

**A SURVEY OF THE CHALLENGES FACING THE USE OF
DIGITAL LIBRARIES IN KENYA:**

**A CASE STUDY OF KENYATTA UNIVERSITY AVU
LIBRARY**

BY

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REG. NO: D/P/61/9039/01

**A MANAGEMENT RESEARCH PROJECT SUBMITTED IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE MASTER OF BUSINESS ADMINISTRATION (MBA)
DEGREE.**

UNIVERSITY OF NAIROBI

SEPTEMBER, 2007

Declaration

This management research project is my original work and has never been presented for a degree in any other University.

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This management research project has been submitted for examination with my approval as the University supervisor.

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Dedication

I dedicate this research project to my husband and my family for being supportive during the time of my studies.

Acknowledgement

I would like to acknowledge the support, advice and tireless efforts of my supervisor Mr. J.T Kariuki.

I would also like to acknowledge the assistance provided by the administration of Kenyatta University in allowing me to collect data from the staff and the students.

I also thank the Librarians at the University of Nairobi for allowing me the use of the library facilities.

Finally, I would like to acknowledge the assistance given by the staff at the School of Business, University of Nairobi.

Abstract

The creation of digital libraries was meant to solve the problems encountered in the traditional paper based libraries. However many challenges are being encountered in the process of establishing and use of the digital collections. The purpose of this study was to investigate the challenges facing the use of digital libraries in Kenya. This was achieved by taking a case study of the Kenyatta University AVU library in Kenya.

In establishing the challenges facing the use of digital libraries, a descriptive research design was used. The target population for this study was the library users and employees of the Kenyatta University AVU library. The population was stratified into two strata namely library employees and library users. A sample of 120 respondents from both users and employees of Kenyatta University AVU library was selected through convenience sampling method. Primary data was collected using questionnaires which contained both open ended and close ended questions. The data was analyzed through the use of factor analysis and descriptive statistics. The findings were presented through the use of tables.

The findings established that the challenges being faced by employees and users of digital libraries are occasioned by seven broad factors namely: policies related to management, infrastructure-related, quality assurance, attitude of users towards digitalization, connectivity and reliability of networks, training-related and system design issues. To counter these challenges, the study recommends enhancement of library ICT infrastructure, change management and training of both users and employees.

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List of Acronyms

API	- Application Programming Interface
AVU	- African Virtual University
BLOB	- Binary Large Objects
CD-ROM	- Compact Disc Read Only Memory
CHE	- Commission of Higher Education
COMSAT	- Communications Satellite Corporation
DBMS	- Database Management System
ICT	- Information and Communication Technology
IS	- Information System
IMF	- International Monetary Fund
JSTOR	- Journal Storage
K,I,E	- Kenya Institute of Education
KNLS	- Kenya National Library System
K,U	- Kenyatta University
NGOs	- Non-Governmental Organization
SSA	- Sub-Saharan Africa
SGML	- Standard Generalized Markup Language

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The paper library proved effective and durable for an extended period of time, however the problems inherent in the paper library are real and substantial (Michael, 1996). Paper is a localized medium therefore for the paper library to be functional the paper and the user must be in the same place at the same time (Michael, 1988). However, the situation has since improved with modernization of traditional paper library to the modern day library that utilizes digital technology in search and retrieval of information.

The inflexibility of paper as a medium implies that copies of documents could be made by reprinting, photographic production and more modern reprographic means. The advent of facsimile transmission (fax) was regarded as a remedy for transmission of short paper documents. However, this was short-lived since it involved the transmission of an electronic copy of the document as an intermediary between the original paper in one place and creation of a copy paper in another place. Individual copies of a document can have annotations added to them and with sufficient standardization paper documents can be interfiled (Gore, 1994). To counter these challenges of paper based library, Libraries' technical operations started being computerized and thereby paper libraries are being transformed into what is presently called Automated/digital Libraries (Fremont, 1995).

Before the introduction of modern Information and Communication Technology (ICT), Libraries in Kenya were characterized by inadequate resources in terms of funds, information materials, equipment and staff (CHE, 2001). CHE reported that there was a widespread opinion among students, lecturers as well as university administrators that university libraries play a critical role in teaching, research and learning activities. The use of old manual cataloguing systems is characterized

by inefficiency in delivery of services to the university academic communities. The information search and retrieval is quite tedious and slow due to poor information management, organization and storage (Kavulya, 2003). This necessitates the need for an adoption of a system which is efficient, easy to use and fast in information retrieval. To counter the inefficiency in the paper libraries, modern information and communication technologies (ICT) are being incorporated in the management of libraries especially in universities to improve services delivery. According to Drabenstott (1994), a digital library is a collection of documents in an organized electronic form available on the internet or CD-ROM disks or a collection of texts, images encoded so as to be stored, retrieved and read using a computer or a digital device.

