ASSESSMENT OF AUTOMATION OF LIBRARY OPERATIONS AND SERVICES AT THE KENYA AGRICULTURAL RESEARCH INSTITUTE (KARI): PRESENT STATUS AND PROSPECTS

BY

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DECLARATION

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This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

This thesis is dedicated to my husband Alfred, our children Joan and Simon, brothers, sister and my friend Hellen, for their great support and encouragement to do all my best even when the going was very tough.

ABSTRACT

Application of Information and Communication Technology (ICT) is rapidly becoming popular in library operations and information services because it offers libraries an easier way to link with other libraries, information centres, information resources and users at a very low cost. It provides a universal and easy to use set of technologies and technology standards. Automation of library operations and information services in libraries has improved library operations, delivery of services, resource sharing, and storage of information. This study investigated the level of automation of library operations and information services at the Kenya Agricultural Research Institute (KARI), with the view of identifying the challenges and recommending a model for adoption to enhance the automation process. The objectives of the study were: to establish the information services and products available in selected KARI libraries; to find out the extent of application of Information and Communication Technologies (ICTs) in library operations and information services in selected libraries; to examine the range of digital formats of information resources; to establish the level of ICT skills and knowledge among library staff at KARI; to establish the challenges experienced in the automation process, and to suggest ways by which KARI would optimise the utilization of automation and to propose a model for enhancing the automation process at KARI libraries. This study used survey research and was informed by Rogers' Theory of Diffusion of Innovation. The sample population was forty four (44) respondents who comprised of library staff, ICT staff and centre directors from selected KARI Centres. Quantitative and qualitative research methods were used in this study. The data collection methods consisted of interviews, administration of questionnaires and document review. This study used purposive sampling to identify and select the sample population. Quantitative data was analysed and presented in tables and percentages while qualitative data was analysed by coding the themes. This study found that the major challenges to automation at KARI are: KARI libraries do not have a common approach to the automation process but instead have fragmented and piece meal approaches, lack of ICT policy, inadequate ICT infrastructures, lack of system administrators and inadequate budget. The study recommends adoption of open source Software, acquisition of ICTs tools, recruit ICTs compliant library staff, formulate institutional information policy, allocate adequate funds for implementation and maintenance of the systems.

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ACRONYMS AND ABBREVIATIONS

ARC	Agricultural Research Center
APRD	Animal Production Research Department
ARD	Agricultural Research Department
CAS	Current Awareness Services
CD-ROM	Compact Disc- Read Only Memory
CDS/ISIS	Computerized Documentation Service/Integrated Set of Information System
DESIDOC	Defense Scientific Information and Documentation Centre.
DOS	Disk Operating System
DVD	Digital Versatile Disk
EAAFRO	East African Agricultural and Forestry Research Organization
EAC	East Africa Community
EAVRO	East African Veterinary Research Organization
FRD	Forestry Research Department
HQTs	Headquarters
ICRAF	International Center for Agro forestry
ICT	Information, Communication Technologies
IDS	Information and Documentation Services
ILRI	International Livestock Research Institute

ILS	Integrated Library System
IMCT	Information Management and Communication Technology
KARI	Kenya Agricultural Research Institute
KAiNet	Kenya Agricultural Information Network
KEFRI	Kenya Forestry Research Institute
KENET	Kenya Education Network Trust
KLISC	Kenya Library and Information Services Consortium
MLD	Ministry of Livestock Development
MoA	Ministry of Agriculture
OCLC	Online Computer Library Center
OPAC	On-line Public Access Catalogues
RIKS	Research Institute for Knowledge Systems
SDI	Selective Dissemination of Information
TINLIB	The Information Navigator for Libraries
TEEAL	The Essential Electronic Agricultural Library
TRC	Trypanosomiasis Research Centre

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CHAPTER ONE

INTRODUCTION AND BACKGROUD INFORMATION

1.0 Introduction

Use of technological innovations in the field of information through Information and Communication Technology (ICT) has opened opportunities to libraries and information centres. Electronic resources and automated information services can now be accessed online through variety of interfaces. Information professionals can download softwares' and modify them to suit their needs. Libraries and information centres can subscribe to multimedia resources, online databases, e-books, e-journals, CD-ROM databases, web-based resources, and other electronic resources. Mishra (2008) suggests that the development in information technology has brought drastic changes in the way in which information is collected, stored, retrieved and distributed. A number of existing specialized databases, online information services, resource sharing networks and databases in CD-ROM necessitate the application of computers in libraries.

Today, libraries are using Information Technology (IT) for diverse purposes to serve the needs of their users. Library operations, provision of information services and administrative tasks have become easy and are performed very fast. There is a great saving of manpower, cost, space and time. In addition, the library customers get empowered for maximum utilization of the resources (Kumar, 2005). This result from; improved services, new services and customized services.

Automation is the use of automatic machines to perform some of the traditional library operations and information services, such as: control of acquisitions, cataloguing, serials and circulation, user education, search and retrieval, which were previously done by people. According to Omirin and Olayinka (2007) automation is the application of computers and information technologies to library operations and services most especially in the areas of housekeeping such as acquisitions, circulation cataloguing, serials control and reference service.

Automation of library operations and information services allows development of new services in addition to the traditional ones, for instance, selective dissemination of information (SDI), search and retrieval, library networks (consortium), library social networks (Web 2.0), data transfer and sharing, translation services, among others. Therefore automation is important and necessary to handle the vast amount of information and for providing faster, accurate, precise, efficient, and effective information and services as well (Rajput, and Gautam, 2010).

Library automation implies the application of computers and utilization of computer-based products and services in the performance of different library operations and functions. The need for automation in libraries was felt because of the workload in all spheres of library activities. (Ansari and Amita, 2008). Additionally, Lam (2001) defines library automation as the use of computer and networking technologies in the library. The main objectives of the library automation are: to improve control over collection; to have an effective control over the entire operation; to improve the existing services; to share

effectively the resources among various libraries in a region; to avoid duplication of work; to use the services of the existing staff effectively (Faisal and Surendran, 2008).

There are many factors which have led to automation of library operations and information services such as: the need to improve productivity, performance, access, efficiency and delivery of quality services. Bhardwaj and Shukla (2000) noted the following factors for library automation:

Growing Information and Shrinking Space

The enormous growth or information explosion of literature in each area, subject in number and size and results fragmentation of literature and increasing specialization in every field of knowledge. Due to this information explosion, the quantity, variety and complexity of information are being increased rapidly in every field. Computer application can solve this problem, as it is capable of storing huge bulk of information on tiny storage mediums for example a CD-ROM can store the text of the complete set of Encyclopedia Britannica. Serials, abstracts, indexing periodicals among others are already available on CD-ROM.

Diversity, large number of users and information overload

Increase in the number of users of library and information centres and their specialized desires (change in information seeking behavior) has led to change on the method of organizing information because traditional methods have become inadequate. The manual

method has serious limitations and, facing problem to provide access to reader's information that is available in a wide of publications from so many sources.

Cost hike of printed as well as electronic reading materials and resource sharing

Rapid increase of price of printed information materials has led the library and information centers to share databases and other electronic resources..

It has also made Libraries and information centres automate their library operations, information services to reduce cost.

1.1 Background Information

In 1880 Hollerith invented punched cards and were used in tabulating the US census data. The library at the University of Texas was perhaps the first to use punched cards in 1936 for circulation control (Faisal and Surendran, 2008). Isaac (2008) affirms that, library automation began in the 1930's as punch card based equipment which was used for library circulation and acquisition.

The introduction of the typewriter into libraries was a revolutionary concept in the late 1800s. In the 1950's, the Library of Congress produced a book catalogue using punch card. In 1960, Machine Readable Cataloguing (MARC) was introduced which was a standard method for cataloguing. Feather and Sturges (2003) assert that the first use of library automation was the use of computers to store bibliographic data and to enable the circulation of stock. The project to place onto computer the stock of the US Library of

Congress resulted ultimately in the development of Machine- Readable cataloguing (MARC) opening up the possibility of libraries exchanging bibliographic records and encouraging co- operation between libraries.

In the 1980s, networking technologies, optical discs, CD-ROMs and communications technologies were introduced. The primary objective of the early technology applications was to automate circulation, acquisitions and the catalogue to bring efficiency and effectiveness in library operations and services. The 1980s saw the advent of microcomputers and the emergence of CD-ROM technology (Segesta and Reid-Green, 2002). CD- ROM were used as bibliographic databases such as CAB Abstracts .Later stages of modernization witnessed the introduction of unit record equipment, the move to offline computerization, and use of online systems (Anuradha, 2011).

The 1990s witnessed revolutionary changes in the application of ICT in libraries such as the Internet, World Wide Web protocols, information retrieval standards, integrated library systems and online databases. The 2000s was an era of digital libraries, virtual collections, paperless environment and round the clock instant remote access to unlimited resources. The rapid advancement in computers and telecommunications, exponential growth of information and media, availability of online databases, reduction in hardware and software costs, passion of using the internet, provision of cost effective communication mechanism and growing user demands are the major factors responsible for the increasing use of IT in libraries around the world (El-Sherbini and Wilson, 2007).

Today's integrated library systems must not only provide modules which automate traditional library functions but also capable of connecting through the local systems into systems of other information or knowledge suppliers, databases and internet (Faisal and Surendran, 2008).

1.2 Approaches to Automation

Modern information technologies have brought dramatic changes in today's library management and user expectations. Libraries and information centres software's have been developed frequently, librarians and ICT staff use different softwares to automate library operations and information services, such as LIBRARYSOFT, TINLIB, WINISIS and Koha. Software can be divided into two approaches, proprietary and non-proprietary software

1.2.1 Proprietary Software

Proprietary software is acquired through subscription. Libraries and Information centres acquire proprietary software if they have good funding because they are expensive. They are developed by companies or individuals but the source code is not revealed to their users. Raymond (2001) defines proprietary software as software which the constituent source code is not available for the recipient to access, thus sometimes it is referred to as closed source software. The software is regarded as valuable intellectual property and is protected by copyright and license agreements. Additionally proprietary software is designed to meet the needs of its customers not what all customers may want (Fitzgerald, 2006). Examples of proprietary software are: operating systems (Windows), application

software (Microsoft office) integrated library system: LIBRARYSOFT, TINLIB, INMAGIC and others. The way in which the user utilizes the system is restricted both by the terms of the license and by blocks within the system which are designed to prevent certain activity. Breeding (2008) opines that proprietary products have been available for many years, have reached a high level of maturity, and remain the dominant approach used for library automation.

1.2.2 Non-Proprietary Systems/ Open Source Software

Rapid technological advancement and shrinking library budgets have made libraries to look for approaches to meet user needs as well as providing less costly quality systems and resources. Open Source Software helps information professionals on automation of library operations and information services because it has low cost compared with commercial software. Open Source Software refers to software that is free of proprietary restrictions and is developed, released to, and can be modified by the public, free of charge. Users of open source software are able to view the source code, alter and re-distribute it (Open Software Working Group, 2002).

Payne and Singh ((2010) laments that library end users with technical and nontechnical skills can participate in OSS installation and maintenance, librarians can engage in OSS development and modifications, and library user groups can often customize OSS environments. It could be used as a tool to achieve their objectives such as effective service delivery and access of information resources.

Open source software approaches has the advantage of giving libraries direct control over the technology use. System librarians can have a direct role in developing the software and can focus on functional enhancements which are of local value but which would not be viable commercially for a mainstream supplier. This can be shared with the library community, compensating for the relatively small size of the library system market (Mickey, 2001).

Mutula and Kalaote (2010) add that deployment of open source software is usually available to anyone without prohibitive license fees or other proprietary restrictions. Open source software presents a good opportunity for the world's poor countries to move toward the information society by helping bridge the digital divide and deepening universal access.

Breeding (2008) makes clear the benefits of adopting OSS are such as: the freedom of licensure, variety of computing solutions, liberty to examine the logic or workings of the application, and the ability to append or otherwise alter the OSS source code to meet specific user needs. Ebenezer (2000) asserts that open source systems has the advantage of promoting software quality and reliability through peer review, where technical resources exists and it is relatively low cost.

Additionally, OSS meets both the needs and the wants of its customers because of its openness, which allows the product to evolve, gaining more appeal as wants are addressed by skilled developers, who have access to the open source code (Fitzgerald,

2006). Smith, (2010) opines that one advantage of releasing a source code is that it allows developers to design software which works well with the system and to develop patches and fixes for problems.

Open Source software could be used in libraries and information centres to embrace automation of library operations and information services because information professionals can modify, incorporate it with other software, tailor according to their needs and share it. Example of open source software is Koha which is used at Strathmore University in Kenya. Strathmore University has modified Koha and it is currently distributing to other libraries such as St Paul's University.

1.2.3 Turnkey System

Turnkey system is a complete system of hardware and software delivered to the customer ready-to-run. Collins (2009) defines turnkey system as a computer system purchased from hardware and software vendors, customized and put in working order by a firm that then sells the complete system to the client that ordered it. According to ETS (2010), a turnkey system is a system which is designed, specified, purchased, installed, and started up by a single company. Turnkey systems are built in the "design-build" style of contracting, as opposed to the traditional "design-bid-build" style of contracting in which the owner contracts out the design and installation/construction himself/herself while procuring all of the equipment. They add that turnkey systems provide a number of advantages over traditionally-procured systems such as:

a) Owner has a single point of responsibility for project performance;

b) Design/build contractor acts as construction manager, freeing up Owner to manage his business;
c) Costs are often lower due to simplified organizational structure;
d) Schedule can be compressed since all project activities are coordinated in one company;
e) System design is more integrated since a single company handles all designs;
f) Owner still has approval authority over major project items.

1.3 Kenya Agricultural Research Institute

The origin of Kenya Agricultural Research Institute (KARI) can be traced in Tanzania when Amani Institute was founded by German administration in 1902. After the First World War (1914-1918), its resources were mismanaged. It was closed but later re-opened under British administration in 1928 as one of the proposed chain of long-range agricultural research institutes serving the British Empire. The status of Amani Institute was that of an independent, inter-territorial department under the control of the Secretary of State and supported by funds provided by Her Majestry Government and six central African territories. (Annual Report, East African Common Services, 1948).

In 1944, Mr. Agg Hill prepared detailed proposals for the re-organisation and re-sitting of the East African Agricultural Research Institute. The proposals were later approved by the East African governments and the Secretary of State in 1945. These proposals contemplated the acquisition of a new headquarters site for the institute near Kabete with sub-stations in the lowlands and highlands, mainly for food crop experiments.

In 1948, the Colonial government donated a 1,600 acre estate for the construction of the new headquarters at Muguga. This estate was to be shared between the East African Agricultural and Forestry Research Organisation (EAAFRO) and the East African Veterinary Research Organisation (EAVRO). In 1977, the East African Community collapsed and the two institutions, EAAFRO and EAVRO, were disbanded. A new institution, the Kenya Agricultural Research Institute (KARI) was established. KARI took over all the EEAFRO and EAVRO resources and continued to serve a national role.

The collapse of the East African Community (EAC) in 1977 led to a critical appraisal of the structure and functions of the research activities co-ordinated from Muguga with those of the Ministry of Agriculture (MoA) and that of the Ministry of Livestock Development (MLD). The Science and Technology Act, (1979) established semi-autonomous research institutions to strengthen the organisations and management of research in the country. KARI was established through an ACT of Parliament (Cap 250, revised 1979) and became operational in 1986 (KARI, 2010). Under the Act, KARI was given the mandate to conduct agricultural research of strategic national importance and produce improved technologies, information, knowledge and approaches to support the agricultural sector (KARI, Service Charter, 2009).

1.3.1 Vision

KARI envisions a vibrant commercially-oriented and competitive agricultural sector, propelled by science, technology and innovation (KARI, 2009).

1.3.2 Mission

To contribute to increased productivity, commercialization and competitiveness of the agricultural sector through generation and promotion of knowledge, information and technologies that respond to clients' demands and opportunities (KARI, 2009)

1.3.3 Mandate of Kenya Agricultural Research Institute

The mandate of KARI as stipulated in KARI Annual report, (2007) are to:

- carry out research in agricultural, veterinary science and forestry;
- cooperate with other organisations and institutions of higher learning in training programmes and matters of relevant research;
- liaise with other research bodies within and outside Kenya carrying out similar research and disseminate research findings;
- cooperate with the responsible Ministry, the National Council for Science and Technology (the council) and the relevant committees in matters pertaining to research policies and priorities;
- do all such things as appear to be necessary, desirable or expedient to carry out its functions.

1.4 Kenya Agricultural Research Institute Centres

KARI as the nation's premier agricultural research organisation contributes to Kenya's economic development through identification and generation of relevant agricultural

technologies, knowledge and information (KARI, 2009). KARI operates through a network of 22 main centres and 14 sub- centres spread all over the country. The centres address priority constraints in accordance with the research within their respective mandates. The following are the KARI centres in Nairobi and its environs which were covered in this study:

1.4.1 KARI Tigoni

The Tigoni Research Centre is in Kiambu District, Central Province. The centre's mandate is to conduct research on potato and flowers, and act as the co-ordinating centre for root and tuber crops research programme. The programmes co-ordinated or conducted by the centre are potato breeding and germplasm evaluation, potato agronomy, integrated pest and disease management of the potato, postharvest handling, seed research and multiplication, and socioeconomics of the potato. On floriculture, research is conducted on the introduction and evaluation of important cut flowers, the production of propagation materials for new flower cultivars, improvement of flower production technology, and postharvest handling studies of cut flowers. The centre has a library to support research work through provision of information services like charging and discharging, reprographic services, user education, current awareness services, selective dissemination of information services and others.

1.4. 2 KARI Muguga South

KARI Muguga South is in Kiambu West District, Central Province. The centre is mandated to conduct research that aims at developing scientific innovations and

technologies required to improve and stabilize crop and animal production. The centre has both National and Regional mandates (Agricultural Research Centre Annual Report, 2009). The centre has a library with a good collection of information resources on soil sciences, agriculture, animal production, plant breeding, climatology and veterinary sciences. It support research work through provision of information services like charging and discharging, reprographic services, user education, current awareness services, selective dissemination of information services and others.

1.4.3 KARI Muguga North

KARI Muguga North is in Kiambu District, Central Province. It is a referral centre for control and management of livestock diseases of national importance, namely, tick-borne diseases, rinderpest and rinderpest-like diseases, contagious bovine and caprine pleuropneumonias, capripos virus infections and helminthiosis. The centre has a library to support research work through provision of information services like charging and discharging, user education, current awareness services, selective dissemination of information services and others (KARI, 2009).

1.4.4 KARI Thika

According to KARI (2009), the centre has a mandate to carry out research in support of the national horticultural industry including development of appropriate technologies covering production of fruits, vegetables, flowers and macadamia nuts.

The centre has a library to support research work through provision of information services like charging and discharging, reprographic services, user education, current awareness services, selective dissemination of information services and others.

1.4.5 KARI TRC

KARI TRC mandate is to carry out research into all aspects that would eventually lead to the effective control of human and animal trypanosomosis and to effective reclamation of tsetse-infested lands. Animal trypanosomiasis research is carried out both in the laboratories at Muguga, and in TRC field stations located in tsetse and trypanosomiasis endemic areas, such as Nguruman in Kajiado District and Lambwe Valley in Suba District. KARI TRC operates a referral hospital for sleeping sickness patients in Alupe in Busia (www. kari.org 2009). The centre has a library to support research work through collection development' organizing, processing, dissemination of information resources and provision of information services like; internet services, charging and discharging, reprographic services, user education, current awareness services, selective dissemination of information services and others. The library has re-prints dating to the time of the East African Community and which would be useful especially in the current regional tsetse control programmes (KETRI, 1991)

1.4.6 KARI National Agricultural Research Laboratories (NARL) Kabete

The Centre has the referral mandates for crop protection, soil survey, irrigation and drainage, and soil fertility research and analytical services (KARI, 2009). The centre has

two libraries to support research activities; one under soil survey and another under NARL.

