ISIS was also being used. Inmagic was also rare and where it was being used, it appeared as if it was loosing popularity. This is because these centres
were in the process of converting the data in Inmagic to Micro CDS/ISIS.

Smart Library System (SLS) on the other hand was being used for handling circulation databases only. Even here, the catalogue database, like at Kenya Technical Training College (KTTC), the catalogue database was created using micro CDS/ISIS and then imported into SLS. Though SLS was, like CDS/ISIS developed specifically for handling textual databases, it appears to be ineffective in handling circulation. This is because it had no facility of automatic data capture equipment like the Plessey pen or Automatic Library System (ALS). It is as a result subject to typographical errors since one has to type in the information. If one makes a mistake, the wrong information is entered or retrieved.

5.1.3 CLASSIFICATION SCHEMES

The classification schemes adopted varied from one information centre to another. Each centre adopted the scheme that it found most suitable to help it in achieving its aims and objectives of serving its clientele most successfully. This was completely with undue regards of whatever other centres had adopted.

Public libraries like Kenya National Library Services (KNLS) and MacMillan, were in favour of Dewey Decimal Classification
Scheme (DDC). The simplicity advantage of DDC makes it easier for
the clientele of public libraries to be able to find their way
inside the libraries and to locate their materials. The clientele
of these libraries have a very wide spectrum ranging from the very
young to the very old and from literate to illiterate. Such kind
of clientele needs an easy scheme without much details and
complications, which they find easy to understand and follow.

Dewey Decimal Classification (DDC) Scheme is also suitable for
small libraries.

Special libraries appeared to favour Universal Decimal
Classification Scheme (UDC) since it is more specific. Special
libraries are organised along subject lines because they are
limited in scope and are oriented to a single subject or a group
of related subjects. Their scope is furthermore determined by the
interests of the parent organization. Their clientele are also
interested in specific topics for their research.

The Library of Congress Classification Scheme (LC) was adopted
only in the academic centres. Its' detailed and wide subject
coverage makes it suitable for these centres. The clientele of
such centres requires a wider subject coverage of their work which
is mostly academic. The collection of academic centres is usually
general in coverage since they have to acquire materials in all
disciplines covered by the parent academic institutions curriculum.
The kind of clientele and the purposes of the centre plus the kind of literature seemed to make the subject headings also vary. However each centre had adopted the subject headings that most suited the type of classification scheme in use. The centres that used Dewey Decimal Classification Scheme (DDC) or Universal Decimal Classification Scheme (UDC) tended to use Sears List of Subject Headings (SLSH). Those that had adopted Library of Congress Classification Scheme (LC) were using the library of Congress Subject Headings (LCSH).

The kind of literature a centre was dealing with was also a factor in the choice of subject heading. For example, KEMRI uses Medical Subject Headings (MESH) since it deals with medical literature hence it would not have found a better choice. This was also the reason behind the usage of Thesauri in most of the special libraries. The Thesauri in use were dealing with the specific literature the centre was dealing with and special libraries deal with specific literature. Thesauri in use were CABI, AGROVOC and AGRIS which deal with agricultural literature and the centres that were using them (ICIPE, ILRAD, ICRAF, KARI) deals with one aspect or other of agriculture. Exchange of information between such centres is further enhanced by the adoption of these Thesauri since subject descriptors will always be the same. This shows the advantage of using the same subject headings.
5.1.5 CATALOGUING RULES

The adoption of different classification schemes and subject headings means that the subject tracings and the call numbers of the materials will be different from one centre to the other. However, even if the centres were to form computerised networking, this need not be a major problem. It will always be possible to identify a document regardless of the classification scheme or the subject headings adopted and this forms the crux of the matter. This is facilitated by the fact that all the centres use the same cataloguing rules. The main entry and the physical description of the materials therefore will always be the same.

5.1.6 COMPUTERISED DATABASES

The databases in information centres included acquisition, catalogue, circulation and serials. Acquisition deals with the materials to be acquired. That is, the whole process of receiving requests to acquire certain materials, processing them, sending out the orders to suppliers and receiving the ordered materials. Cataloguing deals with the processing of the already acquired materials (classifying and cataloguing) ready for use by the clientele. Circulation deals with the lending out and receiving back materials and their related functions like tracking down materials and reservation. Serials deals with the acquisition and processing of periodicals.
Creating these databases, especially catalogue and serials, forms the basis of any computerised networks. Otherwise without computerised databases there cannot be any computerised networks. Coincidentally, all the centres that were computerised had created the catalogue database. Even those that were in the process were actually converting their manual catalogue into computer form.