Digital libraries are viewed as systems to provide a community of users with coherent access to a large organized repository of information and knowledge. The ability of the user to access, re-organize and utilize this repository is enriched by the capabilities of digital technology (Commission of Higher Education (CHE, 2001). Introduction of the digital libraries makes information search and retrieval easier, improves information management, organization and storage. This system is efficient to use and fast in information retrieval. Establishment of digital libraries is being hindered by factors as lack of funds to purchase computer equipment and set up networks, lack of skilled personnel in information technology and poor telecommunications infrastructure in the country (Kavulya, 2004). The African Virtual University (AVU) is one of the institutions that have created a digital library to facilitate access to worldwide resources by students and lecturers.

The African Virtual University (AVU) was started as a World Bank project. It commenced its pilot operation in 1997. It entered into agreement to collaborate with African Universities to run seminars, short courses, diploma and degree programmes. AVU is currently operating in twenty African

countries with a total of thirty eight (38) learning centers. AVU is a technology based distance education network of universities in Sub-Saharan Africa (SSA). The AVU Digital Library provides electronic resources for academic work, research or general knowledge. AVU's mission is to bridge the knowledge gap between Africa and the rest of the world by dramatically increasing access to global education resources throughout the world. AVU's objectives among others are to increase access to tertiary education in Africa by reaching large numbers of students and professionals in multiple sites simultaneously. AVU also aims at improving the quality of education by tapping the best African and global academic resources (Republic of Kenya, 1995).

The teaching method at the AVU include a blend of online, in-class learning and flexible delivery systems combining e-learning, discussions with onsite facilitators, web-seminars and video broadcast (Republic of Kenya, 2000). In Kenya, one of the AVU center is located at Kenyatta University (K.U). At the Kenyatta University's AVU facility, students and lecturers are able to access on-line journals and other digitized learning materials.

1.2 Background of Kenyatta University

Kenyatta University is situated about 16 kilometres from Nairobi on the Nairobi-Thika dual carriageway on 1,000 acres of land. The long journey to university status started in 1965 when the British Government handed over the Templar Barracks to the Kenya Government and they were converted to Kenyatta College for training secondary-school teachers. In 1970, Kenyatta College became a constituent College of the University of Nairobi. It acquired the status of a university on 23rd August 1985. Like other public universities, Kenyatta University obtains the bulk of its funding from the government and this covers approximately 85 per cent of its expenditures. Other sources of income are student fees, income-generating activities and external grants.

The AVU at Kenyatta University was started in June 1997 after the AVU inaugural workshop in Addis Ababa in February 1997. Kenyatta University participation in the AVU establishment was an opportune moment to revitalize and supplement existing academic provision. AVU programmes have led to increased enrolment in science courses such as computer science, computer engineering, information technology and electrical engineering (Joint Admissions Board, 2000). The university hosts one of the AVU's digital learning center.

1.3 Statement of the Problem

The higher education sector in African countries has encountered an increasing rate of student enrollment, insufficient budgets for academic inputs, declining staff to student ratios, low level of research and low internal and external efficiency (World Bank, 1998). As a result, many countries have initiated print-based distance education programs or correspondence courses, introduced regulations to encourage the emergence of private tertiary institutions and rationalized expenditures. The imposition of student fees, reduction or cancellation of student subsidies and the privatization and commercialization of universities are recommendations which though well intentioned have not been suitable for the fragile economy of the developing countries (World Bank, 1998).

Kenya places much importance on the role of education in promoting economic and social development. In spite of the reduced resource allocation, public universities in Kenya have expanded significantly within the past decade. However the high number of student admissions has not been matched with the available resources which include library services, teaching facilities, lecture halls, student housing and tutorials (Republic of Kenya, 2000).

Despite the problems facing most universities in Kenya, the use of digital resources for teaching and learning by higher education is increasing but at a slow rate (CHE, 2001). The growth of the library collections does not appear to have kept pace with the user's expectation which has led to the cost of

creating and maintaining these collections difficult and unaffordable by most users. The creation of digital libraries is meant to enhance efficiency in the use of libraries. However many challenges are being encountered in the process of establishing and use of the digital collections. This study set in to investigate the challenges facing the use of digital libraries in Kenya. A case study of Kenyatta University AVU library in Kenya was used.

1.4 Objective of the Study

The objective of this study was to establish the challenges facing the use of digital libraries in Kenya.

1.5 Significance of the Study

This study will be useful to the management of AVU and other universities in the country in their bid to improve the library services through the use of ICT technologies.

This study will be of great importance to academicians and future researchers who might be interested in related areas. It will act as a guideline and reference in their subsequent works.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the related literature by various researchers, scholars, analysts and authors. The researcher has drawn materials from several sources based on the theme and the objectives of the study.