1.4.7 Information Management and Communication Technology (IMCT)

Information Management and Communication Technology formerly Information and Documentation Services (IDS) was established to strengthen information management within KARI. Its goal is to ensure effective and efficient management of knowledge and information resources within KARI. The IMCT division is geared towards collection, exchange, preservation and dissemination of research findings in agriculture and related to agricultural development so as to improve the transfer of technologies to farmers and enhance agricultural production and efficiency. The division is a service-delivering unit supporting operations of the all programmes both at KARI and at centre level (KARI, 2005).

The division constitutes of the following units which are linked to each other: Library and Information Services (LIS), Publication Services and Products Unit (PSPU), Information Technology Unit (ICT), Corporate Communication and Marketing (CCM); the East African Agricultural and Forestry Journal (EAAFJ) (KARI, 2009).

1.4.7.1 KARI Headquarters Library and Information Services (LIS)

The Library and Information Services unit is a multi-faceted focal point for the acquisition, access, retrieval, processing, exchange and dissemination of information, knowledge and technology in agriculture and related fields to support agricultural research for productivity. The unit provides library information services and products in

response to clients' demands and opportunities along the agricultural production line to consumption continuum and continually works to improve the same (KARI, 2009).

1.5 Statement of the Problem

According to Mairaj & El-Hadi (2012), the world has witnessed important changes during the last fifty years. They single out Information and Communication Technology (ICT) as having brought a revolution in every sphere of life. Libraries have not been left behind. They have not only observed remarkable changes in their daily operations and services, but also identified a new and active role for librarians. Application of ICT to library operations and information services is important. It facilitates speedy library operations, services, and access to and delivery of information.

The Kenya Agricultural Research Institute (KARI) is a national institution in Kenya and it operates through a network of 22 national branches spread all over the country. KARI has also a network of libraries that support research scientists and support staff in delivery of quality research and services. KARI libraries have not fully embraced the ICT and therefore most of the library operations and information services are still manual. The challenges they are facing are; lack of common standards and common approaches to automation leading to duplication of efforts, inadequate ICT infrastructures, lack of institutional information policy, inadequate computer literacy skill had led to inadequate library operations and information services.

However no studies have been undertaken to evaluate the current status of automation of library operations and information services at KARI libraries. It was with this in mind that this research was conceived with a view of filling this gap in literature.

1.6 Aim of the Study

To evaluate the current status of automation of library operations and information services in selected Kenya Agricultural Research Institute (KARI) libraries, and propose a model that could enhance the automation library operations and information services.

1.7 Objectives of the Study

The study will be guided by the following objectives:

- to establish the information services and products available in the selected KARI libraries;
- to find out the extent of application of Information and Communication Technologies (ICTs) in library operation and information services in the selected KARI libraries;
- To examine the range of digital formats of information resources available in the selected KARI libraries;
- to establish the level of ICTs skills and knowledge among library staff in the selected KARI libraries;

- to establish the challenges experienced in the automation process, and to suggest ways by which KARI would optimise the utilization of automation;
- to propose a model for enhancing the automation of library operations and information services at KARI libraries.

1.8 Research Questions

To achieve the above objectives, the study will seek to answer the following questions:

- What aspect of information services and library operations are automated in the selected KARI libraries?
- What is the status of application of Information and Communication Technologies in library operations and information services at the KARI libraries?
- What digital formats of information resources are available in the KARI library system?
- What is the level of ICT skills and knowledge among the library staff?
- What are the challenges experienced in the automation of library operations and information services at KARI libraries?
- What recommendations can be proposed to improve automation in KARI libraries?

1.9 Assumption of the Study

The researcher had the following assumptions:

a) The lack of standards and common approaches to automation has affected the provision of information services at KARI libraries.

b) Lack of training needs assessment contributes to inadequate information services at KARI.

1.10 Significance of the Study

The significance of the study was:

1.10.1 Theoretical Significance

The study constitutes a new addition to the general body of knowledge relating to application of ICT in research libraries.

1.10.2 Practical Significance

The study provides practical solutions to the challenges experienced when using modern information technologies at the KARI libraries.

1.10.3 Policy Formulation Significance

The research will inform policy formulation in automation of library operations and information services.

1.11 Scope of the Study

KARI Library systems are spread all over the country. The research will be confined to six Kenya Agricultural Research Institute Centres located in Nairobi and its environs. These are: KARI Agricultural Research Centre, Muguga South, KARI National Veterinary Research Centre, Muguga North, KARI National Agricultural Research Laboratories Kabete, KARI Trypanosomiasis Research Centre, Muguga, KARI-Horticultural Research Cente, Thika, KARI Potato Research Centre Tigoni and KARI Headquarters library.

1.12 Limitation of the Study

To ensure the centre directors understood the questions the researcher used interviews. During the interview probing questions were raised to get necessary information to specific objectives of this study. The researcher made appointments in advance of face to face interview with centre directors.

1.13 Summary

This chapter has provided the background information of library automation, and approaches to automation used in Libraries and Information Centres. It also gives an overview of the KARI set-up, vision, mission and objectives. The objectives of the study and research questions are outlined to give a view of what the study intended to find out. The assumption, significance of the study: theoretical, practical and policy formulation was expressed. The scope of the study and definition of terms were outlined.

1.13 Definition of Terms

Automation is the use of automatic machines to perform some of the traditional library activities such as control of acquisitions, cataloguing, serials and circulation, previously done by people.

Bibliographic or Library Database: Database of bibliographic records. It may be a database containing information about books and other materials held in a library (e.g. an online library catalogue, or OPAC) or, as the term is more often used, an electronic index to journal or magazine articles, containing citations, abstracts and often either the full text of the articles indexed, or links to the full text.

Browser: a programme used to view HTML documents

Graphical User Interface: computer environment that simplifies the user's interaction with the computer by representing programmes, commands, files, and other options as visual elements, such as icons, pull-down menus, buttons, scroll bars, windows, and dialog boxes. By selecting one of these graphical elements, through either use of a mouse or a selection from a menu, the user can initiate different activities, such as starting a program or printing a document.

Database: A collection of data that is managed by a database management system or a file management system**.**

Database Management System: A collection program for storing and relating large amounts of information, such as credit cards, library cards, patron information, address and others.

Free Software: Software which, once obtained, can be used, copied, studied, modified and redistributed. It is often made available online without charge or offline for the cost of distribution; however, this is not required, and software can be "free as in free speech" and sold for profit.

Library Catalog (or **library catalogue):** register of all bibliographic items found in a library or group of libraries, such as a network of libraries at several locations. A bibliographic item can be any information entity (such as: books, computer files, graphics, realia and cartographic materials.), that is considered library material

Interlibrary Loan: service whereby a user of one library can borrow items or receive copies of documents that are owned by another library. The user makes a request with their local library, which, acting as an intermediary, sources the material from the library that owns it, manages the loan to the user, and arranges for its return in due course.

Document Delivery: Supply of journal articles and other copies on a personalized basis, whether these come from other libraries or direct from publishers.

Integrated Software: Software packages that usually include word processing, database management, spreadsheet, telecommunications and graphics

Internet: The global network linking millions of computers. It consists of a set of protocols for exchanging information in many ways.

Plagiarism: Using another person's work as your own.

Proprietary Software: Any closed-source material which fundamentally means that the user does not control what it does or cannot study or edit the code.

Public Domain: Information, the source of which is available to anyone and is not subject to Copyright restrictions.

Public Services: Library work that involves direct interaction with the public, serving the library user directly such as circulation, reference services and interlibrary loan.

Non-proprietary Software: Software that has no proprietary restrictions attached to it, particularly the restriction about the access to the source code.

Online Public Catalogue (OPAC): A computer-based library catalogue for use by the public. It is accessed through a dumb terminal or personal computer. It replaces the card catalog.

Selective Dissemination of Information SDI: A service provided by a library or other information agency whereby its users are periodically notified of new publications, report literature, or other sources of information in subject in which they have specified an interest.

Software: The invisible part of the computer; the set of instructions that tells the hardware what to do with the data it receives.

Technical Services: Library work that is done behind the scenes and does not have much contact with the users such as acquisition, cataloging, classification, physical processing, and repairs.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

According to Kombo (2006), literature is the work the researcher consulted in order to understand and investigate the research problem. A literature review therefore, is an account of what has been published on a topic by accredited scholars and researchers. Mugenda and Mugenda (1999) states that the purpose of the literature review is to determine what has been done already related to the research problem being studied. It sets a foundation of what has been done by other researchers so that the researcher can avoid both the mistakes that have been made and duplication of efforts. This chapter discusses the literature concerned with library automation in libraries and information centres

2.1 Theoretical Framework

Theoretical framework provides the researcher with a guide as she/he reads literature (Kumar, 2005). According to Kombo (2006), a theoretical framework is a collection of interrelated ideas based on theories. A theory is a reasoned statement or groups of statement, which are supported by evidence, meant to explain phenomena. They are a systematic explanation of the relationship among phenomena (Kombo, 2006). The study looked at different theories and models that helped to understand automation program in libraries and information centres.

Automation of library operations and information services require positive attitudes from all stakeholders and acceptance from management so that they can provides funds when they are making decisions for the institution. Acceptance by all stakeholders in library automation in KARI would lead to effective, efficient and economical library operation and information services. Application of ICT to library operations and information services is an innovation. Diffusion of Innovation Theory was viewed as theoretical framework for this study because it deal with innovations, acceptance, adoption and diffusion of technology.

2.1.1 Diffusion of Innovation Theory

The study adopted Diffusion of Innovation theory by Rogers (2003) because adoption of automation of library operations and information services have an influence on the e-resources and online services method chosen to alert adopters to make maximum use of resources and services. Rogers and Scott (1997) define diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. The diffusion of innovations model, credited to Everett Rogers (2003) delineates the process by which an innovation spreads via certain communication channels among members of a social system.

Rogers (2003) defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. Rogers' definition contains four elements that are present in the diffusion of innovation process.

The four elements are: innovation - an idea, practices, or objects that is perceived as new by an individual or other unit of adoption. Communication channels - the means by which messages get from one individual to another. Social system - a set of interrelated units that are engaged in joint problem solving to accomplish a common goal and time. The time factor is divided into three: Innovation-decision process, relative time within which an innovation is adopted by an individual or group and innovation's rate of adoption.

Roger (2003) notes that the stages through which a technological innovation passes are as follows: knowledge (exposure to its existence, and understanding of its functions), persuasion (the forming of a favourable attitude to it), decision (commitment to its adoption), implementation (putting it to use) and confirmation (reinforcement based on positive outcomes from it). Minishi- Majanja (2004) asserts that some of these influences include: the nature of the innovation, the communication channels, the characteristics of social group, institutions or organizations

Roger (2003) highlights the important characteristics of an innovation as: relative advantage (the degree to which it is perceived to be better than what it supersedes); compatibility (consistency with existing values, past experiences and needs); complexity (difficulty of understanding and use); trialability (the degree to which it can be experimented with on a limited basis) and observability (the visibility of its results).

Kiplangat and Ocholla (2005) add that the theory rests on the premise that a new idea, practice or object has perceivable channels, time and mode of being adopted by individuals or organizations. Roger (1997) agrees that the theory has potential application of information technology, ideas, artifacts, and techniques.

2.2. Application of Diffusion of Innovation Theory to the Study

Application of technological innovations in library operations and information services centres has opened new horizons to libraries and information centres such as: e-resources, bibliographic databases, internet services, consortium and social networking services (library 2.0). Libraries are responsible for creating innovative information systems for the dissemination and preservation of information and new knowledge regardless of format (Keystone principles, 2000). Rogers' Diffusion of Innovations Theory was considered a suitable framework because automation of library operations and information services are new innovation in libraries and information centres in developing countries. Libraries and information centres had not embraced application of ICTs in library operations and information services fully. Diffusion of Innovations has potential application to information technology ideas artifacts and techniques, and has been applied as the theoretical framework for a number of related studies such as information system projects (Minishi-Majanja and Kiplangat, 2004). According to Rogers (2003), adoption is a decision of 'full use of an innovation as the best course of action available' and rejection is a decision 'not to adopt an innovation'. Rogers (2003) defines diffusion as the process in which an innovation is communicated through certain channels over time among the

members of a social system. Libraries and information centres are using different ICT infrastructures to order information resources, process, store, search and retrieve, disseminate to users through various ways. Rogers and Scott (1997) assert that diffusion is a special type of process of 'communication by which an innovation, in the form of new ideas, practices or products, is spread through certain channels, over time, among the members of a social system'. As expressed in these definitions, innovation, communication channels, time and social system are the four components of the diffusion of innovations process. These four components are explained below.

2.2.1 Innovations

Libraries and information centres use modern technological innovations to establish new information systems in order to catch up with the modern world and communicate in terms of information storage and effective delivery of information services. Rogers (2003) defines innovation as an idea, practice or project that is perceived as new by an individual or other unit of adoption. An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them (Rogers, 2003). ICTs have brought a lot of innovations in automation of library operations and information services. Lam (2001) notes areas of library automation such as: automation of library functions, use of electronic resources within the library for example, CD-ROMs for accessing remote electronic resources, office automation word-processing for spreadsheet and databases.

Libraries and Information Centres had been using manual systems in library operations and provision of information services. Digital information resources, Open Source Software, automated technical services and Web-based information services and Web 2.0 are perceived as new innovations in the field of Information Sciences. Librarians and Information Technology personnel have adopted these innovations for effective delivery of library operations and information services. For example, development of Libraries and Information centres online networking (consortium) has been perceived as new innovation which has enabled all partners to have access to information resources. Social networks, for example, Library Tools 2.0 are also new innovations which are helping users to share information with Information Professionals. For instance, research scientists have a lot of research information in form of power point presentations. This information is put in the slideshares and uploaded into the internet by Information Professionals and can be shared by many users. Twitter, Youtube, facebook, blogs and Yammer are also new innovations in libraries and Information Centres and users are appreciating these innovations.

2.2.2 Communication Channels

Rogers (2003) defines communication as ‘a process in which participants create and share information with one another in order to reach a mutual understanding’. Rogers (1997) laments that different communication channels play different roles at various stages in the innovation decision process. This communication occurs through channels between sources. Rogers (2003) asserts that a source is an individual or an institution that

originates a message. A channel is the means by which a message gets from the source to the receiver. Libraries and Information centres use E-mail, Online Catalogues, Open source software, automated bibliographies, Internet, automated accession lists, Library 2.0 tools, Online librarian (for example Ask a Librarian), digital resources and others as communication channels to enhance diffusion of current information to users.

2.2.3 Time

Time is very important in research libraries. Ranganathan in his five laws of library science also noted time is very crucial and reader's time must be saved. New research for development is needed by research scientists therefore librarians should provide information to users at any given time. Automation of library operations and information services has led to improved services with less time wasted. For example producing statistical reports in circulation and arranging bibliographic records is very easy in automated systems. Introduction of Web 2.0 and online information services in libraries and Information Centres saves readers time. According to Rogers (2003) the time aspect is ignored in most behavioral research. He argues that including the time dimension in diffusion research illustrates one of its strengths.

2.2.4 Social Systems

The social system is the last element in the diffusion process. According to Rogers (2003), a social system is a set of interrelated units engaged in joint problem solving to accomplish a common goal. In this study, libraries and Information Centres were used as social system. Since diffusion of innovation takes place in the social system, it is

influenced by the social structure of the social system. Rogers (2003) opines that structure is the patterned arrangement of the units in a system. Libraries and Information Centres have a set of interrelated departments namely processing department, circulation department, reference department, special collection department, multimedia department among others. Information professionals in these departments work according to the established goals of their libraries and Information Centres and they share the common objectives that make them work together. Inadequate funds has made libraries and Information Centres come together to form consortiums, for example, the Kenya Education Network Trust (KENET); Kenya Library Information Services Consortium (KLISC). These consortia assist in resource sharing among there members. Rogers (2003) argues that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters. Inadequate funds have also led libraries and Information Centres to look for other alternative to automate their services through social systems. For example use of the Open Source Software in automation of library operations and information services has made information professionals come together and share ideas.

2.3 Automation

Automation of library operations and information services is essential for efficient functioning of the library and saving the library users' time. Bhardwaj and Shukla, (2000) define library automation refers to use of computers, associated peripheral media such as magnetic tapes, disks, optical media etc. and utilization of computer based products and

services in the performance of all type of library functions and operations Pratap (2004) cited the following definitions:

- the organization or machine handling of routines of operation, requiring minimal human intervention;
- a machine which performs a function according to a set of coded instructions;
- a moving mechanical device made in imitation of a human being;
- the use or introduction of automatic equipment in a manufacturing or other process or facility.

Automation refers to the use of computers and other electronic machinery for the execution of business-related tasks. Automated machinery may range from simple sensing devices to robots and other sophisticated equipment.

2.3.1 Need for Automation

Libraries are undergoing significant changes today not only in outlook but also in function, services, methods and techniques for collection development, processing and dissemination of information (Singh & Krishna, 2004). Automation of libraries and Information centres has unlimited potential for variety of applications. It reduces the work stress of library staff and helps in getting the information immediately. Automation leads to development of new library operations and information services. Library automation involves creation of database and information retrieval systems, computerized library network and use of telecommunication for information. It needs a careful handling and systematical planning. Automation allows the information professional to better

respond to the information needs of library users. There are many reasons for automation of library operations. Rajput and Jain (2006) cited the following main reasons:

1. Increase the processing efficiency than a manual system.
2. Realize financial saving or continuing cost in certain cases where cost saving has been realized through automation.
3. Improve library services
4. Make library administration and management efficient.
5. Avoid duplication of the work.
6. Facilitate resource sharing and increase technical processing efficiency over a manual system.

2.3.2 Library Automation

Widespread use of computers, increased reliance on computer networks, rapid growth of Internet and explosion in the quality and quantity of information had compelled libraries and information centres to adopt new means and methods for acquisition, processing of information resources, storage, retrieval and dissemination of information. Ramzan and Singh (2009) defines Library automation as to all the computer and related hardware, software, e-mail, internet, library management systems, electronic databases, compact disc-read-only-memories (CD-ROMs) and other information access technologies involved in the recording, storage and dissemination of information through the libraries. Such information management, network and communication technologies have become indispensible tools to perform different library functions and to provide innovative services. Library automation refers to use of computers, associated peripheral media such

as magnetic tapes, disks, optical media etc. and utilization of computer based products and services in the performance of all type of library functions and operations. Computers are capable of introducing a great degree of automation in operations, functions since they are electronic, programmable and are capable to control over the processes being performed (Bhardwaj and Shukla, 2000). Library automation is the use of machines to perform different activities which can be done by people. According to Lam (2001) library automation is the use of computer and networking technologies in the library. Pratap (2004) adds that library automation is perceived in a simple sense as a process of mechanization of library operations which are of routine and repetitive nature. This covers usually housekeeping functions such as acquisition, serial control, cataloguing, circulation, reference just to mention a few.