Catalogue database is the most important database in any network. It is therefore apparent that information centres in Kenya are heading in the right direction by starting with this database. Serials database is also important. The only problem is that it is usually very difficult to computerise serials due to the varied amount of information required to identify a serial. There is also the need to index them which further complicates the whole process. Most information workers would rather prefer to leave it to operate manually.

The other two databases, acquisition and circulation don't count much in a network formation/environment. They are usually for the operations of that particular centre.

5.1.7 COMPUTERISED NETWORKS

There isn't much computerised networks existing between information centres in Nairobi. This is in spite of the fact that computerisation has gained great acceptance and many benefits
accrue out of networks. The number of centres that maintain any kind of computerised networks is a clear indicator to this fact.

The centres that maintain any kind of computerised network are mainly those owned and maintained by international organizations. These are mainly the special libraries. This could be due to the clientele they aim at serving (mainly researchers) and the need to gather all the related information in a certain field of research to avoid duplication. The researchers themselves also need to be connected if they are doing research on a related field.

The methods used are both off-line and on-line. The centres mostly network between themselves or with other centres in other countries which are also of international standards. There is little if any networks existing between these centres and the local ones and where it is existing, it is mostly off-line.

Majority of these centres maintain an on-line Local Area Network (LAN) type. This network operates within the centre and other departments of the organisation. The reasons behind the existence of this type of network could be attributed to its advantages which Marks and Nielsen (1991 p.2) have listed thus;

1. "Costly peripherals such as laser printers, hard disks, and modems can be shared by all users of a LAN.

2. Information too can be shared: for example, all members of an office can use their own PCs to access and update an important database.
3. Another plus is electronic mail—using PCs to send and receive interoffice messages. Some LANS allow PCs to link up with minicomputers, mainframes, and even computer networks in other locations.

4. For management, LANS represent a way to increase productivity with a modest outlay. Usually, PCs have already been purchased for the office; a LAN makes their use more efficient.

5. In addition, an office with a LAN requires fewer printers and hard disks.

6. For those using PCs, LAN can make work less frustrating—fewer floppies to keep track of, easier access to files, and ready use of all hardware on the system.

7. Work becomes less solitary—electronic mail makes it easier to work together with the people in your office."

The local centres on the other hand, majority do not maintain any kind of computerised networks. This is both with other locals and the international ones. At the same time, majority of them are not computerised. Even those which are, took a fairly long time before they could acquire a computer. Yet still, some of them are in the process of inputting their manual catalogue into a computer form. Where the network is existing it is off-line.

The existing computerised networks faces problems that hinder their maximum utilization. Inspite of this, information centres are still keen on installing them to help them be able to access more information and thus offer even better services to their clientele. Some benefits nevertheless accrue out of the existing networks which the information workers find valuable.
5.1.8 CD-ROM FACILITIES

There are some few information centres that have installed Compact Disk Read Only Memory (CD-ROM) facilities. CD-ROM is an off-line method of computerised networking. CD-ROMs contain databases which are mostly commercial, and one can only read the information. They have no facility of altering or adding information. They avail abstract and bibliographic citations on current literature in various subject areas.

The CD-ROM databases offered are the ones that are relevant and useful to each respective information centre's primary clientele and serves the interest of the parent organisation.

There seemed to be no way one can know what exists where. Concerning this fact, Muttunga (1994 p.8) reckons that,

"There is no existing mechanism through which an identity of existing CD-ROMS and the respective subscribed databases can be ascertained. There are no existing networks through which such needed services can be shared and plans should be instituted towards their sustainability in the long run as most of them are currently available through donor support."