2.2 Overview of Libraries in Kenya.

Macmillan library is the oldest library in Kenya, it was established in 1928 under the sponsorship of Lady MacMillan who provided funds for its establishment in the memory of her husband, Sir William Northrup MacMillan. In 1944, a group of Asians in Nairobi also established a public library known as Desai Memorial Library for use by the Asian community (KNLS, 2002). Public libraries were developed along racial lines, they were privately maintained and were not accessible by Africans.

In 1948, the East African Literature bureau was established with its headquarters in Nairobi. East African Literature bureau instituted two services; the book box library services to institutions and postal services to individuals who lived in remote areas (KNLS, 2002). The 1950s saw the inception of academic libraries in Kenya, first with the establishment of the Royal Technical College and its Gandhi Memorial Library in 1954.

The 1960s was a landmark decade for the development of libraries especially public libraries in Kenya as the Kenya National Library Service (KNLS) was established in 1965 by an act of parliament. KNLS began operating in 1969 and opened its first branch in Kisumu in the same year (KNLS, 2002).

During the 1970s more public, academic, special and school libraries were established. Five branch libraries were established by the Kenya National Library Services throughout the country. Several academic libraries were established, notably KU college library in 1972, KIE Library in 1974 and KTTC 1978. The 1980s witnessed the growth and expansion of all types of libraries in the country resulting from the establishment of new academic institution and the increased need for library and information services (KNLS 2002).

Presently some of the libraries are transforming their bibliographic catalogs to online and turning aggressively to the construction of online searching aids that support discovery and use of archival materials, recorded sound, prints, photographs and other special non-bibliographic collections. Research libraries are also aggressively building online journal and reference literature as the libraries gets digital (World Bank, 1998).

Library systems in Kenya consist of academic, special and public libraries, which have distinct orientation of services to their areas of focus. Academic libraries comprise those of six public university libraries, the five chartered private universities, four national polytechnic libraries and libraries of teacher training colleges and other publicly or privately sponsored tertiary colleges (Daniel, 1996). Academic libraries also comprise those in primary, secondary and special schools both privately and publicly funded. The academic libraries provide reading materials for primary school and secondary pupils mostly for academic and leisure purposes. The key role of the university library is to provide information service in support of teaching and research service. The achievement of this mission requires the development of standards to address the ways in which goals are developed, needed resources estimated, and success in goals evaluated (Aissa, 1999).

Public and community libraries are managed by the Kenya National Library Service (KNLS). Public library provides two programmes of services that bear some possibilities for replication – the camel mobile library and the bookbox scheme. The indications are that both services are being heavily used and have contributed to increasing the success of students in their examinations. Additionally, the Kenya National Library Service (KNLS) has introduced two new activities, the AIDS-awareness and the Braille unit.(Aissa, 1999).

Public and community libraries in Kenya are experiencing serious problems, particularly in terms of their infrastructural capacities and financing (Aissa, 1999). All public libraries in Kenya report financial difficulties with no solutions identified as yet. However, despite the existence of these constraints, the number of library users has increased in the last few years and the pressure for study facilities has led to continued growth in demand. Suggestions advanced for the improvement of services to the public include collaboration with local publishers, based on the fact that if readers can access locally produced information they will use the libraries. Also, the creation of legal mechanisms to operate within the library sector, such as a national book policy and legal deposit, have been suggested as some of the measures to ensure the availability of local information in libraries. According to Aissa (1999), the management of the public library sector needs to be reviewed, and that greater focus on users, through user-needs and user-education surveys, should be developed.

The other category of libraries in Kenya comprise of special libraries. Special libraries comprise those in business, research or government ministries as well as those sponsored or operated by non-governmental organizations, diplomatic missions and international bodies. Examples of business organizations with libraries are the Nation Media Group, East Africa industries and Kenya Commercial Bank. Research institutions include the International Livestock Research Institute,

International Center for Insect and Pest Ecology, Kenya Medical Research Institute and the African Medical Research Foundation. Most of the diplomatic missions in Kenya have libraries notably the British Council Library and the Goethe Library. International organizations with remarkable libraries include United Nations Environmental Programme (UNEP) and the World Bank (KNLS, 2002).

2.3 Introduction of Digital Libraries

A digital library is defined as a managed environment of multimedia materials in digital form, designed for the benefit of its user population, structured to facilitate access to its contents and equipped with aids to navigate the global network with users and holdings totally distributed but managed as a coherent whole (KNLS, 2002). The rise of the digital library is linked to Information and Communication technology (ICT) advancement. It is an integrated set of services for capturing, cataloging, storing, searching, protecting and retrieving information (Fremont, 1995).