New technologies also help increase circulation, remote access to bibliographic and full-text data, increases circulation of materials, provides unlimited information from different sources and facilitates the reformatting and combining of data from different sources (Ramzan quoted: Mutula, 2007).

2.4 Approaches to Automation

The automation of libraries is an important activity as it is a pre-requisite for networking of libraries and resource sharing. It enables promotion of e-Learning for remote users, usage of e-Journals/e-Books remotely, digitization of contents including non print materials, creation of centre of excellence in library, information and computer sciences, creation of e-Archives, creation of institutional repositories. Almost all the operations in

a library can be automated to achieve more efficient and effective functioning and for providing excellent library and information services (Williams, 2008).

Automation of library operations and information services will reduce workload, enhance development of new services, security of data; portability of resources, increase efficiency, standardization, co-operation and centralization of resources. This increases user satisfaction. Automation of library activities provides the services very efficiently, rapidly, effectively, adequately and economically (Bhardwaj and Shukla, 2000).

Computer software is one of the important and easily available resources in academic networks. It ranges from electronic spreadsheets, simple IR systems, communication softwares, and application softwares of various subjects, to complicated systems (Huang, 1992). The development and availability of software appropriate for the information needs of development organizations is a vital strategic issue (Powell, 2003). Software is the most important item in the automation process. A computer without software is like a library with neither books nor librarians (Khalid 1999)**.** Software can be divided into: proprietary software and non proprietary software.

2.4.1 Proprietary Software

Proprietary software is any closed-source material that fundamentally means that the user does not control what it does or cannot study or edit the code. A proprietary system is a system which relies upon software and equipment which is licensed from a copyright holder. Some examples include proprietary software, operating systems, and entire

computer systems. The way in which the user utilizes the system is restricted both by the terms of the license and by blocks within the system which are designed to prevent certain activity. (Smith, 2010). To enhance library automation many vendors have developed many proprietary software for example LIBRARYSOFT which is used by Kenya Methodist University (KeMU), or operating system like Windows-Microsoft office.

Proprietary softwares' are used in libraries and information centres because they have many advantages. Rowley (1990) cited the following advantages: they are economical because the investment cost for the initial creation and later maintenance of the package is spread over several users, the packages come as a well- tested set of programs, the software producer is likely to be a specialist in that kind of software. Packages are well documented including detailed system specifications and user manuals, packages are available readily and can be implemented earlier and support and advice services should be available from the package supplier.

2.4.2 Turnkey System

A Turnkey System is a complete and ready to be used system delivered to the customer ready-to-run. Librarians and ICT Personnel make a contractual agreement with the vendors of turnkey system. Courant (2006) notes that once a library purchases an online public access catalog from one of these vendors, it has entered into a long term contractual agreement with that company, not necessarily because this is what vendors

require but because of the amount of effort required for a library to switch vendors. Each vendor relies on a proprietary, closed-source method of storing the library's records. If a library is to change vendors, as occasionally happens, the entire database would need to be converted. This is a time consuming and rarely trouble-free process. As a result, libraries often select a single integrated library system vendor and then rely completely on that vendor to anticipate and respond to the library's needs. Since one vendor will often sell the same turnkey system to different libraries, response time for changes to a library system can be slow. Libraries and Information centres sometimes prefer Turnkey systems because they are ready made and there are no problems of dealing with system designers and system administrators in developing the system. Examples of Turnkey software's is : INMAGIC used in INOORERO University.

2.4.3 Non-proprietary Software / Open Source Software

Non-proprietary software is software that has no proprietary restrictions attached to it, particularly the restriction about the access to the source code. Open Software Working Group (2002) defines open source as software that is free from proprietary restrictions or software that is developed, released and can be modified by public, free of charge. Users of open source software are able to view the source code, alter and redistribute the software. According to Mutula (2007) open source refers to software that is free from proprietary restrictions or software that is developed, released and can be modified by the public, free of charge. Open source software is computer software for which the human-readable source code is made available under a copyright license (or arrangement such as

the public domain) that meets the Open Source Definition. This permits users to use, change, and improve the software, and to redistribute it in modified or unmodified form. It is often developed in a public, collaborative manner.

The Free Software Foundation (2009) adds that Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software: more precisely, it refers to four kinds of freedom, for the users of the software: the freedom to manage and use the program for any purpose, the freedom to examine how the program works and change it to suit individual needs, the freedom to redistribute copies so as to help others and the freedom to improve the program (via access to the source code) and release the modified improvements to the public, so that the whole community benefits.

Mutula, (2007) notes the following benefits of open software and open standards:

1. Reduced costs and less dependency on imported technology and skills;
2. Affordable software for individuals, enterprise and government;
3. Universal access through mass software rollout without costly licensing implications;
4. Access to government data without barrier of proprietary software and data formats;
5. Ability to customize software to local languages and cultures and participation in global network of software development.

Libraries and information centres are adapting open source software for example Koha and then modify it to suit their library operations and information services. Cervone (2003) opines that libraries are increasingly looking for methods to meet user demands while simultaneously providing less costly quality systems and resources. In the context of an ever increasing need for technology and ever decreasing resources to acquire new products, OSS offers libraries an attractive solution. Library end users with technical and nontechnical skills can participate in OSS installation and maintenance, librarians can engage in OSS development and modifications, and library user groups can often customize OSS environments. Moreover, OSS is an important library solution, for there exist a large user base for OSS applications, a wide variety of available OSS tools, and a multitude of OSS support channels.

Strathmore University and St. Paul's University are some of the libraries in Kenya which are using Open source Software (Koha) KARI, Ministry of Agriculture Libraries among others use CDS/ISIS or WINISIS Open Source Software on their library operations and information services.

2.4.4 Cooperative System

Cooperation is the manner of coordination that is necessary for agreeing on common goals and for the coordinated achievement of common work results among the participants. Cooperation processes such as software development in a team demand coordination processes in order to coordinate the cooperative activities of the individual

team members. Cooperation processes in turn demand communication processes, such as the exchange of information across the various development activities.

2.4.5 Integrated Automation Systems

Integrated library systems (ILS) are multifunction, adaptable software applications that allow libraries to manage, catalog and circulate their materials to patrons (Muller, 2011). Integrated library systems encompass a variety of library operations. By sharing the same database, one computer system can serve several modules for applications in cataloguing, acquisition, serial control, circulation, and the Online Public Access Catalogue. One input or update keeps the entire database current for all functions. The system also allows the online public access catalogue to link to the commercially available online reference services such as abstracting, indexing and full-text reference databases (Kao, 2006).

Libraries and information centres have developed Library Management Systems to enhance library operations and information services. Rowley (1998) opines that Library management systems are now established as an essential tool in the support of effective customer service, stock management and in general, management of the services offered by libraries and other agencies engaged in the provision of access to collections of documents. The focus of such systems is on maintenance, development and control of the documents in the collection. Systems support selection, ordering, acquisitions, labeling, cataloguing and circulation control of library stock. Dzurinka (1998) suggests that current information technology requires software that allows easy integration with local network

resources and is designed to accommodate a library's constantly changing needs and services.

Libraries and information centres should choose integrated library systems with all library modules and which could accommodate advancement in technology. Muller, (2011), states that in choosing ILS software, libraries must base their decision not only on the performance and efficiency of the system, but also on its fundamental flexibility to readily adapt to the future demands and needs of their patrons.

2.5 Application of ICTs in Libraries

Application of ICTs in library operations and information services has brought a lot of conveniences to the libraries and information centres. Powell, (2003) notes that the growth of the World Wide Web has seen an explosion of services being provided on-line, for example, the availability of internet services, On-line search and retrieval services, Web-based reference services, document delivery service, Library 2.0 and others. ICTs are applied in libraries and information centres on the following information services:

2.5. 1 Web-based Reference Services

The role of reference services is to make information available to library users, to facilitate access to library collection and to provide guidance to library usage. Web-based reference services provide information to users by linking related information

together. Mutula and Wamukoya (2007) noted the following benefits of web-based reference services:

Open reference services to those who cannot, or prefer not to visit the library premises; ensure that a library services remains relevant as information on the internet increases; provide tools to allow the patron to interact with library resources in the way they deem fit; deliver information to clients in different ways and formats; provide free access to various online references sources; improve efficiency through statistics produced with less efforts and more accuracy; provide integrated sets of information and services that are easily accessible by staff and clients; provide staff with the opportunity to become conversant with different types of technologies while delivering real-time services; enhance cooperation between libraries and the different staff roles within the library; extend library services to those users with physical challenges and increase accessibility to all types of government services.

Web-based services enhance quick respond to users' queries and Information professionals use different online resources for example Emerald, Springer, JSTOR, EBSCO, Oxford, among others. Syed and Syed, (2000) lament that libraries are invariably providing web-based services such as catalogues, search engines, forms, instructions, distance learning and e-reserves

2.5.2 Web- based Information and Referral Services

Currently web - based and referral services are one major component of library services. Han and Goulding (2003) observed that users prefer the convenience of web resources to

library. Information professionals have adopted ICT infrastructure such as databases, e-libraries to facilitate the storage, search, retrieval and dissemination of information. Fagan (2000) opines that Information & Referral services (I&R) help people obtain relevant and accurate information to meet specific needs.

Library users value the services that they access from their desktops because the services save time. They appreciate beings able to access services at their convenience, without being restricted by the library's hours of operation (Syed, 2002)

2.5.3 Automated User Education or Guide Services

Automated user education or automated guide services helps the users to make maximum utilization of information resources and services available in the library such as computers, CD-ROM databases, online databases, Internet among others. Ocholla and Ojiambo (1993) assert that users' guidance embraces an organized and directed system which ensures that library users are familiar with their library, its resources and services.
It provides a map into the centre, reflects on its staff, collection, the retrieval system and the services. It helps the user to know how to access to the library information resources adequately.

Technology is changing and therefore libraries and information centres require implementing online user education. Kibirige and DePalo (2001) stress on an urgent need to develop user-education programs that emphasize the nature and various types of digital collections: interfaces, hardware and software requirements, telecommunications access

modes and making such programmes part of continuing education. In addition Syed (2002) observed that web environment is proving to be another useful platform for library instructions. As users are becoming informed online users, it is important that libraries be ready to offer online instruction.

The questions that users ask now include ways that deal with how to operate the equipment and software systems that must be used to find information. The reference interview must often address users' unrealistic expectations of the Internet or their ability and willingness to use computer hardware and software (Bopp and Smith, 2001). Library users value the services that they access from their desktops because the services save time. They also appreciate being able to access services at their convenience, without being restricted by the library's hours of operation. Web-based online tutorials should be made and linked to library web sites to enhance utilization of resources.

2.5.4 Online Question and Answer Services

Advancement of technology has made information professionals develop new information services, for example, Internet, Question and Answer Services to enhance quick delivery of services to users. Web forms are created on web portals and users can fill in their requests and submit them to online librarians. Haines and Grodzinski, (1999) affirm that electronic services are currently offered via electronic mail by many libraries, but there are limitations. However, the Web-based forms improve upon these limitations and add value to the library's electronic services. Forms let the user write back to

libraries with comments, or suggest a new book, make a book renewal or request for a library instruction class or select from a host of other alternatives. Communication between users and libraries is enhanced when electronic forms are introduced to these communities (McCloskey, 1996). For example, the Technical Centre for Agricultural and Rural Cooperation (CTA) offer online Question and Answer services to ACP countries.

2.5.5 Internet Services

Libraries are using the Internet to support their library operations and information services such as: acquisition, circulation, reference, classification, cataloguing, CAS, SDI and providing access to the Internet as an independent service.

Raitt (2005) affirms that the advent of the internet has broken down barriers of communication and permits access to information from anywhere in the world. It is fast reliable and does not have restrictions on content or format and has limitless range of facilities, which assist users to access the almost infinite information on the Net.

It further offers the opportunity for access to up to date reports and knowledge globally. Mutula (2002) adds that the internet is a global super-highway through which decisions are now being made more quickly than ever before and it has had powerful and pervasive effects on every part of our lives including business, education, health, transport, communication and industry. Provision of Internet in libraries and information centres help users to access from different location. Use of Internet in library operations and information services has led to effective, efficient and economical services. Information

professionals use internet services to communicate with users, locate, order, search and retrieve, download information required by users globally.

2.5.6 On-line Search and Retrieval Services

Huang (1992) laments that an information retrieval system is a system in which information is retrieved electronically via the network by the user on demand. Information professionals search and retrieve information online for the users. Godden (1991) notes that rapid access to online databases has replaced the time- consuming process of searching for copy in sources as the National Union catalogues in printed or microfiche form for most copy cataloging, greatly increasing the efficiency and productivity of the process.

2.5.7 Information Network/Resources Sharing

Information networking/resources sharing are necessary in libraries and information centres. Okeagu and Okeagu, (2008) affirmed that libraries have realized that no matter how well they are funded, it is difficult to acquire all the materials needed by their clientele. Reitz (2004) adds that resources sharing is the activity, is the result from an agreement, formal and informal among a group of libraries (usually a consortium or network) to share collection, data, facilities and personnel for the benefit of the users and reduce the expense of collection development. Information professionals are using consortium for example, the Kenya Library and Information Services Consortium (KLISC), Kenya Education Network Trust (KENET), Kenya Agricultural Information Network (KAiNet) and others to improve provision of information services. Through the

consortium information professionals and users can access different online databases freely and quickly, for instance, Emerald, Springer, JSTOR, EBSCO, Oxford, Wiley, Hinari among others. Okeagu and Okeagu, (2008) concluded that networking is a way to gain access to a greater range of expertise and other resource and avoid duplication of efforts by the efficient use of available resources.

2.5.8 Social Networking Services (Web 2.0)

The information world is in a state of rapid change. Web 2.0 is now playing a key role in promoting information accessibility by exploring information sharing and collaboration through the worldwide web. Libraries use theWeb2.0 phenomenon for the same purpose that is, extending their reach into the range of available information by merging Web 2.0 technologies with other communication tools (King and Brown, 2009). Birdsall (2007) asserts that Web 2.0 is a social movement. It is characterized by open communication, decentralization of authority, and freedom to share and reuse content. Aharony, (2009) noted the following characteristics of Web 2.0:

1. User generated content – self-publishing, personal publishing, and self-expression.
2. The wisdom of crowds – the theory that groups operating according to certain conditions can solve problems more effectively than even the most intelligent individual member of the group.

Libraries and Information centers are also using facebook, youtube, slidshare, twitter yammer as means of communication between librarians and users in delivery of information to users. Web 2.0 allow web users to generate, describe, post, harvest, search,

annotate and exchange online content in various forms ranging from bookmarks to photographs and documents**.**

2.5.9 Automated Circulation Services

Libraries and Information Centres are using circulation control system to enhance circulation services. The purpose of circulation systems is to keep track of the library materials on loan to registered borrowers, to calculate overdue charges and give reports on statistics on usage. The widespread use of automated systems has allowed libraries to be more flexible in lending their collections. For example, automated systems can cope with several categories of clients borrowing different types of materials for varying lengths of time (Adersen, 2007). He further elaborates that a circulation system should be able to: confirm that the borrower is a registered client and is eligible for service, differentiate between types of borrowers and lend items according to the type of borrower keep track of how many items a client has borrowed already and disallow further lending when the maximum is reached, tell library staff and users when items are on loan and when they are due to be returned, bring overdue items to the library's attentions for recall purposes and hold circulated items for other borrowers and inform them when the items are available. Automation of circulation services could be efficient, effective and economical.

2.5.10 Online Public Access Catalogues Services (OPAC)

With the advent of the internet and more recently with the World Wide Web (WWW), most library OPACs can now be searched from inside and outside the library. Web

OPAC is a library catalogue on the Web or Intranet. Users can search the required information by connecting to Uniform Resource Locator (URL) of Web OPAC anytime during the day (Kulkarni, 2003).

The OPAC system has changed the traditional concept of access in a significant way. It allows multi-dimensional searches providing as many access points as the data elements depending on the software used. OPACs allow searches through author, title, subject, keyword, call no., accession no., ISBN and others. In addition to these; OPACs also facilitate searches through publisher, place of publication, year of publication. Also provision for truncation of terms is available (Ansari and Amita, 2008).

Zahiruddin (2007) opines that an extension of this facility provided powerful searching of web resources together with the searching of local catalogues, online journals, and locally digitized resources with a single sign-on. Users can also initiate a reference question through electronic reference services (ask a librarian) and submit an interlibrary loan request with the same log-in. Gopinath (1995) asserts that OPAC is designed to do the following:

1. To provide access to literature available in a library.
2. To provide multi-point and multi-person access.
3. To tell about what books have been lent and what are in the stock of a library.

2.5.11 Readers' Advisory Services

Automated Readers' Advisory Services are very important. Information professionals have created websites with interfaces which are user friendly and they can navigate through various information resources such as, online databases, electronic journals and ebrary. However, helping users find useful materials to address problems and issues in their lives, continuing educational goals or other non-fiction reading interests is still an important and satisfying service for reference librarians to provide. With so much information on current issues available from so many sources including the Internet, today's readers advisors face the challenge of helping users develop strategies for finding, evaluating and using print and electronic resources, within the library and beyond to achieve their goals (Bopp and Smith, 2001).

2.5.12 Online Bibliotherapy Service

Advance in technology has led to development of new information services in libraries and Information Centers, for example online Bibliotherapy service. Bibliotherapy is a more specialized form of guidance, related in its goals to readers' advisory work but generally practiced in a group. Bopp and Smith (2001) observed that today bibliotherapists use literature, film or other media chosen for their appropriateness to the needs of the group, to assist the personal growth and/ or rehabilitation of group members through discussion of the materials read or viewed. Libraries and information centres are using bibliotherapy service to serve different user groups according to their needs.

2.5.13 Interlibrary Loan (ILL)

Interlibrary loan is the process by which a borrower in one library obtains the use of books, periodicals articles or any library materials from another, sometimes distant, library. Interlibrary loan assists in sharing of information resources. Hao-Ren Ke (2002) affirms that interlibrary cooperation is a concept of collaborative activities among libraries. By sharing resources in a cost-effective manner, it aims to supply better services to patrons, improve the efficiency of library operations, and utilize resources effectively. The growth of electronic bibliographic utilities such as OCLC and cooperative networking among libraries has made the interlibrary loan process faster and easier. Today, however, when the borrowing and lending libraries both belong to such an electronic network, the borrowing library may be able both to verify the citation and place the ILL request electronically Bopp (2001). He elaborates that when using a bibliographic utility or network to request a book the cataloging record already in the network serves as verification. The request is transmitted instantly and as a result the library user receives the material faster.

2.5.14 Document Delivery Service (DDS)

The principal aim of libraries and information centres is to provide relevant and timely information to their client group. Interlending and Document Supply (ILDS) offers expert analysis and practical recommendations on all aspects of the supply of information through the library network. It is not possible for libraries to have everything that its users may need. Libraries use document delivery services from other libraries and commercial organizations for copies of research papers among others not held by them. According to

Reitz (2010), asserts that Document Delivery Service is the provision of published or unpublished documents in hard copy, microform, or digital format, usually for a fixed fee upon request. In most libraries, document delivery service is provided by the interlibrary loan office on a cost-recovery basis. The patron is usually required to pick up printed material at the library, but electronic full-text may be forwarded via e-mail. DSS also refers to the physical or electronic delivery of documents from a library collection to the residence or place of business of a library user, upon request.