This clearly shows the existing situation. As a result, some of the databases are least utilised though there are potentials of maximum utilisation making them more cost effective. Such facilities could be better utilised through the establishment of computerised networks between the information centres.
5.1.8.1 ADVANTAGES OF CD-ROM

The usage of CD-ROM has several advantages. These advantages have been outlined by Convey (1989 pp. 85-86) as follows:

1. "It does away with the necessity to pay telecommunications charges to access remote online systems, and the connect time charges levied by those systems; by-passing telecommunications problems could be quite a significant advantage, bearing in mind the failure rates in telecommunications.

2. It gives the searcher all the power of the retrieval software of major online systems - this software is normally included on the disc with the database.

3. It gives unlimited access for one annual subscription, thereby simplifying costings, and also eliminates financial pressures while searching - the searchers can have as much 'thinking time' as needed.

4. It has a large storage capacity, durability, and low cost of reproduction.

5. It can help to introduce more people, particularly end-users, to computerised literature searching, and so the overall markets for databases should expand.

6. It can combine text, graphics, audio and moving images".

5.1.8.2 DISADVANTAGES OF CD-ROM

Convey (1989 pp. 86-87) has as well outlined several disadvantages and problems of CD-ROM as follows;

1. "The cost of the databases. An annual subscription would normally be required for each database on CD-ROM.

2. The number of sources available is much greater online than would be possible for an organisation to finance in CD-ROM form. It would be more economical to search infrequently used databases online rather than to subscribe to the CD-ROM format.
3. CD-ROM creates logistical problems - access is limited to one person per CD installation; this could be remedied in the future by the use of Local Area Networks (LANs) and multi-user systems, but response time could be severely affected. CD-ROM also creates problems of security.

4. Currency of CD-ROM products is not as good as the online version; it falls between the on-line and printed products; the online version will almost always be the most current.

5. Lack of compatibility of equipment and software.

6. Other possible disadvantages are: slower response time than online, for more complex searches; not all features available on-line are always available on the CD-ROM version of the databases; lack of standard retrieval software-searchers need to learn different systems; an increase in staff involvement, particularly in training and overseeing end-users".

5.2 CONCLUSIONS

Several conclusions could be made out of the above discussions.

1. Computerisation of information centres in Kenya is gaining momentum at a very encouraging pace.

2. Computerised networks between information centres have not been well exploited. However, the potential is very high. This is evidenced by the high level of computerisation and the possibility of hardware and software compatibility.

3. There could be possible peculiar problems that hinder the installation of networks between information centres, particularly the local centres.
4. The information centres develop independently of the others. Each centre does its things without any regards of what others are doing. The databases are designed and created independently. There are no agreed or thought off standards, methods or formats to be followed in computerised database(s) creation (Appendix II displays various data entry worksheets from some selected information centres using mini micro CDS/ISIS database management system software). This disparity could be attributed to lack of an information policy. This fact makes Karei (1994 p.6) to state among his recommendations the need of a "national information policy which incorporates networking for efficient information exchange."

Stressing on the need of an information policy Mutula (1994 p.6) states that,

"a national information policy is basic and the pillar without which much progress cannot be accomplished in an effort to develop mechanisms and ways of exploiting national information resources".

If an information policy is instituted, it will be used as a point of reference as concerns the development and use of information.

5. There are possibilities in Kenya of achieving the UNESCO National Information System (NATIS). There are many and varied information centres in Kenya, which Mutula (1994 p.3)
puts at over 300. These centres gather and store information in various fields. The only problems is the lack of a national coordinating means which Gehrke (1984 p. 31) says is the means for resources sharing and the essence of the NATIS concept.

6. The efforts and agreements that are existing between different information centres in the area of information and information sharing are informal. They are done on what is termed as "the gentleman's agreement."

7. There are very few qualified information workers who are also trained in computer. Most of the interviewees appeared not confident enough to answer the questions.

5.3 RECOMMENDATIONS

5.3.1 TO GOVERNMENT, PLANNERS AND POLICY MAKERS

The government, planners and policy makers in all fields of information ought to look into the following areas so as to enhance the development of information centres and consequently, information as a national resource.

1. Look into the possibility of having an information policy formulated. This will lead to the formation of a national
coordinating organ which will oversee the development of information centres. Such a policy would be used as a reference point when developing any information centre. It would go a long way in avoiding duplication thus saving on the meagre available resources. Such is like the formation of Kenya Agricultural Research Database (KARD) while Kenya Agricultural Documentation Centre (KADOC) was already existing. These centres deal with the same information, agricultural literature. Instead of forming KARD the resources would have been used to revamp KADOC.