Higher education can be served well if it supports and maintains the development of digital libraries that contain works of lasting intellectual value including both primary sources that open up and support new lines of scholarship in the arts and sciences. Secondary sources that record and disseminate scholarly activity. Priorities and policies should guide higher education in its approach to the development of digital libraries. The mission of any emerging digital library is to develop, store, provide access and electronically distribute collections of high-quality digital images. digital library should also provide related materials for the study of art, architecture, and other fields in the humanities (Donald, 2001).

2.4 Principles for the Development of Digital Libraries

There are four key principles that are critical in the general development of digital libraries for higher education.

2.4.1 Exploiting the distinctive features of the technology.

Investments in electronic journals such as the materials available from digital library of scholarly journals (JSTOR) and from most major academic publishers have proven to be clear winners because of the economies and ease of use afforded by using the technology to aggregate and search text in thousands of articles. Similar benefits are being achieved for reference works such as encyclopedias and dictionaries though at a slower pace because of the cost required to achieve the right scale for books and monographs (Troll, 2002).

As institutions build digital libraries, some have begun to assemble primary source collections of Web pages, e-mail correspondence, electronic manuscripts, software programs, electronic games, digital art and other uniquely digital artifacts to serve as records of modern culture for future scholars. However many have experimented with digitizing existing collections of primary sources in order to make them more accessible. Many of these projects have digitized the material simply in the hope often unrealized that an audience will emerge that is willing and able to sustain the collection (Troll, 2002).

Many colleges and universities maintain slide libraries of reproductions of works of art. These slide libraries typically contain images of the same canonical artworks taught in nearly all undergraduate curricula. ArtSTOR's Image Gallery aims to create scholarly value by systematically building digital collections of images that it can deliver electronically from a central repository (or a small set of replicated repositories) thereby taking advantage of the technology to avoid the substantial system-wide expense of duplication across institutions (Donald, 2001).

2.4.2 Creating Collections of Coherence and Integrity.

Many of the early efforts to digitize primary sources have placed insufficient emphasis on intellectual integrity and coherence as criteria for selection. In some cases digitizing projects have settled for a “greatest hits” approach which simply illustrates a collection rather than making it available (Troll, 2002). In other cases databases of art images reflect the individual strengths of the museum and other contributors rather than a mutual interest in creating a resource that is genuinely useful to scholars. There are at least two alternatives to these approaches. First, coherence and integrity can be achieved by being comprehensive in digitizing all the existing collection. Secondly, if selectivity is required, scholars who would use the resource being developed must assist in deciding which information is to be included and how it should be directed toward a specific pedagogic or research need (Donald, 2001).

2.4.3 Protection of Intellectual Property Rights

The legitimate rights of content owners must of course be protected. The Mellon Foundation’s experience in developing both ArtSTOR and JSTOR suggests that several distinctions are essential for striking a productive balance between the intellectual property rights of content owners and the interests of scholarly users (Troll, 2002).

Above all commercial uses of copyrighted materials must be rigorously distinguished from non-commercial and educational uses. In the agreements that ArtSTOR has made, for example content owners retain full ownership rights for commercial and other uses while ArtSTOR is granted a limited/non-exclusive license for non-commercial and educational uses. Furthermore, like JSTOR, ArtSTOR will provide a well-regulated environment for such use one in which content is available not to all comers but only to authorized users of subscribing institutions which are subject to a strictly enforced user license (Donald, 2001).

2.4.4 Being Realistic on the Costs Involved

Building digital libraries is expensive. The costs are not just technical but also involve aiming the technology at scholarly goals, carefully selecting content and managing intellectual property. There are other significant costs including those of cataloging. But perhaps the most important and most overlooked costs are those associated with distribution and ongoing support (KNLS, 2002).

Many individuals and institutions are seeking to digitize important materials including art and other visual materials as primary sources for scholarship notwithstanding the size of the projects, isolation of data structure hence end up facing enormous challenges in finding an appropriate means of distribution (Troll, 2002). To achieve large economies of scales for the distribution of digitized scholarly products especially when there is little prospect of attracting commercial investment, a provider must be willing to implement a business model that includes a levy of modest user charges as well as a strategy for building a user community that not only wants but also is able to pay to help support the products through the course of rapidly changing technologies (Donald, 2001).

2.5 AVU Technological Infrastructure

African Virtual University (AVU) uses a technical infrastructure that integrates satellite and web-based technologies to transmit video and data resources from anywhere in the world to the participating institutions in Africa. It also provides the flexibility to incorporate proven and emerging interactive tools and multimedia resources to support student learning and network operations. A combination of live and video-taped instruction, supported by textbooks, a digital library and course notes are provided by the participating universities and content providers. Students interact with their instructors and other students via phone, e-mail, discussion forums or fax (Kavulya, 2004). AVU transmits courses and seminars via N5S803, a C-band international satellite whose footprint covers the entire African continent, Western Europe and the East Coast of the USA and Canada.