2.5.15 Current Awareness Information Services (CAS)

Online CAS helps to match users query and the online resources and link them together. Ocholla and Ojiambo 1993 defines Current Awareness Services as systems of reviewing newly available documents, selecting items relevant to the needs of an individual or group and recording them so that notifications may be sent to those individuals or groups to whose needs they are related. Current Awareness Services, users with varying interest are supposed to find out the relevant information depending on their choice and interest. But they have to make some extra effort to be aware of the new information which is also compiled with efforts put by the information service provider (Hossain, & Islam, 2008).

2.5.16 Selective Dissemination of Information (SDI) /Alert Services

Special libraries like KARI Libraries compile user profiles which indicate subjects of interest to users, whenever information related to the subject of a user's is received in the library, he/she is notified. Mahapatra and Chakrabarti, (1997) define SDI as a type of current awareness service which under optimum conditions involves screening of documents, selecting information exactly tailored to meet the specific research needs of

each user or a group of users and supplying the information directly to each individual or group so that user can keep abreast of the latest developments in the area of his specialization. Dawra, (2004) opines that SDI is a service that can be regarded as a by-product of CAS which not only serves current information but also totally is user-oriented

Fatoki (2005) asserts that specialised and personalized information services can be designed using the wireless technologies made available to all. Personalized services to patrons could be by sending renewal notifications to alert them that the books borrowed by them are almost due or overdue. Sensitizing and alerting users on available resources on their area through modern technology will help them make maximum utilization of resources. In the past reference librarians in their offer hours discussions sometimes would ask questions of themselves like "What reference sources should I place close to me, because they are used so frequently or answer many of the reference questions that come along every day at the information desk". Then online searching made it possible for a library not to have to buy own hard-copy print versions of such basic sources as general encyclopedias and dictionaries but rather to purchase CD- ROMs or access them via online such as DIALOG, Compuserve and internet (Shuman, 2001).

Application of ICTs on the SDI have changed the service to an e-type services using e-mail to inform readers. Databases' indexes are used when matching users' interests as reflected by searching subjects. Moreover, users themselves find from these e-sources,

specifically e-journals, the most important, up-to-date sources of information where they can browse and retrieve the contents from their desktop connection through the organization's servers (Jabr, 2008).

Modern technology has changed SDI to alert services or e-mail alerts. According to Penn State Libraries (2007) an alert service is a type of user account in a database that automatically sends email notifications for new citations or tables of contents.

Library automation has made the SDI effective, efficient and economical because newly added information to a database could be searched, saved and used again..

2.6 Automated Library operations

Adeleke and Olorunsola (2010) adds that the advent and use of ICT has made it possible for remote libraries to access the huge databases of big libraries in developed countries for the purpose of adopting or adapting their bibliographic data for their own library use; and indeed the online catalogues have transformed the landscape of cataloguing and classification.

Kao (2006) defines technical services as library work that is done behind the scenes and does not have much contact with the public. They include services such as acquisition, cataloging, classification, physical processing, mending and repairs, gifts and exchanges, preservation, organization of documents and serial control. Evans (1999) adds that technical services are acquisitions, bindery and repair, cataloguing, and serial control, while public services revolve around circulation and reference activities. Automated

technical services may handle maintenance of an online catalog, creation and maintenance of MARC records in the catalogue, labeling, covering, security processing, and/or distribution of materials. Technical services sometimes cover the tasks involved in maintaining a library's technology resources, such as servers, OPACs, circulation scanners, and other devices. Information resources require organizing and processing to enhance search and retrieval of information. Books, reports, standards, legal documents, journals, videos, DVDs and electronically held documents (the collection) must be organized for use by users who have direct access to the collection and to facilitate the work of information officers (Panty and Griffiths, 2005).

2.6.1 Automation of Acquisition Service

Several computerized book selection tools are used in libraries and information centers such as: Publishers' catalogues, authors' works, booksellers' publicity blurbs and publication details are available on-line in a website (Satyanarayana, 2006). The advantage is that both the librarian and the user can make the selection, highlight required resources and acquire them in a short span of time.

Acquisition of library materials is another important activity in a library which can be computerized. According to Khalid (1991), selection of material, bibliographic verification, ordering, budgeting and file management in the acquisition department can be computerized. Riaz (1991) further discusses the concepts of tele-ordering and the relationship between acquisition and other library sections. The acquisition service contributes to the process of ordering and receiving of materials selected for inclusion to

the library collection. Satyanarayana (2006) assert that process and procedure are almost the same in manual as well as automated environment. But the outcome and net result is far better in automation of the acquisition process so far as quality is concerned. He further explains that additional services can be provided in a computerized acquisition system. The conspicuous advantage of a computerized acquisition is the promptness and transparency of the data for retrieval. A number of statistical reports useful for decision making can be generated at a given point of time for a given purpose in a computerized acquisition.

2.6.2 Automated Cataloguing Services

Online catalogues are to core library operations. There now exists a critical mass of resources for technical services work available via the World Wide Web. Some of these resources are provided by commercial vendors on payment of a fee. Many resources are free, some being provided by particular libraries and some by knowledgeable and enthusiastic individuals (Poulter, 1997). For example, the Library of Congress, The British Library Online Catalogue, Online Computer Library Center (OCLC) and others.

Library automation would enhance retrospective conversion process, converting the libraries backlog of manual card catalogues to Machine Readable Catalogues (MARC) format to facilitate online catalogues and resource sharing.

The online records have to be of international standard; that is, following the AACR2 rules to compose bibliographic description and determine access points in cataloguing. The records also have to adhere to the standards of MARC format, so that the records can be interpreted and retrieved in online environment. This is an advantage for organization like KARI with centres spread all over the country as KARI libraries should be able to share records if they automate the cataloguing activities. According to Zaid (2008), the advantage of online cataloguing cannot be over-emphasized, for cataloguers and classifiers that have embraced the new technology, it is no longer common to see newly acquired information resources held up in the cataloguing unit for months.

2.6. 3 Automated Classification

Librarians are using various automated classification to process information resources such as: Web Dewey Classification, Web version of Library of Congress and automated subject classification. Adeleke, (2010) asserts that web Dewey is the electronic version of Dewey Decimal classification scheme. It enhances the print updates with online delivery that is updated continuously.

The web version of Library of Congress classification schedules. are online cataloguing and classification tool with many potentials and advantages such as access to data globally, full text schedule, correlations between the LC classification numbers and LC Subject, all files updated daily and automatic calculation of classification table numbers (Adeleke and Olorunsola, 2010).

According to Koraljka**, (**2006**)** automated subject classification denotes to machine-based organization of related information objects into topically related groups Automated classification of text finds its use in a wide variety of applications, such as: organizing documents into subject categories for topical browsing, including grouping search results by subject; topical harvesting; personalized routing of news articles and filtering of unwanted content for internet browsers. (Sebastiani, 2002; Jain 1999). Koraljka (2005) opines that Web documents have specific characteristics such as hyperlinks and anchors, metadata, and structural information, all of which could serve as complementary features to improve automated classification.

2.6.4 Automated Serials Control

Computers have also made a significant contribution in serials control. It shows the information resources which were ordered, when they were received, which were not received and also the mode of payment. According to Khalid (1991) and Riaz (1991), computers can handle inventory, ordering and acquisition, accessions, cataloguing and circulation of serials.

2.6.5 Bar-coding of Library Materials

Bar coding is an important library operation. Wijayaratne (2005) opines that barcodes have become an indispensable part of library automation because they serve as a computerized accession number - a unique identifier that links a specific book, journal, and compact disc- to the computerized bibliographic record that describes it. KARI Libraries should barcode all materials to enhance security.

2.7 Range of Digital Formats of Information Resources

The rapid development of Information and Communication Technologies in many information sectors and change of user's information seeking behaviour has led libraries and information centres to change from printed resources to digital formats. Pantry and Griffiths (2005) outline the numerous information sources including: books, reports

pamphlets, journals, newsletter, computer databases, electronic journals, statistical electronic books, legislation, guidance, codes of practice, official circulars, research results, films, videos, DVDs, press releases, standard specifications, encyclopedias, handbooks, datasheets, translations, microfiche and microfilm, CD-ROMs and DVD-ROMS and computer disks (Hard disk and Floppy). There now exists a critical mass of resources for technical services work available via the World Wide Web. Some of these resources are provided by commercial vendors on payment of a fee. Many resources are free, some being provided by particular libraries and some by knowledgeable and enthusiastic individuals (Poulter, 1997). Digital formats of information resources can be divided into electronic and electronic – magnetic formats. Libraries and Information centres use electronic and electronic – magnetic formats to enhance library operations and provision of information services because they are efficient, effective, ease of use and access than printed resources. Mishra (2008) qualifies this by saying digital information is manipulateable, networkable, dense, compressible and impartial.

2.7.1 Electronic Formats

Huang (1992) defines electronic text as any computer generated monographs, periodicals, articles, reports, or manuals, known as electronic texts, to which users in the networks can have free access without any restrictions of copyright. Information professionals sometimes scan the documents or search in the internet and use the electronic text to users. For example they attach electronic text on the user profile when they are offering Selective Dissemination Service.

The following are Electronic formats commonly used in Libraries and Information Centers to enhance library operations and information services.

2.7.2 Electronic Books (E-books)

The electronic book brings various access points for users, such as author, publisher, title and keywords. E-books refer to digital texts that are issued as individual works and designed to be accessed by using special software for text navigation and ease of reading (Hughes, 2007). According to Noorhidawat (2009), an e-book (short for electronic book and also known as a digital book, ebook, and eBook) is an e-text that forms the digital media equivalent of a conventional printed book, sometimes restricted with a digital rights management system. An e-book is, or should be, its digital equivalent, a medium where information is organised and structured so that it can be presented to the reader in order to facilitate consultation (Landoni, 2003). E-book is an electronic version of a printed book which can be read on a personal computer or hand-held device designed specifically for this purpose. E-books are usually read on dedicated hardware devices

known as *e*-Readers or e-book devices (Oxford Dictionary of English, 2005) Librarians consult e- books when they are ordering books, processing search and retrieval. Examples of e-books are online encyclopedias (Britannica), DDC, online publishers' catalogue, online Dictionaries, Glossaries and others. Hughes (2007) asserts that since the ultimate type of e-book is hypermedia, which integrates textual material with video, sounds and pictures and provides alternative reading paths. E-books are commonly used in libraries and information centres because they are easy to use, access and share among others. Noorhidawat (2009) confirms the following characteristics of e-books:

1. high capacity of storage and able to store vast amount of information;
2. speed of use and Information is displayed instantly;
3. portability: smaller and easy to carry anywhere;
4. immediate access to new information and ideas.

E-books are now commonly used in library operations and online information services such as Online Dewey Decimal Classification, Online Dictionaries, Thesaurus and Encyclopedias, like Online Encyclopedia Britannica. E-books have enhanced online reference services very much. Wallop and Bell, (2010) opines that E-books are helping libraries attract a flurry of new members, as readers embrace digital novels.

2.7.3 Hyper Books

Libraries and information centers are using modern technologies to improve information services. Catenazzi, (1995) defines hyper book as a free mobile web based e-book reader. Hyper books are used to link users from one book to another instead of using 'see' and 'see also' references in manual cataloguing systems. Hyper books are electronic books

defined on the basis of the paper back metaphor. The feature of the text is that it contains embedded links for example, active text that are connected to other parts of the book. Hyper books are used in automated Current Awareness Services instead of circulating content pages. Mishra (2008) outline the following advantages of hyper book as: it can be shared by users in different geographical locations; it is quick, accurate, easy to locate by using searching and browsing mechanism; binding for preservation and shelf maintenance

2.7.4 Electronic Journals

Electronic journals, also known as ejournals, and electronic serials, are scholarly journals or intellectual magazines that can be accessed via electronic transmission. In practice, this means that they are usually published on the Web. They are a specialized form of electronic document: they have the purpose of providing material for academic research and study, and they are formatted approximately like journal articles in traditional printed journals. Librarians use online journals to offer information services. Examples of online bibliographic databases are: Emerald, ERIC, JSTOR and TEEAL. They have full articles search on these electronic journals and attach them to users profile. Libraries save space by subscribing to e-journals as these do not take up as much space as bound volumes of printed journals.

2.7.5 Electronic mail

The explosive growth of electronic mail (e-mail) has enhanced effective and efficient library operations and information services in libraries and information centers. It is

possible to order information resources from different vendors and also to create awareness on available resources in libraries and information centers without paying any fee for postage through e-mail services. Rowley (1998) opines that e-mail allows messages to be sent over a telecommunications network from one computer to another without use of paper. An e- mail system may be a local system that delivers messages around one site using Local Area Network (LAN) or a national or international system using the telecommunications network. Exchanging electronic mail (e-mail) is the most popular feature on the Internet (Shuman, 2001). Fatoki (2005) opines telephone and e-mail are important tools to facilitate prompt handling and response to the stream patrons questions from within and out of the library user community. E-mail helps Information professionals to communicate with users effectively and users can read the messages at their convenient time. For example, users are notified on new arrivals or notified on availability of reserved information resources through e-mail. Also reminders, over due charges and recall of information resources required in the library can be done through e-mail services.

2.7.6 Facsimiles (faxes)

Faxes are commonly used in libraries and information centers, especially when information professionals are ordering for information resources or submitting urgent articles to users.

2.7.7 Online databases

The availability of online databases has enhanced search and retrieval services in libraries and information centres. These databases assist libraries to search large bodies of literature in almost every subject area in a very short span of time. Examples of online database which are used by information professionals in provision of automated information services are, KARD, CAB Abstracts, AGRICOLA, TEEAL, Emerald, ERIC, JSTOR and EBSCO.

2.7. 8 Microform Resources

Microform is a generic term used to designate materials that contain micro or small images of printed or graphic material. The most common microforms are produced either on rolls or sheets of film. Rolls of 35mm or 70mm film are called microfilm and microfiche are sheets of 3x5 inch or 4x6 inch film each containing from 60 to 100 images of material (Chernik, 1992). He further elaborates that they were originally very popular in libraries such as special libraries which needed to store large numbers of technical reports or which needed quick access to individual copies of magazines. Libraries and Information centres use Microforms to store information. For example Microfilm is used in Kenya National Archives to store mass media information (Newspaper) and rare information which require permanent preservation. Microfishe are used in research organizations to store abstracts. For example, ILCA used to produce microfiche with information on livestock and distribute to many libraries and information centres dealing with that field.

2.7 .9 Audiovisual Resources

According to Chernik (1992), the term audiovisual (AV) has been used by libraries to identify audio and visual materials that need to be played on some type of equipment for them to be heard or seen. The commonly used audio or visual media in provision of information services are records, tapes, films and filmstrips. Audio visual resources are used in Automated User Education services to demonstrate how different equipment work, for example, how to use a library catalogue, how to use reference collection materials or how to use machines like computers.

2.7.10 Audio Resources

Libraries and Information centres serve different user groups, physically impaired and physically fit. There is need to have different digital formats of information to cater for all. Several of the first audiovisual media found in libraries were records and audiotapes. However, improvements in technology enabled the tapes to be wound on smaller reels and encased in plastic cases or cassettes that could be inserted into very small and portable tape recorders. They were welcomed by libraries because they were not only easy for patrons to use, but they were also less easy to erase or damage than either reel- to reel tapes or records. Library patrons particularly appreciated listening to Books on Tape while they were performing other activities such as commuting or jogging (Chernik, 1992).

2.7.11 Film /Video Resources

Chernik (1992) notes that other common types of audiovisual materials included in library collections are slides and films. In the past, slides were such an important medium in some libraries that they were sometimes stored in separate library collections where individual slides were cataloged and filed in large slide cabinets. These were later replaced by videotapes and videodiscs. Slides and films are used in libraries to demonstrate library services. Film / video resources are very important because they cater for different groups of users especially impaired users. Video resources are used on user education services to demonstrated how to use different library facilities and information services offered.

2.7.12 Repository

Libraries and Information Centers are establishing repositories for institutional information resources so that they can be preserved and accessed by many users. Chang (2003) defines an institutional repository as a new method for capturing, collecting, managing, disseminating, and preserving scholarly works created in digital form by the constituent members of an institution. Repository enhances information services

2.7.13 Web- Based resources

There are different kinds of web-based reference resources and services, including, but not limited to gateways, search engines, portals, electronic journals, subject directories and online databases (Mutula and Wamukoya, 2007)

2.7.14 Gateways

Information professionals use subject gateways in library operations and in provision of information services. Mutula and Wamukoya, (2007) affirm that subject gateways are internet services that support systematic resource discovery. Many internet resources concerning a particular subject are indexed so that users can access the information easily. Mutula and Wamukoya (2007); quoted Kirriemuir and Martin (1998) defined a gateway as a facility that allows easier access to network-based resources in a given subject area. They add that a cataloguer manually identifies suitable resources using a template to describe the resource and creating entries by submitting the template to the database for indexing.

2.7.15 Portals, Intranets and Extranets

Boss (2006) defines a portal as a single user interface for access to a wide variety of electronic resources both within and outside the library. Mutula and Wamukoya (2007) opine that portals are facilities that offer information services to a specific audience. They add that the information they provide ranges from web-searching, new shopping information, reference tools and communication in the form of chat and e-mail.

Libraries use intranets to improve coordination among different library departments. For example acquisition and circulation departments can coordinate and share information. Stoddart (2001) defines an intranet as a private network implemented using Internet concepts and technology to disseminate and exchange data, sound, graphics, and other

media. It is one of the concrete methods that organizations are using to change the way they communicate internally and share information. Information professionals use intranet to share information from one section to another.

Libraries use extranets to coordinate acquisition processes shared by vendors. Extranets help librarians to streamline library operations, for example communicating with suppliers of information resources. Using intranets and extranets all users and vendors can instantly communicate with each other, using up to date information to notify users, order information resources, communicate with vendors to adjust purchasing.

2.7.16 Search Engines

Search engines enhance retrieval of information on the Internet for example, Internet Explorer, Mozilla Firefox and others. Collins (1999) defines search engine as software that carries out a search of a database when a user asks it to find information. Search engines are popular tools for locating Web pages; they crawl the Web and log the words from the Web pages they find in their databases. It is always a good idea to create a page with links to the search engines that librarians are comfortable using and rely on.

2.8 Electro-magnetic Formats

The capabilities of computer associated peripheral media and its application in library activities and services led to a highly significant quantitative and qualitative improvement especially in online technology (Bhardwaj and Shukla, 2000). Electro-magnetic formats

are used in automation on library operations and information services to enhance automation processes. Electro-magnetic formats are used in library operations as storage devices and to aid on delivery of information resources. The following are the most commonly used electro- magnetic formats in libraries and information centres:

2.8.1 Magnetic Tape

Collins (1999) defines magnetic tape as a narrow length of thin plastic coated with a magnetic material used to store signals with a magnetic material. Magnetic tapes are used in automation of library operations because they can store most audio, video and computer data. For example, magnetic tapes are used to store bibliographic data and back up of information resources. Tapes provide a quick and efficient way to store a spare or backup copy of large amounts of data (Vernon, (2001).

2.8.2 Magnetic Disks

Libraries and Information centres use magnetic disks (Hard disk and floppy disks) on automation of library operation and information services. These devices are used to store data and move it from one location to another, for example CDS/ISIS software is stored on Floppy disks.

2.8. 3 Hard Disks

Advancement in technology has led to development of internal and external hard disks which are commonly used in libraries and information centres for backup, exchange of bibliographic data and software from one location to another. The hard disk is usually the usual main backing storage media for a typical computer or server. The operating system

(for example, Microsoft Windows), applications software (for example. word-processor, database and spreadsheet) and any program data would all be stored on a hard disk.