2. Information ought to be managed like any other resource such as manpower, materials and funds. It should therefore be given the same preference like any other resource development or even more for without the relevant information, it's hard to achieve development. In Kenya as Chick (1984 P. 47) reckons;

"recognition of the fact that information must be managed as a valuable and costly resource has been slow and piecemeal".

Remember the adage "information is power".

3. Information centres be given all the resources they deserve to enable them offer even better services. Such resources include manpower, better buildings, and modern facilities such as computers.
Information centres are not just funds guzzling institutions, but also income generators though in an indirect way. It is rather hard to qualify the usefulness or the value of information in terms of hard cash. It can only be seen in terms of better results whose origin if well traced could be the availability of the right information at the right time.

4. There is need to train more information workers in the field of computer. Study facilities such as scholarships, fellowships, and even leave of absence should be sought and encouraged. This will help to eliminate the shortage of qualified information workers who are also computer trained.

5.3.2 TO INFORMATION MANAGERS

The information managers in various information centres may consider the following;

1. Give computerisation priority. The centres that are not computerised should start hatching out plans to do so. It has become apparent that the amount of information being produced can no longer be handled effectively through the use of the conventional manual methods. Computers can be acquired through soliciting for funds from donor agencies.
2. During the acquisition of the computer hardware, go for micro computers. They are the common types of computers in use in most information centres.

3. For the computer software, instal mini micro CDS/ISIS as a database management software. It has several advantages over other common softwares when it comes to the management of textual databases.

4. When planning to computerise, take into account the possibilities of forming computerised networks with other centres. This is in view of the fact that networking is one of the ways of promoting information exchange between information centres. Networking fosters cooperation, research and other development activities between centres and avoids duplication of efforts and resources.

5. Consult each other in the acquisition of the computer hardware and software.

6. Consult each other in the creation of databases so as to have certain established and agreed upon standards and formats.

7. Look for ways of networking the databases offered in certain information centres through CD/ROM facilities to ensure their maximum utilization through sharing.
8. The usage of CD-ROM facilities should be encouraged. Each information centre should identify which CD-ROM database it would frequently use and start subscribing to it. Then through cooperation with other information centres, it would be possible to have access to other many and varied databases on CD-ROM.

5.3.3 TO RESEARCHERS AND SCHOLARS

There is need for further research in the following areas in order to gather and accumulate more information for the sake of the growth and development of computerisation and computer networks in and between information centres;

1. Survey the manpower of information workers to establish how the situation is as concerns their computer knowhow and training.

2. The problems that hinder the establishment of computerized networks between information centres especially the local ones.

3. Which network facilities are existing in Kenya that can be exploited and recommend the best one.

4. Why upto now there isn't an information policy existing
inspite of the various calls that have been made in various forums.

5. Which databases both local, if any, and international that are being exploited in the information centres through CD-CD-ROM facilities and how can these databases be coordinated so that it will be possible to tell who has what database.

6. What problems the information managers face in their exploitation of CD-ROM databases.
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APPENDIX I

INTRODUCTORY LETTERS AND THE QUESTIONNAIRE
TO WHOM IT MAY CONCERN

The bearer of this letter Mr. Edward Muchai Ng'ng'a is a member of staff in our Library. He is currently pursuing studies leading to the award of a masters degree in Library and Information Science. As part of his studies, he has to undertake research and write a thesis.

Mr. Ng'ang'a is undertaking research on the following topic:-

"Computerized information networking: a study of information centres in Nairobi."

requires to use your Library resources and I would be grateful if you could give him the necessary assistance.

J. M. NG'ANG'A
LIBRARIAN

c.c. Deputy Librarian (to see on file)

JMN/rwn
Dear Sir/Madam,

I am a postgraduate student undertaking a research project for an MEd (Library Science) degree course at Kenyatta University. My research project is entitled, "COMPUTERISED INFORMATION NETWORKING: A SURVEY OF INFORMATION CENTRES IN NAIROBI".

I am pleased to inform you that your Information Centre has been selected to participate in the research.