Programmes are transmitted through AVU's American hub located at COMSAT Digital Teleport in Maryland, USA (AVU, 1996).

Appropriate and sustainable collection management is one of the key issues in the development of a university library and information system. This includes the purchase of new materials (acquisition), deselecting (weeding) and providing access to other collections outside the campus through resource sharing and co-operation. The primary goal is to select, organize and provide access to all varieties of information for users. Therefore the library should select and acquire materials in all formats to the level required to support academic programs, research and teaching (Stueart, et al, 1977).

2.6 Challenges Facing Digital Libraries

2.6.1 Digital preservation

Digital preservation is the planning, resource allocation and application of preservation methods and technologies necessary to ensure that digital information of continuing value remains accessible and usable. Recording media for digital materials are vulnerable to deterioration and catastrophic loss and even under ideal conditions they are short lived relative to traditional format materials. Preservationists within the library and archival community have been instrumental in developing an array of tools and methodologies to reduce the decay of traditional materials and to restore books and documents that have deteriorated to such an extent that their longevity and usability are threatened (Jewell, 2001). The challenge is the absence of established standards, protocols and proven methods for preserving digital information. With few exceptions digital library research has focused on architectures and systems for information organization and retrieval, presentation and visualization and administration of intellectual property (Greenstein, 2001).

2.6.2 ICT Infrastructure

ICT infrastructure is an impediment to access of information. The infrastructure include components such as high-speed local networks and fast connections to the Internet, relational databases that support a variety of digital formats, full text search engines to index and provide access to resources, a variety of servers such as Web servers and FTP servers and electronic document management functions that will aid in the overall management of digital resources. Libraries need to enhance and upgrade current ICT architectures to accommodate digital materials especially with the rapid changes in technology (Greenstein, 2001).

2.6.3 Data Migration and Storage

Migration of digital materials to new generations of hardware and software are much needed for digital preservation regardless of breakthroughs in mass storage technologies. Planning for migration is difficult because there is limited experience with the types of migrations needed to maintain access to complex digital objects over extended period of time. When a custodian assumes responsibility for preserving a digital object it may be difficult to predict when migration will be necessary, how much reformatting will be needed and how much migration will cost. However, there are no reliable or comprehensive data on costs associated with migrations either for specific technologies and formats or for particular collections. (Wanyembi, 2002).

A digital library's storage system must be capable of storing a large amount of data in a variety of formats and accessing this data as quickly as possible. Text-only documents stored in formats such as ASCII, LaTeX, HTML, SGML and PostScript are by far the easiest to store. Digital audio and video are more difficult to store because they require significantly more storage space and their delivery is time-dependent. Object-oriented database systems are slowly gaining acceptance and overcoming earlier performance and implementation problems (Daniel, 1996).

2.6.4 Copyright right /intellectual property

A key element for digital libraries is appropriate recognition and protection of legal rights such as copyright, publicity, privacy, matters of obscenity and defamation intellectual property - protection as well as less legalistic but serious concerns associated with the ethics of sharing or providing access to folk or ethnographic materials (Stueart, et al 1977).

The copyright law provides for the protection of literary material, works of art and music. Smith (2001) described Copyright as the “single most vexing barrier to digital library development”. The current paper-based concept of copyright breaks down in the digital environment because control of copies is lost. Digital objects are less fixed, easily copied and remotely accessible by multiple users simultaneously. The problem for libraries is that unlike publishers that own their information, libraries are simply caretakers of information. They do not own the copyright of the material they hold. It is unlikely that libraries will ever be able to freely digitize and provide access to the copyrighted materials in their collections (IMLS, 2001). Instead, they will have to develop mechanisms for managing copyright mechanisms that allow them to provide information without violating copyright called rights management.

Rights management functions include usage tracking, identifying and authenticating users, providing the copyright status of each digital object and the restrictions on its use or the fees associated with it and handling transactions with users by allowing only so many copies to be accessed or by charging them for a copy or by passing the request on to a publisher. This is often in conflict with the duties of libraries and archives entrusted with care and management of materials that may be subject to privacy rights or other needs for security (Stueart, et al 1977).

2.6.5 Lack of skilled employees

Information Technology presents a wide variety of technological challenges to employees in an organization. As the IT environment changes this poses a challenge not only for MIS managers but also for academicians (Maier, Clark & Remington, 1998). Despite the need for IS workers increasing over time the identification of the specific skills required for the variety of IS positions is not clear (Noll,2002). Straub and Watson (2001) noted that with the explosion of the internet and other networks like the satellite downlinks and cable TV, systems that have been the historical focus of IS research are being rapidly transmogrified. Most of library employees do not have adequate knowledge on the ICT and IS therefore this is an impediment to the use and access of the digital library.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes the research design, the target population, the sampling design, data collection instruments, sample size and the techniques used in data analysis.