2.8.4 Floppy Disks (Diskettes)

Floppy disks are used in libraries for storing and transferring data for example, software (anti virus updates), databases (CDS/ISIS) and letters. Vernon (2001) asserts that diskettes are removable (unlike the hard disk) and are convenient for passing information to others. They can readily be sent in the post. They are also useful for making backup copies of small amount of data. Librarians use them for storing literature search results and storage of software.

2.8.5 CD-ROM (Compact disk)

CD- ROM technology is used in library operations and information services for different purposes for example, data storage and offline databases such as: The Essential Electronic Agriculture Library (TEEAL), AGRIS, TROPAG and RURAL, CAB Abstracts and others. It is also used to distribute data on a wide range of topics (Vernon, 2001). Mishra (2008) outlines the advantages that made CD- ROM practically attractive in today's competing information environment as; multimedia-the ability to deliver unlimited end user access to over 600MB information delivered using ordinary posts means, it can be used for text, graphics, data, audio and video in one simple purchase; multilingual- sophisticated CD- This format is very useful for frequently used reference material such as encyclopedias, dictionaries, directories, abstracts, e- journals and others. The searching of CD-ROM discs is carried out locally, possibly via a local area network,

with no long- distance communication links (Large, 2001). Users can browse for information when they are offline and o their free time.

2.8.6 Digital Versatile Disk (DVD)

Libraries and Information Centres use the digital video (or versatile) for example, Disc Read Only Memory (DVD-ROM) as a storage medium on library operations and information services. Large (2001) states that a further development in optical storage technology has been the DVD_ROM which looks similar to a CD-ROM, but which is capable of holding about seven times as much data and was designed from the beginning to deliver high-quality multimedia streams at high data rates..

2.9 ICT Skills and Knowledge among Library Staff

Staff training is a critical and challenging task that has come to be identified with the development of the future of many organizations. Buckley and Caple, (1992) define training as a planned and systematic effort to modify or develop knowledge, skill or attitude through learning experience to achieve effective performance in an activity or range of activities. New technologies introduced new duties for librarians, including web page design and maintenance, troubleshooting and the need to become an Internet searching expert (Blessinger, 2002). He further elaborates that because of the advent of new technologies, new avenues have been created for the information professional, vendors, corporations, information brokers, consultants just to name a few. New titles have arisen since the dawn of the Internet including LAN administrator, Chief

Information Officer, Webmaster, Knowledge Manager and Systems Librarian, to name a few. The variety of electronic resources and the new services increases the importance of and need for education of end-users to enable them to take full advantage of the new opportunities available to them. This has made many libraries accept the reality that the library staff needs to be re-skilled to impart user education. The librarians should be geared up to play the roles of knowledge managers, web managers and be alert to accommodate technology as it comes. In the library policy, staff development programmes that include refresher courses, workshops, seminars and conferences should be covered.

King (2006) observed that traditionally library staff have been trained on a "need-to-know" basis, with an initial training concerning basic library procedures such as circulation, and with additional training occurring as and when it is needed; such as training in the use of a new catalogue or management system. In his study, he found that it became the number one choice of library administration to have public library staff trained in ICT competency.

Technology is changing rapidly and librarians should move along with it to satisfy user needs. Fatoki (2005) opines that for librarians to continue to make substantial contributions as information disseminators, they will have to understand and exploit information communication infrastructures and emerging technology in packing disseminating and delivery proactive services to their clientele. ICT skills are needed by librarians in order to apply them to library operations and information services.

2.10 Challenges Experienced by Information Professionals in Automation of Library and Information Services

Libraries and Information Centres experience several challenges and constraints in the course of automation of library operations and information services. Emmanuel and Sife, (2008) note that while new technologies have added value to library services by presenting new modes of collecting, storing, retrieving and providing information, they have also brought new challenges and aggravated some of the challenges that faced libraries before. The challenges relate to acquisition of ICTs, preservation of electronic information resources, maintenance and security issues, training of users, and general lack of awareness and commitment among library stakeholder. KARI (2009) opines that the key amongst these are inadequate infrastructure (power (electric/generator), telephone, Internet connectivity), inadequate funding, lack of a comprehensive policy and regulatory framework, inadequate skilled human resources, lack of integrated information system and networks.

Okiy (2005) identifies ICTs obstacles which includes inadequate funding, inadequate electricity supply, shortage of competent manpower for operation and maintenance of ICT facilities, lukewarm attitude of the government towards the provision of ICT facilities and low level of computer literacy.

2.10 .1 Inadequate ICT Infrastructure

Adequate infrastructures are the backbone of automation process in libraries and information centers. Republic of Kenya (2002-2008) agrees that efficient ICT infrastructure is a prerequisite for effective ICT industry growth. Although the government is expanding and improving ICT systems, the current state of infrastructure is still a major hindrance to the country's full participation in the information society. Automation of library operations and information services require a lot of ICT tools, for instance, computers, telecommunication facilities, storage devices, photocopiers, barcode machines and others.

Software

To enhance automation of library operations, libraries and information centres could acquire library management system with all the modules, such as UNICORN, LIBRARYSOFT, Koha, ABCD just to mention a few. Some library software do not have the facilities for operations like circulation, acquisition, serials control. For example CDSISIS which is used at KARI libraries does not have all the modules required for library operations .The librarians opted for such softwares have confronted with several difficulties in the smooth process of automation. Some commercial software's provide the facility of exporting of data only at the software developer's level and not at the users' level. This may be to indirectly force the libraries to continue the use of these software's on commercial interests (Mahapatra, 1998). Example for a commercial software is TINLIB which was used at Margaret Thatcher Library (Moi University).

Selection of the library software

Librarians are faced with problem of selecting library software because of inadequate technical skills. Software's have different performance capability. The performance of a particular software may be very good for some applications and at the same time, this may not be suitable for some other applications. The professionals should have basic knowledge on these aspects to make a comparative analysis in selecting particular software (Mahapatra, 1998).

2.10 .2 High Cost of ICT Tools

ICT equipment are very expensive and library and information centers find it hard to purchase the required equipment to enhance automation process. Oduwole (2002) opines that the high cost of telecommunication facilities is a hindrance to the provision of electronic services.

2.**10.3 Information literacy among Information Professionals**

Information Professionals need both computer and information literacy (IL) skills to effectively use the rapidly growing and changing information resources. Lack of IL skills has been pointed out as one of the major causes of underutilization of electronic information resources in many African libraries (Dulle and lwehabura, 2004).

2.10.4 Information Overload

There is a lot of information resources on the Internet and organizing it has become a problem. Proliferation of electronic resources has posed several challenges like multiple logins, multiple interfaces and resource discovery. (Groenewegen & Huggard, 2003).

2.10 .5 Funds for Acquisition of ICT Infrastructure

Libraries require sufficient funds to acquire modern ICT facilities such as computers, servers, scanners, photocopiers, e-journals, e-books, software as well as paying for online and offline services such as e-journals and digital libraries. Most of these ICT facilities and services are very expensive and can be purchased from developed countries (Emmanuel and Sife, 2008). For example The Essential Electronic Agricultural Library (TEEAL), Online Dewey Classification Scheme, Online Dictionaries, Online Encyclopedia and others. Funds influence the decision to automate library operations and information services. Adequate funds are required to purchase Library software such as LIBRARYSOFT, SIRI UNCORN, INMAGIC and TINLIB, Internet connectivity also require adequate funds. Purchase of e-journals, e-books and other multimedia resources require sufficient funds for renew and maintenance. Inadequate funds had made information professionals not to embrace modern technology fully.

2.10.6 Storage and Preservation of Electronic Information Resources

While a lot of electronic information is available freely, electronic information resources for academic/research purposes require careful selection, acquisition, organization and should be made available, and preserved in ways that are different from traditional print

materials. Keeping and handling CD-ROMs, TEEAL for example, is challenging, as they are used by users who actually not conversant with handling and using such facilities. In addition, conditions such as dust, heat and dampness have negative effects to CD-ROMs and other ICT facilities (Emmanuel and Sife, 2008).

2.10 .7 Limited bandwidth

Bandwidth refers to the amount of information that can be carried in a given time period (usually a second) over a wired or wireless communication link, expressed as bits per second (bps). Emmanuel and Sife, (2008) observed that the higher the bandwidth, the more data can be transferred in bits per second. Whenever there are few data transferred in bits per second (low bandwidth), users get frustrated as it takes long to retrieve information from the internet.

Limited bandwidth is a problem common to many libraries and information centres. For example, for many years bandwidth at KARI libraries had been 100/128 kps, making Internet connectivity extremely slow. Effects of limited bandwidth is felt more in the library than other sections in the parent organizations because of the need to download information resources.

2.10 .8 Maintenance and security issues

Emmanuel and Sife, (2008) asserts that Frequent maintenance of ICT facilities is crucial to sustainability of any ICT services. It is imperative that there are qualified technical personnel for managing and maintaining ICT facilities and networks that the library

system runs. However, many libraries have inadequate qualified ICT personnel. Most traditional librarians have low ICT skills and sometimes have technology phobia. Some libraries have managed to recruit and train their own ICT experts but failed to retain them. Consequently, many libraries depend on ICT experts from outside.

2.10.9 Rapid Change of Technology

Modern information technology is creating (or perhaps only exacerbating) a worrisome problem that has yet not been solved, and may never be. It is the problem of how to preserver present knowledge for future generations. Librarians and archivists continue to warn that we are losing vast amount of important scientific and historical materials because of disintegration or obsolescence of the storage media we are using (Shurman, 2001). ICT infrastructure such as: storage devices, communication devices, information resources, hardware (computers, scanners, photocopies and others) are changing rapidly.

2.10.10 Awareness and commitment among key stakeholders

Lack of awareness on the importance of library automation from top management has been great obstacle to library and information centres. Tusubira and Mulira (2004) observed that real change and progress in ICT integration occur where there have been top-level commitments. Continuous commitment and involvement of key stakeholders is important when integrating ICTs in library operations and information services.

2.10.11 Interfaces

Interfaces are found in many information environments and libraries require good interface to enhance information retrieval. Inadequate interfaces have led to poor display

of information. For example, librarians should remember all the commands on CDS/ISIS MSDOS version when entering data. Large (2001) asserts interfaces in information retrieval domain, must be designed to cope with databases of varying sizes, retrieval software of varying complexity and fast, local processing or remote, networked processing.

2. 10.12 Unreliable Power Supply

Library automation rely on electricity for the facilities to operate. Frequent power cut is a persistent problem in Kenya. This affects among other things, management and utilization of ICT facilities and service. For example, computers, scanners, telephones, fax machines and others.

Libraries and Information Centres require back up generator in order to combat the problem of unreliable power supply. For the backup generator to be effective adequate funds must be allocated to for fueling and running the generator.

2.11 Summary

Library automation has become inevitable in an era of information explosion and widespread use of digital information resources. The chapter provides in depth information on library automation and approaches of automation in libraries and information centres. The study was informed by Rogers' Theory of Diffusion of Innovation and its relevance to the study was discussed. Application of lCT to Library and information services was discussed in depth. A range of digital formats of

information resources are necessary to cater for diverse needs of users. Qualified and skilled staff are required in automation of library and information services. Challenges experienced by information professionals in automation of library and information services was also addressed in this chapter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter explored the research methodology used to carry out this study in order to achieve the stated objectives. Methodology refers to the ways or procedures and tools adopted in carrying out research. According to Rowley (1994), methodology is the systematic combination of various techniques used in sampling and collection of data for a particular research. That is, the direction a researcher adopts to accomplish the objectives of a particular study.

The chapter gives details of the research design used in the study which was mixed research design, study population, sample size, sampling method, sampling technique data collection methods, data collection instruments, pilot study and as well as data analyzing.

3.1 Research Design

The study used mixed research design namely, qualitative and quantitative approaches. This is because the centre directors, library staff and ICT staff are the key informants to automation program. Kothari (2004) defines research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Orodho (2003) opines that research design is a scheme that outlines or plan that is used to generate answers to research

problems. A research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problems.

3.2 Survey Research

This study used survey research method to investigate the extent of automation of library operations and information services in KARI libraries. Survey research method was preferred for this study because the target population was drawn from KARI centers in Nairobi and its environs. The chosen subjects were generally a representation sample from a defined population from selected KARI centres.

According to Powell (2005) survey research is descriptive and it is designed to ensure the sample is reasonably representative of the population to which the researcher wishes to generalize and that the relevant characteristics have been accurately measured.

3.3 Research Strategy

According to Mugenda (1999), a strategy refers to the mechanism of implementing the proposed project. The study used both the quantitative and qualitative research in order to achieve the set objectives. Quantitative method is to do with measurement and thus involves amounts of things, which involves numbers. According to Powell (2004), quantitative research involves a problem-solving approach that is highly structured in nature and that relies on the quantification of concepts, where possible, for purposes of measurement and evaluation.

Gorman (1997) defines qualitative research as a process of enquiry that draws data from the context in which events occur, in an attempt to describe these occurrences, as a means of determining the process in which events are embedded and the perspectives of those participating in the events, using induction to derive possible explanations based on observed phenomena.

This study used both primary and secondary data. Primary data was obtained using questionnaires to library and ICT staff while, face to face interviews was conducted to centre directors. Secondary data was acquired from documentary reviews to draw data on automation of information services in the KARI library system. Triangulation helped to get consistent findings on this study as one paradigm caters for the disadvantages of the other a result of this the findings were validated.

3.4 Study Population

The study population of this study were 44 staff from the KARI centers in Nairobi and its environs who consisted of; centre directors, library and information technology staff. According to the Oxford English Dictionary (2005), the target population is defined as the totality of objects or individuals under consideration of which the statistical attributes may be estimated by the study of a sample drawn from it. A population of the study refers to a collection of people or entities such as organizations and items subjected to investigation. Therefore the term basically describes the group of people or items about which information concerning the study was being collected.

3.5 Sampling Method

Sampling is the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Orodho and Kombo, 2006). According to Keya (1989), sampling is the process of selecting a sample from a population. Mugenda and Mugenda (1999) define a sample as a sub-set of a population, and that it is sometimes referred to as the survey population. Kothari (2004) on the other hand says it is a list of items selected from a population.

It refers to the taking of any portion of the population or universe as the unit to be studied assuming that it represents a true representation of the whole population. A sample is thus a fraction of a large group. The information is assumed to be a true representation of the whole population.

3.6 Non-probability Sampling

According to Kombo (2006), non-probability sampling is a method which aims to be theoretically representative of the study population by maximizing the scope or range of variation of the study. Powell (2004) states that with a non-probability sample, the researcher cannot state the probability of the respondents to be interviewed are known by the researcher who will be purposively selected. The techniques of selecting a sample in non-probability are: quota sampling, dimensional sampling, convenience sampling,

purposive sampling and snowball sampling. Purposive sampling was used in this study because the researcher used her judgment to select key informants who were considered as information rich cases.

3.7 Sampling Procedures and Techniques

The study adopted purposive sampling where the researcher had discretion over who was to be involved depending on who plans and implement library automation program. The study used purposive sampling technique to select 44 staff from KARI centers as the target population. The centre directors were selected because they approve the automation programme and solicit for funds. Library staff were key to this study because of their role in sourcing for ICT infrastructure and library management systems with all modules which could enhance library operations and information services. ICTs staff were selected because they participate installation/modify software and maintain ICT tools at KARI libraries. The selected sample enabled the researcher to satisfy the specific needs of this study.

According to Kumar, (2005) the primary consideration in purposive sampling is the judgment of the researcher as to who can provide the best information to achieve the objectives of the study. The reason for choosing purposive sampling was to select the key informants in the study. The researcher only goes to those people who in his/ her opinion are likely to have the required information and are willing to share it.

The table 3.1 below shows the selected distribution of the respondents at the selected KARI centres.

Table 3.1: Distribution of the respondents

Centre	Library staff	ICT Staff	Centers Directors	**TOTAL**
KARI HQTs	6	3	0	8
KARI ARC	5	2	1	7
KARI TRC	4	3	1	7
KARI NVRC	1	1	1	3
KARI Thika	2	2	1	5
KARI Tigoni	2	1	1	4
KARI NARL	5	1	1	7
TOTAL	**25**	**13**	**6**	**44**

3. 8 Data Collection Methods

The researcher gathered both secondary and primary data. Since this study was both qualitative and quantitative, the researcher used questionnaires, interview and documentary sources. The choice of these data collection methods helped the researcher in gathering data from the selected KARI centres, to enhance efficiency and accuracy of information.

3.9 Data Collection Instruments

The following are the data collection instruments that were used for this study.

3.9.1 Questionnaires

A questionnaire was designed with both open-ended and close-ended questions. It was used to collect data from library and ICT staff in the selected KARI centres. The questionnaires were mailed or dropped and picked from the respondents depending on where they were.

Oso and Onen, (2005) define a questionnaire as a collection of items to which a respondent is expected to react usually in writing. Kothari (2004) adds that a questionnaire consists of a set of structured questions relating to the research study dispatched to respondents who are expected to write down their reply in the spaces provided in the questionnaire. The researcher found this instrument appropriate due to the following reasons: it was economical in terms of time and travelling costs to the KARI centers which were scattered. Questionnaires permitted wide geographic contact at minimal cost; questionnaires enabled the collection of information from respondents who were busy and could not be reached for interviews.

The researcher sent reminders to respondents who did not return questionnaires in time. This study also used interview schedules to address the above disadvantages of the questionnaires.

3.9.2 Interview Schedules

Interview schedules were prepared and face to face interviews were conducted with centre directors. The researcher booked interview appointments with the respondents at their convenient time and place. Interviews permit a more thorough understanding of the respondents' opinions and provide a desirable combination of objectivity, depth of the subject under discussion.

3.9. 3 Document Review and Analysis

Secondary and primary sources of information were used for this study were; institutional reports, e- resources, periodicals such as newspapers, scholarly journals, newsletters, brochures, proceedings of workshop just to mention a few. This provided the researcher with better understanding status of automation of library operations and information services at KARI Libraries. The researcher used this method because it was relatively cheap, reliable and time saving. It also enabled the researcher to collect comprehensive information about the study.

3.10 Data Collection Procedure

The researcher obtained a research permit from the ministry of education, a letter from the department of library, records management and information studies and permission from KARI centre directors before collecting data from the respondents. Later the respondents were requested to fill in the questionnaires.

Validity is the ability of an instrument to measure what it is designed to measure. Validity is defined as the degree to which the researcher has measured what he has set out to measure (Smith, 1991). Kothari (2004) defines reliability as a measure of the degree to which a research instrument yields consistent results or data after repeated trials. To ensure validity and reliability of the research instruments, a pilot study was carried out at Kenya Forestry Research Institute (KEFRI). The purpose of the pilot study was to ensure

the respondents understood the questions and correct mistakes which were identified before administering the questionnaires to respondents in the selected KARI centres.

3.11 Pilot Study

Pre-testing of the research instruments was done at the Kenya Forestry Research Institute (KEFRI), library division. The pilot study was undertaken to determine the validity and reliability of the data instruments before the actual study. The researcher issued 10 questionnaires to the Librarian to administer them to library and ICT staff. The respondents were selected by using purposive sampling technique because the study required the key informants on automation program. The respondents were requested to check the coverage of objectives, grammer, spelling of words, clarity of questions, sequence of questions and give suggestions for improvement (**see** Appendix IV: Pre-testing checklist).