I hereby kindly request you to assist me in information gathering by filling in the accompanying questionnaire. Also, I would like to spend sometime to observe the workings of your computer system.

The information so obtained will be treated with the highest level of confidentiality and will only be used for the purpose of this project.

I will greatly appreciate your cooperation and assistance.

Thank you very much.

Yours faithfully.

E. M. Ng'ang'a.
1. What is the official name of your information centre?

2. When was it established?

3. Is your centre computerized in any way? Yes ...... No ......

If yes continue, If no, go to question number no. 28.

4. When was it computerized?

5. How did you acquire your computer? 1. donation ............... 
   2. purchase ........... 3. rent .............. 4. others specify .............

6. What type is your computer? 1. Mainframe .............
   2. mini ............. 3. micro .............

7. Which software do you use? 1. CDS/ISIS........ 2. Tinlib ...
   3. Inmagic ........... 4. Others, specify .............

8. Which other software is it compatible with? .............

9. How did you obtain the software? 1. Donation ............


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10. Which databases have you created? 1. cataloguing ............
   2. acquisition ........ 3. serials ........ 4. circulation
   5. Others, specify ..............................................

11. What type is your database(s)? 1. Bibliographic ........... 2
   Factual ........ 3. Others, specify ..........................
                       ......................................................

12. If you have more than one database, do you use the same
    software? Yes ................ No .........................

13. In either of the above cases, give reasons.
                       ......................................................
                       ......................................................

14. Do you offer any CD ROM facilities? Yes ...... No ..........

15. If yes, which one?  1. Medline ...... 2. Chemical Abstracts
                           ........ 3. Others, specify ..........................
                           ......................................................

16. Do you maintain any kind of computerized network with
    another information centre? Yes ............ No ............

17. If yes, which program do you use?  1. UNIX .................
    2. NOVELL ........ 3. Others, specify ........................
                           ......................................................

18. What standards do you use in your network?  1. CCF .........
    2. MARC .............. 3. Others specify ........................
19. What problems do you face in your network?  

    2. Off-line  ......... 
21. What benefits do you get from the network?  

22. How many information centres are you networked with?  ....  
23. Give their names  

24. What problems do you face with the network?  

25. Do you pay for the network? Yes..............No............. 
26. If yes, approximately how much per year? Kshs  ......... 
27. Who finances the network expenses? 1. Government  
    Donors ............. 3. Others, specify 

28. Which classification scheme do you use? 1. UDC  
    2. DDC ............. 3. LC ............. 4. Others specify 

29. Could there be a reason as to why you chose that classification scheme?  


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31. Is there any reason as to why you chose that subject heading?

32. Which cataloguing rules do you follow? 1. AACR 2 Others specify

33. At what level do you catalogue? 1. 1st 2. 2nd 3. 3rd

If not computerised continue, if computerised stop.

34. Since you are not computerized, do you ever think of doing it? Yes No. If yes, continue if no, stop

35. How do you intend to acquire the computer? 1. Donors 2 purchase 3. rent Others specify


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37. Which software do you plan to acquire? 1. CDS/ISIS
   2. TIN-LIB ....... 3. In-Magic ....... 4. develop it (in-house) ........... 5. Others, specify ............... 

38. Have you got any plans to form a network with other information centres? Yes............... No ...........

APPENDIX II

WORKSHEETS FROM VARIOUS SELECTED INFORMATION CENTRES

USING MINI MICRO CDS/ISIS
<table>
<thead>
<tr>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCESS NUMBER</td>
</tr>
<tr>
<td>DATA TYPE</td>
</tr>
<tr>
<td>REC TYPE</td>
</tr>
<tr>
<td>LIT IND</td>
</tr>
<tr>
<td>UDC</td>
</tr>
<tr>
<td>AUTHOR</td>
</tr>
<tr>
<td>CORPORATE. AUTHOR</td>
</tr>
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</tr>
<tr>
<td>SECONDARY TITLE</td>
</tr>
<tr>
<td>Field</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
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</tr>
<tr>
<td>ISB LEVEL</td>
</tr>
<tr>
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</tr>
<tr>
<td>ORP. AUTHOR</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>EC TITLE</td>
</tr>
<tr>
<td>OTHER TITLE</td>
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</tr>
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</tbody>
</table>