3.2. Research Design

In establishing the challenges facing the use of digital libraries, a descriptive research design was used. According to Kothari (2003) descriptive research design describes the state of affairs as it exists. The design involved conducting a study at Kenyatta University AVU library.

3.3. Target Population.

The target population for this study was the library users and employees of the Kenyatta University AVU library.

3.4. Sampling Design

The population was stratified into two strata namely library employees and library users. The sample for this study was selected through convenience sampling method. A total of 120 respondents (as shown in table 3.1) were sampled from both the users and the employees of Kenyatta University AVU library.

Table 3.1: Sampling Frame

Kenyatta University Library	Total Number in the Library	Sampling Percentage (%)	Sample Size
Employees	200	30	60
Users	6000	1	60
Total	6200		120

Source: Researcher (2006)

3.5. Data Collection Instruments

Primary data was used in the study. This was collected using questionnaires which contained both open ended and close ended questions. The questionnaires were split into two parts. The first part captured demographic information about the respondent while the second part captured challenges to the use of digital libraries by both the users and the employees. The questionnaires were self administered.

3.6. Data Analysis

The data was checked for completeness, edited and coded. Analysis was performed using Statistical Package for Social Sciences (SPSS) to make statistical inferences. The factor analysis and generation of descriptive statistics were used to analyze the data. The data was presented through the use of tables.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.0. Introduction

This chapter presents the analysis of findings gathered from the employees and users of digital libraries. Factor Analysis is the principal data analysis technique. The findings are presented in the form of tables, frequencies and percentages where applicable.

4.1. Characteristics of Respondents

4.1.1. Characteristics of Digital Library Users

The findings established that all the users interviewed were full-time students at Kenyatta University. The users were all within the age category of between 21 and 25 years. Table 4.1 indicates that a cumulative majority of respondents (76.7%) had used the AVU services for a period of two years or less. The rest, 23.3% of the users had used the AVU digital library services for a period of three to five years.

Table 4.1: Duration of digital library usage

Duration	Number of respondents	Percentage of the total
Below 1 year	16	26.7
1-2 years	30	50.0
3-5 years	14	23.3
Total	60	100.0

Source: Researcher (2006)

The findings on Table 4.2 show the frequency at which the users were using the AVU digital library. Majority of the users (44.8%) were using the library on weekly basis while 34.5% said that they hardly ever frequent the library.

Table 4.2: Frequency of using the AVU digital library

Frequency	Number of respondents	Percentage of the total
Daily	4	6.9
Weekly	26	44.8
Monthly	8	13.8
Hardly ever	20	34.5
Total	58	100.0

Source: Researcher (2006)

4.1.2. Characteristics of Digital Library Employees

Majority of the employees interviewed were aged above 30 years. In particular 58.3% were aged between 30 and 34 years while 36.7% were aged between 35 and 39 years. Only 5% of the employees were aged below 30 years. Besides, 95% of the library employees interviewed had attained ‘university’ level of education while the rest had attained the ‘tertiary college’ level of education. Table 4.3 shows that a cumulative majority of the employees (80.0%) had worked at the KU AVU digital library for a period not exceeding two years, 15% had worked at the KU AVU library for a period of between 3 and 5 years, while 5% had worked a period of between 6 and 10 years.

Table 4.3: Duration of working at the AVU digital library

Duration	Number of responses	Percentage of the total
Less than a year	19	31.7
1-2 years	29	48.3
3-5 years	9	15.0
6-10 years	3	5.0
Total	60	100.0

Source: Researcher (2006)

4.2. Principal Component Analysis

4.2.1. Reliability and Validity Assessment

Reliability and validity assessment was used to assess the internal consistency of the resulting scales and validity of constructs within the research questionnaire used. This was achieved by computing Cronbach's alphas using SPSS. According to Hair et al (1995), Cronbach Alpha value of 0.7 is acceptable as cut-off for reliability assessment, although a value greater than 0.6 is regarded as a satisfactory level as earlier suggested by Van de Ven and Ferry (1980). A joint Alpha value of 0.8919 was obtained based on 19 items in the users' questionnaire while a joint alpha value of 0.7523 was obtained based on 20 item in the AVU library employees' questionnaire. This shows that the constructs have adequate reliability for the next stage of analysis.