All the questionnaires were returned. They responded well apart from one grammer mistake which was noted of adding a word in the letter which was not supposed to be there. They understood the questions and gave correct answers. The problem encountered by researcher was a delay in filling in the questionnaires. The researcher made three visits to remind them and several telephone calls. The reason given for delay was that they were busy because they were closing their accounts for the year.

3.12 Data Analysis

Mugenda (2003) defines data analysis as the process of bringing order, structure and meaning to the mass of information collected. Quantitative data collected was analysed and presented in tables, and percentage. Qualitative data was analyzed by categorising data according to themes.

3.13 Ethical Considerations

According to Swaminathan, (2006) plagiarism is copying the writings of another person and publishing the same as original work. Plagiarism was be avoided in this study.

All information collected was treated with utmost confidentiality. The respondents were treated as anonymous. The researcher informed the respondents the aim of the study so that they could participate without the fear of the outcome and there was no way the researcher would exploit them. All the information resources used were acknowledged.

3.14 Summary

In conclusion the study used quantitative and qualitative approach. A target population of forty four KARI staff which consisted of centre directors, library staff and ICTs staff were selected for the study. Non-probability sampling was used for this study and purposive sampling was used to select the sample population. In data collection, descriptive survey involving the use of questionnaires and interview was used. Descriptive analysis, tables, pie charts and percentage were used in this study to help analyze data collected.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presents the results of the study according to the research objectives of the study. The presentation of data was presented using tables and percentage.

4.1 Response Rate

The study involved 44 respondents drawn from selected KARI centres in Nairobi and its environs. The key informants comprised of centre directors, library and ICTs staff.

Interview schedules were prepared and the researcher booked appointment with the respondents. All the six centre directors (100%) targeted were interviewed, while thirty eight questionnaires were prepared and administered to library and ICT staff. Out of 38 questionnaires distributed, 35 were received giving a response rate of (92%).

Table 4.2: Categories of respondents targeted at KARI centres (n=44)

Center	Library staff	ICTs Staff	Centers Directors	Number of respondents
KARI HQTs	6	3	0	8
KARI-ARC	5	2	1	7
KARI –TRC	4	3	1	7
KARI- NVRC	1	1	1	3
KARI-Thika	2	2	1	5
KARI-Tigoni	2	1	1	4
KARI-NARL	5	1	1	7
TOTAL	**25**	**13**	**6**	**44**

Table 4.2 shows the categories of the respondents at the selected KARI centres. The majority of the respondents were library staff (57%), followed ICTs Staff and centre directors.

4.2 Information Services and Products

The research had set out to identify the information services and products within the Kari library network. The findings showed that five libraries KARI Headquaters, KARI NARL, KARI Muguga North, KARI Thika and KARI TRC offer Inter library services, resource sharing, user education, current awareness, referral services, reservation services search and retrieval, service. Translation services, compilation bibliographies, abstracting of information are not offered in all the libraries.

4.3 Extent of Automation at KARI Libraries

To cover this objective, the study looked at the extent of automation of library operations and information services, the software used and the ICT tools used in the provision of these services.

4.3.1 Automation of Library Operations and Information Services

On the extent of automation of KARI libraries, one library KARI Headquarters indicated that they had automated about fifty per cent of library operations and information services, while four other centres, KARI Muguga South, KARI TRC, KARI Thika and KARI NARL, had automated about thirteen per cent. Two centres, KARI Muguga North and KARI Tigoni indicated that they had not started the automation programme because they lacked computers in their libraries.

The study found that five libraries had automated cataloguing and part of acquisitions (such as selection and ordering). All the respondents from seven libraries revealed that the following operations were still manual: acquisition, processing, stocking, weeding of information resource, compilation of library statistics and reports.

Only two centres KARI Headquaters and KARI NARL had automated current awareness services, selective dissemination of information, online resources sharing, Internet services, online search, reprographic services and retrieval of information. The other five

centres still use the manual system. It was observed that only three centres KARI Headquarters, NARL Kabete and KARI TRC had internet services.

It is clear from what has been discussed above that since most of the library operations have not been automated even the information services are still manual. The Centres Directors confirmed that most of information services in their libraries were manual.

4.3.2 Software used for Automation of Library Operations and Information Services

The study sought to find out the software and databases used within the KARI library system. The findings are as shown in the table below**.**

Table 4.3: Software used for library automation

KARI Libraries	Software and its use	Databases and their Application
KARI Headquaters	Windows XP (for operating system) Windows Vista(for operating system) Mozilla firefox (for search and retrieval)) Internet Explorer (for search and retrieval) WINISIS (for cataloguing and search and retrieval) WEBAGRIS(for Institutional repository) Microsoft office word 2007(word processing) Microsoft office Excel 2007(preparation of Budget and workplan) Microsoft power point 2007 (preparation of institution brochures) Microsoft Access 2007 (creation of databases)	KARD (institutional agricultural information) KAiNet(institutional repository especially grey literature) TEEAL(provide access to journals on agricultural sciences, agricultural economics, food science and natural resources) AGORA provides free or low cost access to major scientific journals in agriculture and related biological, environmental and social sciences to public institutions in developing countries. AGORA provides access to 1900 journals from the world's leading academic publishers. Online databases under Kenya Library Information Consortium are: Emerald, Cambridge Journals Online, Wiley InterScience, Springer E-journals, JSTOR, EBSCO, HINARI Emerald: Management, Library and information sciences, Marketing, Engineering and Computer science OARE (provides collections of environmental science research Hinari: Health, nursing Ebsco Host: social sciences and humanities, business, nursing, medicine and allied health Cambridge journals: Politics, Linguistics, Social Science, Humanities, Law, Mathematics, Science and Medicine Jstor: History; Political Science; Language & Literature; Art & History; Music Mathematics & Statistics; Education Oxford journals: Humanities, law, life sciences, mathematics, physical sciences, medicine, social sciences Wiley online library: Agriculture, architecture, art, computer science, Environment, Humanities, Law, criminology,

		mathematics, medicine, nursing, physical sciences, social sciences)
KARI NARL	Windows XP (operating system) Internet Explorer (for search and retrieval) WINISIS (cataloguing and search and retrieval) Microsoft office word 2007(word processing: for production of letters and reminders, acknowledgment, accession list. memos) Microsoft office Excel 2007(preparation of Budget and workplan) Microsoft Access 2007 (creation of databases) Adobe Reader 9 (reading PDF articles)	KARD (institutional agricultural information) KAiNet(institutional repository especially grey literature). TEEAL(provide access to journals on agricultural sciences, agricultural economics, food science and natural resources). AGORA provides free or low cost access to major scientific journals in agriculture and related biological, environmental and social sciences to public institutions in developing countries. AGORA provides access to 1900 journals from the world's leading academic publishers. Online databases under Kenya Library Information Consortium are: Emerald: Management, Library and information sciences, Marketing, Engineering and Computer science Hinari: Health, nursing Ebsco Host: social sciences and humanities, business, nursing, medicine and allied health Cambridge journals: Politics, Linguistics, Social Science, Humanities, Law, Mathematics, Science and Medicine Jstor: History; Political Science; Language & Literature; Art & History; Music Mathematics & Statistics; Education Oxford journals: Humanities, law, life sciences, mathematics, physical sciences, medicine, social sciences Wiley online library: Agriculture, architecture, art, computer science, Environment, Humanities, Law, criminology, mathematics, medicine, nursing, physical sciences, social sciences)

KARI Muguga South	Windows XP (operating system) Windows Vista(operating system) Windows 98(operating system) MSDOS (operating system CD/ISIS (cataloguing and search and retrieval) Microsoft office word 2007(word processing: for production of letters and reminders, acknowledgment, accession list. memos) Microsoft office Excel 2007 (preparation of Budget and workplan)	KARD (institutional agricultural information) TEEAL (provide access to journals on agricultural sciences, agricultural economics, food science and natural resources).
KARI Muguga North	No software	No Database
KARI TRC	Windows 98 (operating system) MSDOS (operating system Internet Explorer (for search and retrieval) Microsoft office word 2003 (word processing: for production of letters and reminders, acknowledgment, accession list. memos) Microsoft office Excel 2003 (preparation of Budget and workplan) Microsoft Access 2003 (creation of databases)	TRC collection
KARI Tigoni	No software	No software
KARI Thika	Windows 98 (operating system)MSDOS (operating system) Microsoft office word 2003 (word processing: for production of letters and reminders, acknowledgment, accession list. memos) Microsoft office Excel 2003 (preparation of Budget and workplan) Microsoft Access 2003 (creation of databases) CDS/ISIS (cataloguing and search and retrieval)	KARD (institutional agricultural information)

a) Software

The study sought to find out the software used in KARI libraries. The capabilities of the software used governs the ways in which the computers can be used, for example whether or not it allows several programs to run simultaneously or whether more than one user can have concurrent access to online information.

Out of seven libraries, three libraries had Windows XP (KARI NARL, KARI Headquarters and KARI Muguga South), three libraries had windows 98 (KARI Thika, KARI TRC and KARI Muguga South), while two libraries did not have any operating system. Window Vista was used in two libraries (KARI Headquarters and KARI Muguga South).

It was also revealed that MSDOS was used in three libraries (KARI Thika, KARI TRC and KARI Muguga South) to enhance (CDS/ISIS) which is basically a DOS Version. WINISIS was used in two libraries (KARI NARL and KARI Headquarters). Although WINISIS and CDS/ISIS are integrated library systems, 80% of respondent agreed that they usually use them for data entry (cataloguing module) and search expression. The study found out that most libraries still use manual system in library operations and information services, .have not embraced fully the modern technology although it has many benefits such as copy cataloguing, sharing resources among others.

The findings from Table 4.3 shows that five libraries (KARI NARL, KARI Headquarters KARI Muguga South, KARI Thika and KARI TRC), had two platform of Microsoft office, 2003 and 2007. Microsoft word office was used mainly for word processing for creating: user profiles, loan reminder forms, book labels, accession lists, letters, memos and others. Microsoft office Excel was used for preparation of Budget and workplan. Microsoft office Access was used for creation of databases,

b) Databases

This study found that two libraries (KARI headquarters and KARI NARL) had adequate databases to enhance information services. KARD and KAiNET are institutional Databases. KARD Database was found in four libraries (KARI Thika, KARI Muguga South, KARI headquarters and KARI NARL). KAINet Repository used on only two libraries (KARI headquarters and KARI NARL). Although KAiNET and KARD have useful information which could be used in provision of information services, four libraries KARI TRC, KARI Muguga North, KARI Thika and KARI Tigoni did not have. The centre Directors lamented that there is need to distribute online resource to all KARI libraries.

From the above finding on Table 4.3 the Essential Electronic Agricultural Library (TEEAL) was used by three libraries (KARI headquarters, KARI Muguga South and KARI NARL), while two libraries KARI TRC and KARI Thika confirmed that they lacked powerful computers which could be used for installation. Two libraries KARI Tigoni and KARI Muguga North revealed that they lacked computers. The study found out that TEEAL could be used for provision of information services such as: Selective Dissemination of Information (SDI). TEEAL is updated annually. The study found out that the three libraries (KARI headquarters, KARI Muguga South and KARI NARL) had 2010 updates.

In addition Director of KARI TRC confirmed that they have TEEAL but they have inadequate computers for installation. The centre directors confirmed that KARI centre libraries had in adequate software and databases, research scientist most of the time had to travel to KARI Headquarters to get update information on e-journals.

4.4 Library Networking

The centre directors confirmed that use of library networking improve efficiency, increase effectiveness, streamline communication, reduces costs of library operations, information services and save the time of users but KARI libraries lacked proper library networking.

4.4.1 Local Area Network

The study found that KARI Headquaters and KARI NARL had a functionally LAN while KARI Muguga North, KARI Muguga South , KARI TRC, KARI Thika and KARI Tigoni had no LAN. Effective communication through the use of LAN has become a critical success factor to libraries and information centres. Five centre directors confirmed that they do not have LAN in their libraries to enhance effective library operations and information services. As a result, there is duplication of efforts and wastage of resources.

4.4.2 Wide Area Network (WAN)

Only two libraries (KARI Headquaters and KARI NARL) revealed that they had a WAN. Five centre directors confirmed they do not have WAN and therefore communication

with other KARI centres was limited since they had to use postage or visits to other libraries. Wide Area Network is a computer network that spans a relatively large geographical area. WAN is very essential in libraries and information centres because it enhance sharing of resources and services.

4.4.3 Metropolitan Area Network (MAN)

The study found out that two libraries KARI Headquater and KARI NARL had MAN while five libraries KARI Muguga North, KARI Muguga South, KARI TRC, KARI Thika and KARI Tigoni agreed that they do not MAN networks. Five centre directors confirmed they do not have MAN.

4.4.4 World Wide Web

The information professionals acquire information globally and therefore the World Wide Web is important for library operations and provision of information services. 10 (29%) of the respondents confirmed that they had World Wide Web (WWW) while 25(71%) indicated they do not have any computer networks.

The study sought to establish whether the computer networks were used for library operations and information services. Out of 35 respondents 10 (29%) agreed that the networks are mostly used for sharing resources

The respondents were asked to indicate if networks were reliable, 15 (43%) agreed the network did not have a problem while 20 (57%) indicated that the network was down and slow most of the time, because of limited bandwidth.

4.4.4.1 Portals, Intranets and Extranets available at KARI Libraries

Advance in technology has brought new innovation progression from internet to portals, intranets and extranets to enhance communication and sharing of information resources The table below gives a summary of web portals, intranets and extranets that are used to enhance library operations and information services at KAR Libraries.

Table 4.4: Portals, Intranets and Extranets available at KARI Libraries

Centres	**Portals**	**Intranet**	**Extranets**
KARI HQTs	√	√	√
KARI- ARC	×	×	×
KARI-TRC	×	×	×
KARI NVRC	×	×	×
KARITigoni	×	×	×
KARI NARL	×	√	×
KARIThika	×	×	×

Portals, intranets and extranets were not fully utilized in KARI. Web Portals Intranets and extranets were only used in one centre whereas six centres did not use them. It was also established through the centre directors that information professionals utilise applications that are common, such as internet and e-mail but web portals, intranets and extranets were not used by many KARI libraries. The main reason for under utilization was that information professionals were unfamiliar with web technologies.

4.5 ICT Tools Used to enhance Library Operations and Information Services

Kenya Agricultural Research Institute is entrusted with development, transfer and dissemination of agriculture technologies in Kenya therefore, scientists carry out research on daily basis and they require current information. In order to meet the set objectives of KARI, there is need to embrace Information and Communication Technologies (ICTs). Therefore there is need for adequate and appropriate ICTs tools to enhance automation library operations and information services. Table 4.5 shows ICTs tools used to enhance library operations, information services and effective delivery of Information Services at KARI libraries.

Table 4.5: ICTs Tools available at the selected KARI libraries (n=7 centres)

ICTS TOOLs	KARI HQTs	KARI ARC	KARI-TRC	KARI NVRC	KARI Tigoni	KARI NARL	KARI Thika	TOTAL
Computers	6	6	1	-	-	4	2	18
Accession machines	1	-	-	-	-	-	-	1
Duplicating Machines	-	-	-	-	-	-	-	-
Photocopier	1	1	-	-	-	-	-	2
Fax	1	-	-	-	-	-	-	1
Scanners	1	-	-	-	-	1	-	2
Typewiters	-	5	-	-	-	-	-	5
Projectors	1	-	-	-	-	-	-	1
CD Players	6	3	1	-	-	4	1	15
DVD Players	6	3	-	-	-	4	-	13
Cassette players	-	-	-	-	-	-	-	-
Headphones	-	-	-	-	-	-	-	-
Microphones	1	-	-	-	-	-	-	1
Microfiche readers	-	2	-	-	-	-	-	2
Roll-Film Readers	-	-	-	-	-	-	-	-

In regard to Information and Communication Technologies (ICTs) tools used to enhance library operations and information services at the selected KARI centres, the study found that a total of 18 computers were found at five libraries KARI Headquaters, KARI NARL, KARI Muguga South, KARI Thika and KARI TRC. One library KARI Headquaters had an accession machine, Fax machines, Projectors and Microphones. Another library KARI Muguga had five typewriters and two Microfishe readers. Two libraries KARI NARL and KARI Headquaters, had scanners. KARI libraries had a total of 15 CD Players and 13 DVD players. None of the centres had Roll-Film Readers, Cassette players, Sound tape recorders players and duplicating Machines.

4.6 Range of Digital Formats of Information Resources

A question that sought to find out the range of digital formats of information resources was asked in the questionnaires. The respondents were asked to indicate the digital formats which were available in their libraries. The study revealed that e-books and hyper books were not available in any of the KARI libraries. Out of 25 respondents 20 (80%) revealed that, they had e-journals, e-mail, and internet while 10 (20%) of the respondents agreed that they do not have the e journals. Out of 25 respondents 6 (24%) revealed that they have fax in their libraries while 19 (76%) indicated they do not have fax in the library. The centres directors Confirmed that most centre libraries do not have faxes which are important on library communication.

4.7 ICT skills and knowledge

A question that sought to find out the level of computer literacy skills of the library staff and ICTs personnel in using the ICTs equipment was asked. The results were that 10 (29%) of the respondents indicated they have average while 25 (71%) of the respondents indicated they were below average. The centre directors confirmed this and indicated that there was need for ICTs training for key informants on automation processes, for example librarians who know what their users require instead of waiting for ICTs personnel in KARI Headquarters'.

The respondents were asked to indicate the skills they would require for effective and efficient automation of library operations and information services. They indicated that they would require following skills:

a) ICTs integration skills
b) Library Information Management skills
c) Software (proprietary and open source) skills
d) Technical skills to handle ICTs tools.
e) Library 2.0 skills
f) Competency with modern technologies in libraries and information centres.

4.8 Challenges experienced in the automation of KARI libraries

To establish the problems encountered in the automation process the respondents were asked to highlight them. Out o 98% of total respondents indicated that there was limited

funding of libraries, 100% revealed the high cost of hardware's and software's has led slow automation implementation, 24% indicated lack of priority of automation program, 85% indicated lack of qualified staff in the centers especially, system administrators and technicians, 12% indicated lack of information policy and inadequate implementation of ICTs policy in KARI libraries. 61% revealed that there is irregular power supply in the centres, 100% indicated that they have a small bandwidth causing the internet to be up and down and poor connectivity of the internet Table 4.5 summarizes the findings.

Table 4.6: Problems encountered in automation process n=41

Problems encountered	**Responses**	**Percentages**
Inadequate funds	40	98%
High costs of hardware and software	41	100%
Lack of priority	10	24%
Lack of qualified staff	35	85%
Poor service providers	41	100%
Limited bandwidth	41	100%
Irregular power supply	25	61%
Lack of information Policy and slow implementation process	41	100%
Poor connectivity of the internet	41	100%

From the analyzed data presented above it is clear that the main problems are lack of funds, lack of information policy, slow implementation of ICTs policy, small bandwidth and poor service providers and others.

4.9 Suggested solutions to problems

The researcher asked the respondents to state the measures which could be undertaken to solve the above problems. 85% respondents confirmed plans are underway to automate research centres to be in line with vision 2030 projections. 96% indicated that there is need for libraries to have a budget in order to operate effectively and efficiently. 61% indicated that the library staff requires training. 39% indicated that there was need to embrace ICTS in library operations and information services. 61% indicated there is need for decentralization of funds to enhance automation program. The above findings revealed that the parent organization has a duty to play for effective and efficiency of automation processes of library operations and information services for the utilization of all information resources by KARI scientists

4.9.1 Budget

Budget helps the library and information centres to plan and prioritize their activities. 85% revealed that the centre libraries have no budget while 14% indicated that they have a budget. After a thorough scrutiny from the documentary sources, the researcher found out that budgets are necessary for development and maintenances of library operations and information services.

4.9.2 Source of Funds

An interview with the Centre Directors to establish the source of funds revealed that the funds are derived from donors, government and partly from stakeholders. Further inquiry

revealed that no funds are allocated to the libraries; most of them are supported by programmes within the centre. To establish whether the funds allocated were adequate, the researcher asked a question relating to this. 80% respondents from the research centres under study indicated that no funds are allocated to the libraries; the little support they get is from administration funds. However as revealed through the interview, it was confirmed that the funds allocated are insufficient to meet the needs of automation program especially buying computers and library integrated software.

80% of the responses revealed the automation program is funded by the parent organization. The budget allocation for the automation is included within the Information and Documentation Services department annual budget. The money allocated to IDS is shared among the three sections namely: - Library services, Information Technology unit and Publications Unit. The bureaucracy involved in obtaining the money from the parent organization brings about delays in the automation program. This is because sometimes the IDS did not get adequate funds requested.

Funding is thus a fundamental factor of consideration in automation of library operations and information services. Implementing automation program where funds are not readily available is costly. As a result development of new information services in the libraries becomes impossible.

4.10 Summary

The chapter presented the data as it was collected. The findings of the study were presented in form of tables. The chapter looked in-depth on extent of automation and application of ICTs at KARI libraries. The study discussed on ICT tools available at KARI libraries which enhance library operations and information services. Automation of library operations and information services require qualified staff therefore the study were looked at level of computer literacy skills was also discussed. The study revealed many issues which need to be addressed for the embracement of Information and Communications Technologies at KARI Libraries.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter provides a summary of the main findings of the study. The summary was provided in reference to the aim, objectives, research questions and assumptions of the study. The research findings are briefly discussed to highlight the key issues. Conclusions and recommendations of the study are also presented in this chapter as well as suggestions for further research. The specific objectives of the study which guided the researcher were as follows:

1. to establish the existing information services at the selected KARI libraries;
2. to find out the extent of application of Information and Communication Technologies (ICTs) in library operation and information services at the libraries;
3. To examine the range of digital formats of information resources available in the selected KARI libraries;
4. to establish the ICT skills and knowledge among library staff at the institution under study;
5. to establish the challenges experienced in the automation process, and to suggest ways by which KARI can optimise the utilization of automation;
6. to suggest ways by which KARI libraries can optimise utilization of automation in library operations and information services;
7. to propose a model for automation at KARI libraries.

5.1 Summary of Findings

In this section, a summary of the research findings is given. The summaries are presented to reflect the research questions based on the data presentation and analysis dealt with in chapter four. For KARI libraries to have standard and common approaches for automation of the library operations and information services, centre directors should liaise with information professionals and the top management of KARI for effective implementation.

5.1.1 Information Services at KARI Libraries

The study found out that current awareness services (CAS), Inter- library loan service and reference service are offered in the selected libraries. Selective dissemination of information services (SDI), resources sharing, search and retrieval of information and internet services are only offered in four libraries. Translation services, abstracting services, and compilation of bibliographies are not offered in the centres under study.

5.1.2 Extent of application of ICTs

Window XP was commonly used in KARI Libraries although two libraries had an old version of Window 98 which was not compatible with current ICT Software and database. Three centres use CDS/ISIS DOS version for cataloguing information resources. WINISIS and WEBAGRIS were found at two centres. Internet explorer was used in three centres to facilitate online information services. TEEAL was found in three centres for search and retrieval of journal articles.

5.1.3 Automated Information Services

It was found that only KARI Headquarters had automated CAS, SDI and resource sharing. Five libraries had Internet services, online search and retrieval. It was also revealed that all the other libraries did not have automated abstracting and indexing services, ,translation services, automated reservations, online referral services, online user education services, online inter-library services, automated document delivery services, information networking, online reference services, online research and retrieval services, automated circulation and automated CAS.

5.1.4 Range of Digital formats of Information Resources

The study established that digital formats of information resources were very important in the automation of library operations and information services because they contribute to effective and efficient services. It was noted that the most used electronic formats at the KARI libraries which enhance library operations and information services are: e-journals, e-mail, fax and internet resources. Electro-magnetic formats are not commonly used. In addition inadequate digital formats of information resources in KARI libraries have contributed to unprecedented decline of library usage.

5.1.5 Information and Communication Technologies (ICTs) Tools

The study found that use of adequate ICTs tools in libraries and information centres could improve library operations and information services. It was also noted that most libraries do not have adequate ICT tools to enhance effective services and this has posed serious

problems on implementation of automation in KARI Libraries. Further findings were that only sixteen computers were available in the centres under study and three computers were very old and they used windows 98 as they could not accommodate the latest windows version.

Scanners and photocopiers were only available at two libraries. Accession machines, fax machine, projector and microphones were found only at KARI headquarters. Microfishe Readers was found in one library only. DVDs players and CD- players were available in four libraries. Duplicating machines, cassette players and Headphones were not available at any library under study.

5.1.6 Librarians Skills and Knowledge on Automation

The study further revealed that most librarians had inadequate information and technical know-how on emerging digital formats of information resources to enhance library operations and information services. It was clear that the level of skills and knowledge of librarians in application of ICTs in library operations and information services was below average because of different reasons. One of the reasons cited was that the IT department at KARI headquarters was responsible for KARI libraries automation and therefore the library staff depended on their services.

5.1.7 Challenges experienced in the Automation of Library Operations and Information services in KARI Libraries

The study further revealed that several problems had hindered automation of library operations and information services in KARI libraries. These were: inadequate financial support, inadequate digital formats, system failures, inadequate ICT tools, lack of library priorities, inadequate training, lack of common approaches to automation, limited bandwidth, lack of institutional information policies and inadequate co-operation between librarians and IT personnel.

5.2 Discussion of the findings

Discussions were based on the 5 objectives of this study. The study established that automation would led to effective, efficient, economical library operations and information services. The reason why the entire 44 respondents were selected was because they were the key informants to automation program. The centre directors approve the program and the Library staff establish the operations and information services they want to automate. The ICT staff would assist on design/modify/installation of the software.

5.2.1 Information Services and Products at KARI Libraries

The findings revealed that most of library operations and information services at KARI libraries were still manual such as; cataloguing, charging and discharging of information resource, search and retrieval of information. User needs have become diverse and complex and therefore KARI libraries could automate their information services to

enhance users satisfaction. This is in line with Syed Sajjad Ahmed and Syed Sajjad Ahmed (2000) who stressed that the demands and expectations of users have also changed considerably. In this changed scenario, more and more libraries over the world are exploring and offering new Web-based services such as Web catalogues, Web search engines, and Web forms to satisfy the library and information demands of its users.

Automation of library operations and information services has enlightened the information professionals on use of Open Source Software, Web catalogues, a range of e-resources, Internet services, social networking services among other. Automation of library operations and services at KARI libraries could improve quality, quantity, reduce costs and improve efficiencies through labour saving and reduce duplication of efforts. Williams (2008) concurs with the study by stating that automation of libraries is an important activity as it is a prerequisite for networking of libraries and resource sharing. It enables promotion of consortium, usage of e-journals/e- books remotely, digitization of contents, creation of centre of excellence in library, creation of e-Archives and creation of institutional repositories

5.2.2 Application of Information and Communication Technologies (ICTs)

The use of modern technologies at KARI libraries would add value to library operations and information services because it would improve access, delivery of services, resource sharing, minimize duplication of efforts, enhance common approaches and standards to library automations. Supporting the findings of this study Chisenga (2006) affirms that

organizations, including governments, in the world today are taking advantage of the many opportunities provided by modern ICTs. Minishi-Majanja and Kiplang'at, (2005) found that new ways of communication are being adopted via ICTs such as the Internet, email, mobile phones, electronic sources among others.

5.2.3 The range of Digital Formats of Information Resources

KARI libraries still lag behind with the emerging technologies of e-books, e- journals, online bibliographic databases, Internet resources, online classification, web catalogues, multimedia resources, just to mention a few. For quality and effective library operations and services KARI libraries require a range of digital formats of information resources in order to satisfy users' needs. This concurs with the findings of Adeleke (2010) who reported that the advent and use of ICT has made it possible for remote libraries to access the huge databases of big libraries in developed countries for the purpose of adopting or adapting their bibliographic data for their own library use; and indeed the online catalogues have transformed the landscape of cataloguing and classification. Similar results have been reported by Pratap (2004) who noted that with the passage of time, several techniques and technologies have emerged for handling the information more speedily and effectively

5.2.4 The level of ICTs skills and knowledge

This study found out that the level of computer literacy skills and knowledge of the library staff was inadequate. These have led to inability for most librarians to use; e-resources, different search engines, ICT facilities, formulate search strategy just to mention a few. If the library staff could have adequate computer literacy skills, automation of library operations and provision of information services would be effective and efficient. The role of libraries has changed dramatically since the development of the Internet and it is necessary for KARI libraries to move with this trend. These findings are supported by the earlier findings of Krishnamurthy and Chan, (2005) who suggest that the developments in Information and Communication Technologies (ICT) and their subsequent absorption in library and information science (LIS) have forced information professionals to change the way they are functioning at present. Because of their popularity with the users, an overwhelming attention is being given to the web-based information services in libraries.

5.2.5 Information and Communication Technologies (ICTs) Tools

The findings of the study showed that most KARI libraries have inadequate ICTs tools. Only 3 libraries were equipped with reasonable quality or basic ICT infrastructure such as internet and computers. Information and Communication Technologies (ICTs) are important tools for libraries and information centres. Information and Communication Technologies tools enhance librarians to carry out library operations and services effectively. This finding agrees with earlier study of Blessinger (2002) who reported that

it is hard for new librarians entering the job market today to do reference work or library service without the aid of computers

5.3 Conclusions

Research libraries are like KARI are important to agricultural countries. Agriculture research is a key component of technology generation, knowledge management, technology transfer and it provides solutions for sustainable development for the country. For researchers and scholars to develop these technologies they require information which is current and in good format.

The study was conducted to evaluate the current status of automation of library operations and information services in selected Kenya Agricultural Research Institute (KARI) libraries. KARI had not embraced the modern technologies fully and they lag behind with the emerging technologies such as: e-books, e- journals, online bibliographic databases, online selective dissemination of information, online user instructions, Library 2.0, Web catalogues, e-mail, Internet connectivity just to mention a few. KARI libraries require a range of digital formats of information resources in order to satisfy users' needs.

The main problems which have affected automation program at KARI libraries were; lack common approaches and standardization of ICT infrastructures, inadequate funds, inadequate and up to date information resources, inadequate manpower, internet connectivity and limited bandwidth, inadequate Information Service Provider (ISP),

inadequate integrated library systems, absence of formal training, seminars and workshop opportunities for KARI librarians were especially at the KARI centre libraries. Development of integrated library systems at KARI libraries could enhance resource sharing networks.

This study highlighted lack of training, seminars and workshop opportunities for KARI librarians to enhance their ICT skills. Skills and competencies of information professionals handling ICT facilitates need to be up graded to enhance maximum utilization of e-resources for example The Essential Electronic Agricultural Library (TEEAL). Therefore KARI management should recruit ICTs compliant library staff because of the changing trends in the information field.

However, KARI headquarters, KARI NARL and KARI TRC had internet connectivity and they could subscribe to online resources especially from CTA effectively. Internet connectivity, good Information Service Provider and bigger bandwidth could improve access of online resources at KARI libraries. KARI centres libraries could join consortium to enhance resource sharing to overcome libraries financial limitations.

It may be concluded that provision of adequate ICT infrastructure, adequate financial resources, cooperation of KARI management and proper training for librarians would help to strength automation of library operations and information services at KARI libraries. It is necessary for KARI libraries to automate their library operations and

information services to adhere ISO Quality Management System to satisfaction library users needs.

5.4 Recommendations

The key to success in automation of library operations and information services is to have adequate funds and to involve top managers in library committees. Emerging technology has enlightened many people on the importance of current information and ICT tools. Library users and especially research scientists require up-to-date information in order to carry out their research activities. They require modern technologies to communicate with their colleagues. KARI libraries should move with the current trends in order to satisfy their users. Users require to share their ideas/opinions with their colleagues using library 2.O tools for example, Slide share, Twitter, Yammer, Blogs, Facebook among others and therefore KARI libraries should have adequate ICT infrastructures. The study recommends the following to enhance automation of library operations and information services in KARI libraries.

5.4.1 Technological Aspects

For automation program to be effective, the study recommended the following technological aspects:

a) Adoption of Open Source Software

The study also recommended that KARI libraries could adopt the modified Open Source Software like Koha or ABCD which have most of the required library modules instead of

using CDS/ISIS or WINISIS which has only two modules had been modified namely cataloguing modules, search and retrieval.

b) Acquisition of ICT Tools

The study recommended that standard and adequate ICT tools should be acquired in all KARI libraries to enhance automation of library operations and information services. ICTs tools such as: computers, external hard disks, internet, scanners, barcode readers, photocopiers, projectors, telephones, just to mention a few because they are important in automation program.

c) Enhance ICTs Security

Security of data is important in libraries and information centres therefore adequate measures should be considered for automation program to be effective. The study recommended the following security measures;

i) Acquisition of Computer Anti-virus Software

The study recommended that KARI Libraries should acquire and install up to date computers anti-viruses to avoid lose of data. Example for computer anti virus like Kaspersky 2012, Mc- cafee, Nord 32, among others.

ii) Provide Power Supply Backups

Library automation is power dependent. The computers and other ICT facilities use power for them to work effectively. The study recommended that KARI libraries should be provided with generators UPS to avoid loss of data and computer power supply blowing off.

d) Enhance Internet Connectivity

The study recommends that KARI should enhance Internet connectivity in all the centres. They should have reliable Information Service Providers (ISP) to enhance communication.

(e) Provide a Bigger Bandwidth

The study recommends that KARI libraries should have a large bandwidth like 512mbps or a minimum of 256 (mbps) to enhance downloading and uploading of information. Currently most centres have a limited bandwidth of 100 (mbps) which is very small especially for downloading of articles of online journals.

e) Develop a Maintenance Strategy

The study recommends that KARI should have a maintenance strategy for effective automation of library operations and information services. A good maintenance plan should be established so that maintenance funds of ICT facilitates should be included in the annual budget allocation to sustain ICT infrastructures even if the donors period elapsed

5.4.2 Human Resource Aspects

The study recommends that KARI libraries should be adequately staffed for effective library operations and information services.

a) Introduce Computer Literacy Programmes

The study recommends that KARI libraries should introduce computer literacy programmes in all KARI libraries. A computer literacy program would help the

information professionals and users to make maximum utilization of ICT infrastructures, formulate search strategy, create online user profile and match the online resources they have with the users needs

The study recommends that KARI libraries should have a continuous computer literacy programme so that the staff could cope effectively with technological change. Training could be provided in the form of orientation courses, in-service training courses, staff exchange, formal educational programs just to mention a few.

b) Popularise/ use of ICTs

The study recommends the sensitization of all stakeholders and especially KARI management staff on applications of ICT in libraries so that they would understand the benefits and potentials. These could help the decision makers in KARI to have short term and long term plans for automation of library operations and information services at KARI libraries.

Reluctance to embrace change had affected automation of library operations and information services. Some KARI library staff were reluctant to accept new technologies; they felt comfortable with manual systems. Well trained and skilled staff are essential ingredients for implementing library operations and provision of information services.

c) Recruit ICT Compliant Library Staff

Automation of library operations and information services require information professionals with background of information technology so that they can modify the software system to suite the libraries requirement.

The study recommends recruitment of library staff who are ICT compliant. For example, staff who can download an open source software and modify to suite KARI libraries operations and information services.

d) Encourage Membership to Professional Associations

The study recommends that KARI library staff should be encouraged to join professional organizations like Kenya Library Association (KLA) so as to learn current trends in Information Sciences and especially advancement in computer technology. For example, Social Networks like Library Tools 2.0 (facebook, Slideshare, Twitter, google talk and others),Open Source Software among others.

5.4.3 Management Aspects

a) Request for Institutional ICT Management Support

The study recommends that KARI libraries should have adequate institutional ICT management support for effective library operations and information services. KARI Libraries help the organization to achieve its objectives through offering current information to research scientists and support staff. User needs are changing rapidly and therefore the library should have various methods to meet users' needs and demands. KARI has many donor funded research programmes which could be encouraged to

support libraries in their centres by purchasing computers, scanners, photocopiers, higher storage capacity, among others which could enhance automation of library operations and information services.

The study also recommends that research scientists could include library expenses when they are writing down their research proposals.

b) Mainstream Funding of Library ICT Projects

The study recommended that for effective library automation, mainstream funding of KARI libraries ICT projects either from parent organization or donor should be well established. KARI Libraries need adequate funds to implement, support and maintain automation of library operations and information services. The parent organization should allocate enough funds to Information Management and Communication Technology (IMCT) so that it could support libraries in the centers in purchasing ICTs facilities and maintaining automation program.

c) Formulation of Institutional Information Policy

Based on the findings the study recommends formulation of institutional information policy and especially ICT policy and collection development policy. It would guide them on funding, acquisition of library software, ICTs tools and distribution of ICTs infrastructures to KARI libraries. KARI is a research organization and therefore require update information resources enhance research.