4.2.2. Principal Component Analysis

An exploratory factor analysis (EFA) based on the principal component method with varimax rotation was conducted using SPSS package to detect the factor structure in the observed variables. First of all, to examine whether the data set was appropriate for a factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Barlett's Test of Sphericity were utilized. As shown in Tables 4.4 and 4.5, the KMO statistic obtained was 0.117 (P-value < 0.001) for employees' data (Table 4.4) and a value of 0.535 (P-value <0.001) for users' data (Table 4.5). Field (2000) recommends that the value of KMO should be greater than 0.5. In comparison with this cut-off level, KMO statistics is sufficiently high for users' data than that for employees' data. However, Barlett's Tests of Sphericity were highly significant (Chi-square = 1527.631 with 190 degree of freedom, at $p < 0.01$) and (Chi-square = 834.102 with 190 degree of freedom, at $p < 0.01$) respectively. These results indicates that the correlation matrices for both data sets were not identity matrices. These results provides an excellent justification for the factor analysis (Kline, 1998). Therefore, it was concluded that a factor analysis of the scale items would be appropriate for both data sets.

Table 4.4: KMO and Bartlett's test based on employees' data

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.117
Bartlett's Test of Sphericity	Approx. Chi-Square	1527.631**
	d.f	190

**** P-value < 0.01 (the critical level of significance for the test)**

Source: Researcher (2006)

Table 4.5: KMO and Bartlett's test based on users' data

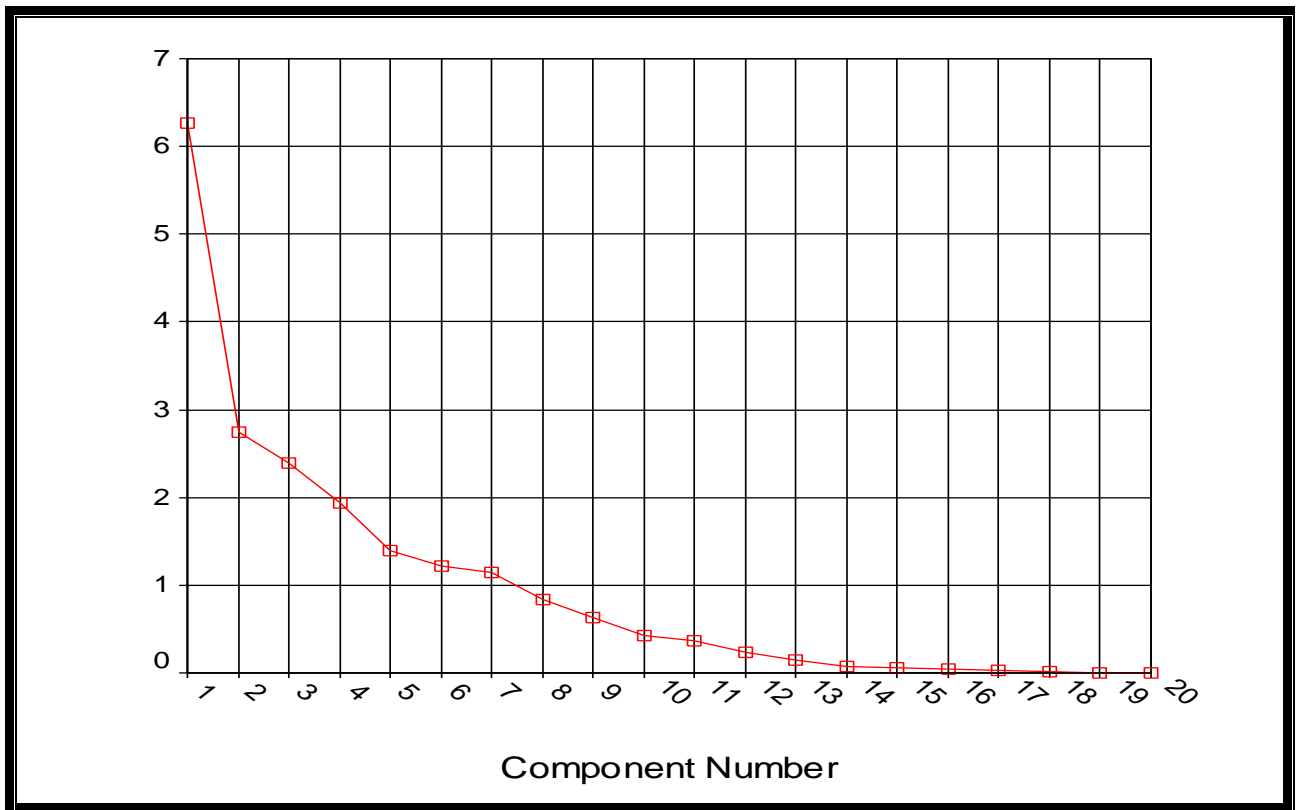
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.535
Bartlett's Test of Sphericity	Approx. Chi-Square	834.102**
	d.f.	190