5.5 Proposed Model for Automation of Library Operations and Information Services

Figure 1 shows a model for automation of library operations and information services which can be adapted at KARI libraries. The model has twelve steps, which are shown below:

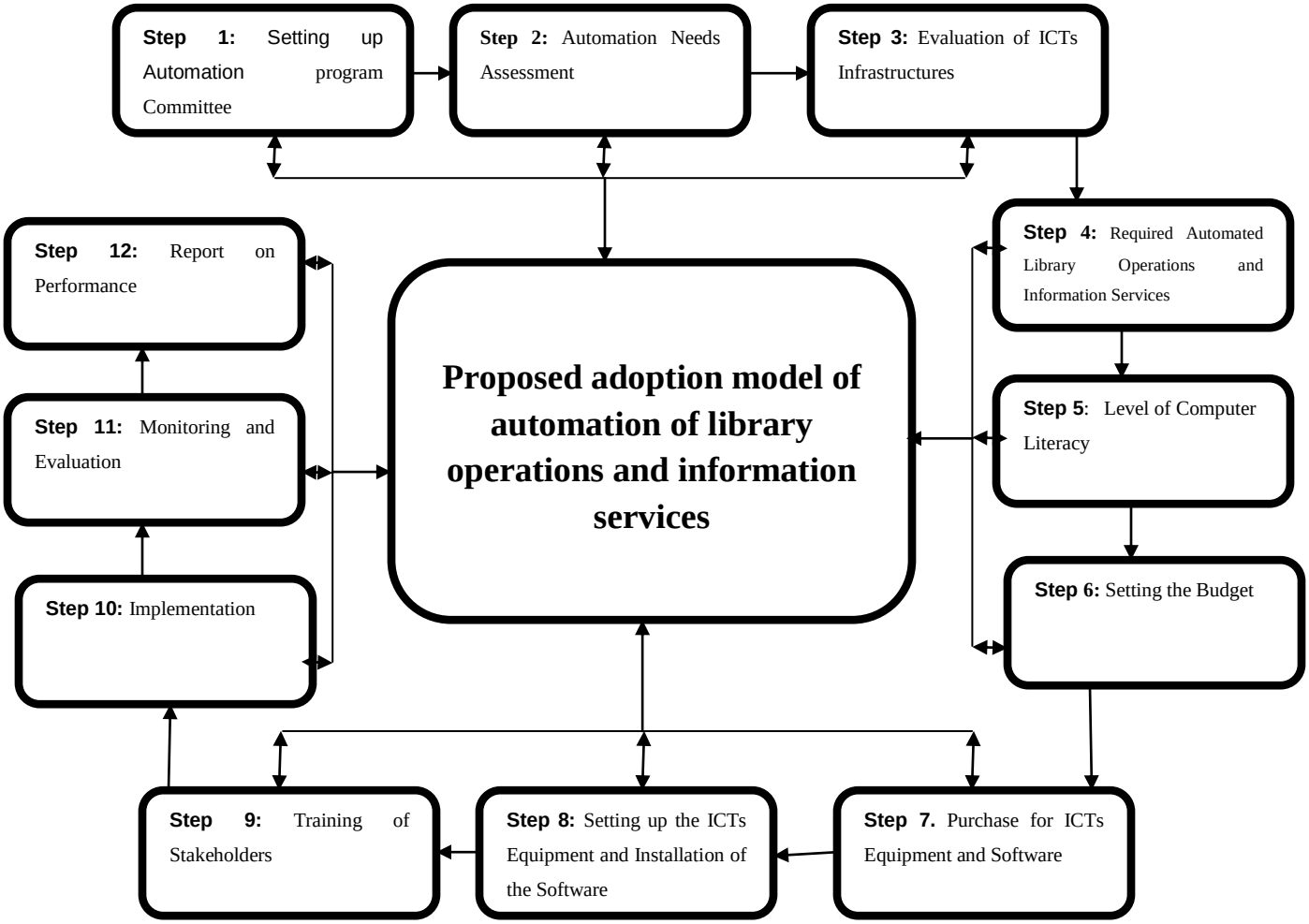

Figure 1: Proposed Model for Automation of Library Operations and Information Services at KARI Libraries

Step 1: Setting up of Automation Program Committee

Automation program requires exhaustive planning, looking at current and future needs of library staff and users. Therefore it is necessary to set up an automation program committee with all stakeholders who consist of centre directors, library staff, ICTs staff and Library users who shall discuss in depth on hardware, software, funds manpower, materials obsoleteness, updating, adoptability and maintenance.

The Centre Director will be the chair of the committee so that he can forward and recommend the project to KARI management.

Step 2: Automation Needs Assessment

The purpose of this step is to allow users to articulate their needs and concerns on the automation program. This will help them to share their views and learn what they expect from the program.

Step 3: Evaluation of ICT Infrastructures

Initiation capital on automation program is very expensive and therefore it is important to identify the ICT infrastructure (for example softwares, computers, scanners, projectors, internet connectivity and others) available at the Centre level. After establishing what is on the ground, then recommendation is done on what to add like powerful computer and current softwares' that could enhance the automation program.

Step 4: Required Automated Library Operations and Information Services

This step would involve looking at all library operations and information services that would be automated. For example, acquisition, accessioning cataloguing, classification, labeling, user education, readers' services, reservation services, references services search and retrieval services.

Step 5: Level of Computer Literacy

It is essential to find out the level of education and computer skills of all the stakeholders so that prior planning could be done. The will help to establish if they require on the job training or formal training to enhance the automation program.

Step 6: Setting the Budget

Report writing is a very essential step because it will give a detailed report on what is available and what needs to be added to improve the automation program. A budget on equipment and staff training will be included in the report.

Step 7: Purchase for ICT Equipment and Software

Once Director KARI approves the report, purchase of the recommended ICTs equipment and integrated library Management system will be done according to procurement procedures. An automation system is a system in which the various applications share one bibliographic database. Each system comes with a set of core modules as well as

additional modules, which can be added on. For example, acquisition modules circulation modules, cataloguing modules, online public access catalogue modules among others.

Step 8: Setting up the ICT Equipment and Installation of the Software

This would involve placing the ICT equipment in their respective places depending on flow of library operations and information services. Local Area Network could be installed to ensure that resources are shared by all sections without duplication of efforts.

Step 9: Training of Stakeholders

Training is an integral component of staff development. A program would be made to train different stakeholders at different times depending on the users need to ensure maximum utilization of all the resources. Training will also enable staff to cope effectively with technological change.

Step 10: Implementation

An Implementation strategy shall be set up to provide a framework for all the proposed processes. This will also help to determine which library operations and information services should be automated and in what order of priority.

Step 11: Monitoring and Evaluation

Monitoring and evaluation of the automation program is important because it will highlight the strengths and weaknesses of the program. Monitoring and evaluation report

will guide the automation program committee where they require improvement to ensure effective and efficient automated library operations and information services to satisfy users' needs so that they can achieve organizational objectives.

Step 12: Report on Performance

Report on performances of automation program is desirable. The report would show whether the automation program had added value to library operations and information services. The report would also show if there are modifications required and if there is need for staff training. The purpose of the report on the performance of automation program is to examine the benefits, strengths and weakness of the automation program**.**

5.6 Suggestions for Further Research

Since the study focused on automation of library operations, information services and application of ICTs, the study suggests that more research need to be done on organizing internet resources. The study also suggests that future research can be done on social Networking Services (Library 2.0) which is more user oriented.

5.7 Chapter Summary

The chapter looked at the findings of the study as they had been presented in the previous chapter. In depth discussion were made with reference to the research objectives. The study found that automation of library operations and services is very vital in libraries and information Centres. The application of ICTs in libraries and information centres has made library operations and information services effective, efficient and economical.

Thus making e-resources shared, distributed, updated, manipulated, searched and retrieved quickly. Automation of library operations and information could enhance effective, efficient and economical service delivery leading to user satisfaction.

The study came up with recommendations that are believed will be useful to KARI management and Information Professionals. Adequate ICT infrastructure should be made available to enhance automation program. Adequate funds should be allocated to KARI libraries to enhance smooth automation program and maintenance. A computer literacy program should be encouraged to enhance effective services. All stakeholders should be involved in planning of automation program. Finally there should be common approaches on automation in KARI library systems.

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APPENDICES

Appendix I: Centre Director Interview Schedule

1. What are the objectives the Kenya Agricultural Research Institute?
2. Do you have a library in your Centre?
3. How does it help in achieving the organizational objectives?
4. (a) Do you recognize the value of this library in achieving these objectives?

   (b) If no, please explain why?
5. (a) Do you have policy guidelines for effective management of this library?

(b) If yes, does the policy provide for automation of library operations and information services?

(c) If no why, please explain why?

6. (a) How effective are the library operations in terms of selection and acquisition of information materials?

(b) Are you satisfied in the manner in which the library select and acquire information resources?

7. (a) Do you have Information and Communication Technologies in the library?

   (b) Have you embraced the ICTs in the library operations and information services?

8. To what extent does the library use the following ICTs systems:

   (a) Local Area Network for Intranet services?

   (b) Wide Area Network for extranet (for sharing information resources with KARI Library network and other libraries)?

   (c) World Wide Web for internet services (browsing, for selection of information materials, electronic buying of information resources, search and retrieval for e-books and e- journals)?

9. (a) Does the library system have a budget?

   (b) If yes, does the budget provide for various library automation services?

10. Are researchers workers satisfied with the quality of KARI library services?

11. (a) Are you satisfied about the diversity of information services provided in the library?

    (b) If no, why are you dissatisfied?

12. (a) Do you demand frequent evaluation of KARI library services to ensure the effectiveness?

(b)If yes, how often? Monthly, Quarterly, Half-year and Yearly.

(c) If no, what is the way forward in improving library services?

Appendix 1I: letter of introduction.

Rahab W. Ngugi,

Moi University,

School of Information Sciences,

P.O. Box 3900,

ELDORET

8th June, 2009

Dear respondent,

I am Information Science master's student at Moi University carrying out a research on automation of library and information services at KARI library systems. In the recent past, there have been a lot of uncertainties in accessing information resources and services due to information explosion. This questionnaire is being issued with the aim of collecting data on Information Communication technologies at KARI library systems. I am therefore requesting you to fill this questionnaire as truthfully as possible. All information shall be treated with utmost confidentiality.

Thank you in advance.

Yours faithfully,

Rahab W. Ngugi

Student – School of Information Sciences

Appendix III: Questionnaire for Library Staff

Please tick √ or fill the spaces provided

Section A-General

BIO-DATA

Name of institution……..

Department …….

Occupational Rank…….

Section A Information Services

1. Please indicate the information services which are automated?

Current awareness services	☐
Selective Dissemination of Information	☐
Abstracting of information resources	☐
Inter-library loan services	☐
Resource sharing	☐
Reference services	☐
Translation services	
Internet services	☐
Search and retrieval of information	☐
Compilation of Bibliographies	☐

Section B Automated library operations

2. (a) What operations are automated in the library?

Selection of Information materials ☐

Acquisitions of documents ☐

Cataloguing and classification of information resources ☐

Accessioning of items ☐

Compilation of Library statistics ☐

Weeding of information materials ☐

Stock taking of library resource ☐

(b) Please indicate why some library operations are not automated……

……

Section C Extent of Application Information and Communication Technologies (ICTs)

3. To what extent is the application of (ICTs) in library operations and information services in the selected KARI libraries;

Hundred per cent (100%) ☐

Seventy five per cent (75%) ☐

Fifty per cent (50%) ☐

Twenty five per cent (20%) ☐

Less than twenty five per cent (25%) ☐

4. Does the library have operating software to enhance library operations and information services?

YES ☐

NO ☐

b) If yes, please specify which platform?.....

5. Which software are used for library operations and information services in your library?

.....

6..(a) Do you have online databases to enhance library operations and information services? ☐

YES

NO ☐

(b) If yes please explain.....

7.a). What types of ICTs Tools are used for library operations and Information services?

Computers

Accession machines ☐

Duplicating machines ☐

Photocopier ☐

Scanners ☐

Typewriters ☐

Fax ☐

DVDs players ☐

CD players ☐

Microfiche readers ☐

Roll-film readers

Cassette players ☐

Headphones ☐

Microphones ☐

Television sets ☐

The Internet ☐

Radio ☐

DVD equipment ☐

Audio visuals ☐

Please, specify any other ICT tools used in the library……

……

(b) Are the ICTs equipment adequate?

YES ☐

NO ☐

(c) If yes, how many? .....

(d) If no, please explain why……

(e) Are they functional?

YES ☐

NO ☐

(f If no, please explain why?.....

8.(a) What types of computer networks are available in the library?

Local Area Network (LAN) ☐

Wide area net work (WAN) ☐

World Wide Web (WWW) ☐

(b) Does the network work?

YES ☐

NO ☐

(f) If yes for what purpose is the use of the networks?.....

……

Section D Range of information formats

9.What are the digital formats of information resources are available in KARI library system?

Electronic formats ☐

Electro-magnetic formats ☐

8.What types of Electronic formats are available in KARI library system:

E-books ☐

Hyper Books ☐

Microforms Resources ☐

E-Journals ☐

E-mail ☐

Facsilmiles (faxes) ☐

Online Databases system ☐

Audiovisual resources ☐

Audio resources ☐

Film resources ☐

Video Resources ☐

Web Based resources ☐

Online repository ☐

Gateways ☐

Portals ☐

Search engines ☐

Others

10.What types of Electro-magnetic formats are available in your institution?

KARI library system?

Magnetic tapes ☐

Magnetic Disks (floppy diskette, hard disk) ☐

Cassette Tape ☐

Audio visuals ☐

Video tapes ☐

Digital Video Disc (DVD) ☐

Compact Disc Read Only Memory (CD-ROM) ☐

Microforms (microfiches and microfilms) ☐

Other ☐

11.a) What, in your opinion, are the levels of Computer literacy skills and competencies do Library staff have to undertake library automation?

Above average ☐

Average ☐

Below average ☐

b) What training/workshops/seminars have they attended in library automation?

c) Are the staff adequate?

YES ☐

NO ☐

12. (a) Do you have computer literacy programmes to library staff and users?

YES ☐

NO ☐

(b) If no, please explain why? ……

13. Suggest any other ways by which KARI can improve the automation of library operations and information services…….

……

Appendix IV: Pre-testing checklist

RESEARCH TITLE : AUTOMATION OF LIBRARY AND INFORMATION SERVICES AT KENYA AGRICULTURAL RESEARCH INSTITUTE

Please refer to the attached questionnaires, interview schedules and kindly answer the following questions after reading the objectives listed below. The study sought to investigate the existing state of automation of library operations and information services at the KARI libraries and to propose measures that can enhance automation process.

Objective of the study

The study will be guided by the following objectives:

- To examine the range of formats of information resources available at KARI library system;
- to identify the type of technical operations undertaken in KARI library systems;
- to establish the existing information services at the selected KARI libraries;
- to find out the extent of application of Information and Communication Technologies (ICT's) in library and information services;
- to establish the ICT's skills and knowledge among library staff at the institution under study;
- to establish the challenges experienced in the automation in the selected KARI library systems;
- to suggest ways by which KARI libraries can optimise the utilization of automation.

PRE-TESTING QUESTIONS

1. Are all the objectives adequately covered in the questions in the questionnaires and interview schedules?

YES { } NO { }

If no, please indicates the objectives not adequately covered and give your view……..

2. Is the grammar used appropriate for the users?
YES { } NO { }

If no, gives suggestions…….

3. Are there any words that are spelt wrongly?
YES { } NO { }

If yes, please indicate them in the questionnaire or interview schedules?

4. Are there any questions in the questionnaire or interview schedules which is not clear?

If yes, please mark them in the schedules and provide suggestions to improve clarity.

5. Is the sequence of questions flowing in the questionnaire or the interview schedules?
YES { } NO { }

If no, provide suggestions……

6. Is the font-size used in the questionnaires or interview schedules legible?
YES { } NO { }

If no, please give suggestions……..

7. Is the font type appealing?
YES { } NO { }

If no, please provide suggestions for others.

Appendix V: Research clearance permit

CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

GPK 6055—3m—10/2009

(CONDITIONS—*see* back page)

PAGE 2

THIS IS TO CERRTIFY THAT:

Prof./Dr./Mr./Mrs./Miss. RAHAB W. NGUGI

of (Address) MOI UNIVERSITY P.O.BOX 3900 ELDORET

has been permitted to conduct research in

KARI Location,

NAIROBI District,

NAIROBI Province,

on the topic AUTOMATION OF LIBRARY AND INFORMATION SERVICES AT THE KENYA AGRICULTURAL RESEARCH INSTITUTE

for a period ending 31ST DECEMBER, 20 09

PAGE 3

Research Permit No. NCST5/002/R/487

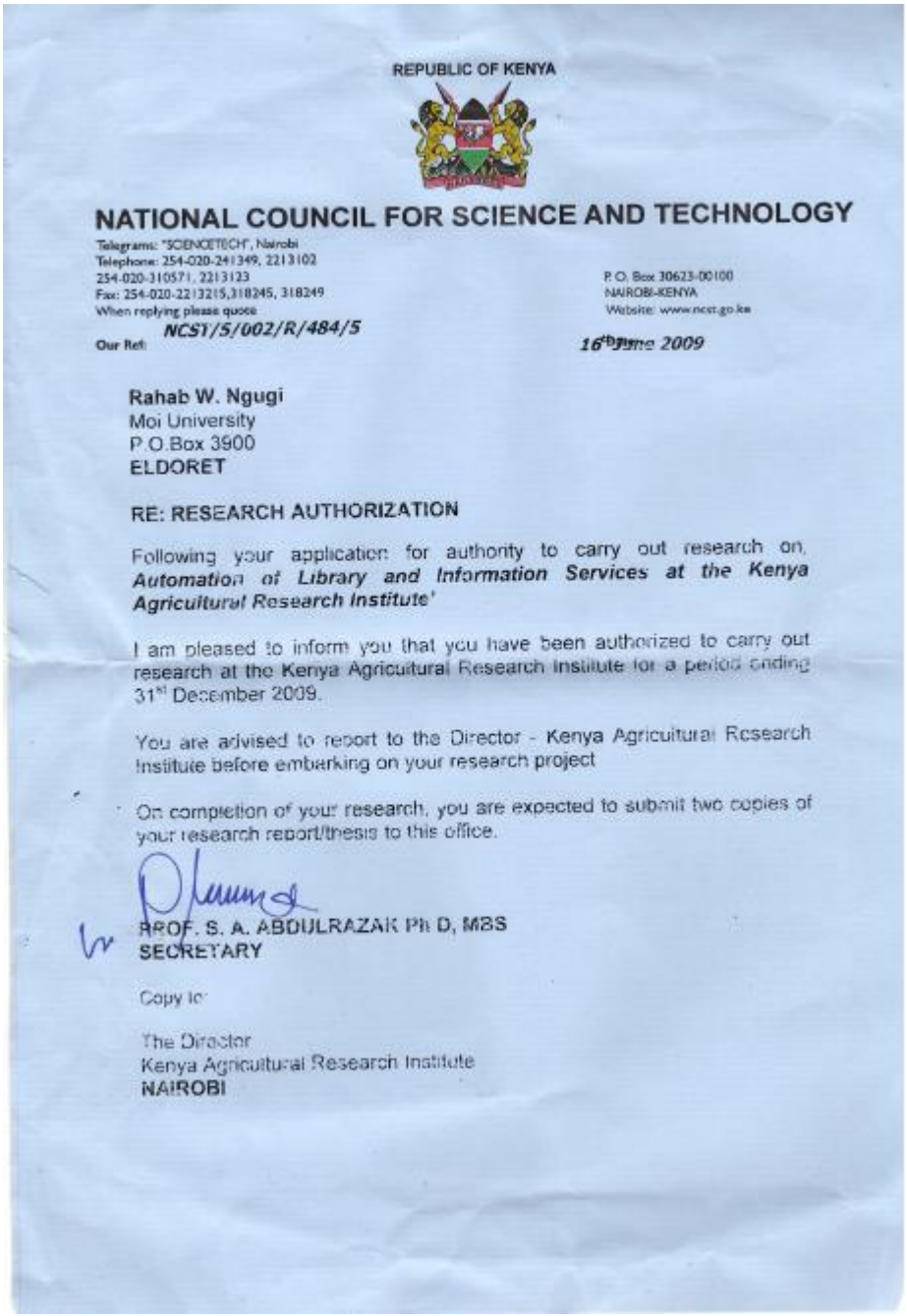
Date of issue 16.6.2009

Fee received KSHS.1000.00

Applicant's Signature

Secretary National Council for Science and Technology

Appendix VI: letter of research authorization



REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
Telephone: 254-020-241349, 2213102
254-020-310571, 2213123
Fax: 254-020-2213215,318245, 318249
When replying please quote

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.nost.go.ke

Our Ref: *NCST/5/002/R/484/5*

16th June 2009

Rahab W. Ngugi
Moi University
P.O.Box 3900
ELDORET

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***Automation of Library and Information Services at the Kenya Agricultural Research Institute***'

I am pleased to inform you that you have been authorized to carry out research at the Kenya Agricultural Research Institute for a period ending 31st December 2009.

You are advised to report to the Director - Kenya Agricultural Research Institute before embarking on your research project

On completion of your research, you are expected to submit two copies of your research report/thesis to this office.

PROF. S. A. ABDULRAZAK Ph D, MBS
SECRETARY

Copy to:

The Director
Kenya Agricultural Research Institute
NAIROBI