**** P-value < 0.01 (the critical level of significance for the test)**

Source: Researcher (2006)

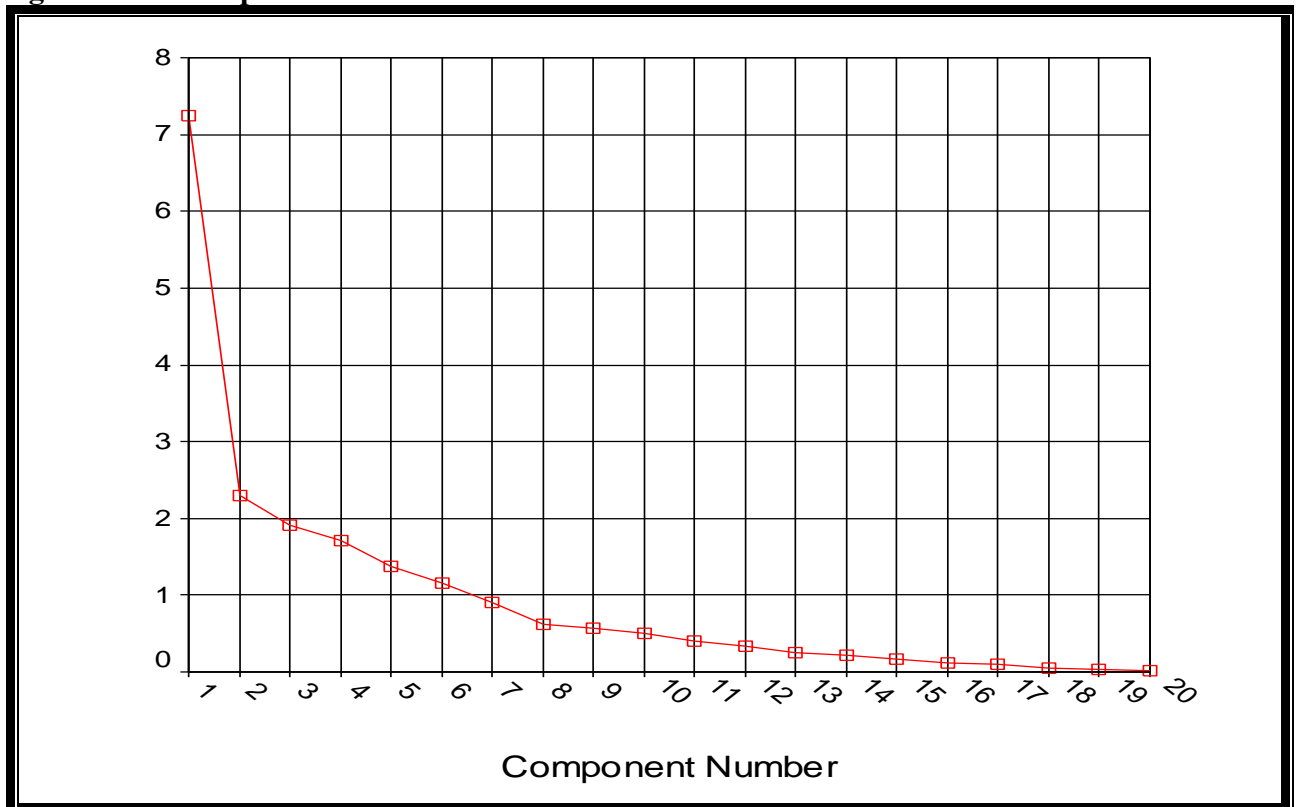
A scree plot was drawn based on the initial statistics from the principal components analysis procedures. For employees' data, the scree plot indicated a clear change in the steepness of the curve at seven components as shown in Figure 4.1 while for users' data the scree plot indicated a clear change in the steepness of the curve at six components as shown in Figure 4.2. This scree test method for the selection of an appropriate number of factors for extraction is generally considered to be the most suitable technique (Kline, 2000). In Figure 4.1, the graph exhibits a declining trend between the first and the seventh component where the eigenvalues go below the 1.0 mark. Likewise, in Figure 4.2 the graph exhibits a declining trend between the first and the sixth component.

Figure 4.1: Scree Plot based on Employees' data



Source: Researcher (2006)

Figure 4.2: Scree plot based on users' data



Source: Researcher (2006)

From the exploratory factor analysis, seven components comprising of 20 items were extracted from employees' data. The components with eigenvalues greater than 1.00 accounted for 85.555% of the total item variance (Table 4.6). Six components comprising of 19 items were extracted from users' data. The components with eigenvalues greater than 1.00 accounted for 78.483% of the total item variance (Table 4.7).

Table 4.6: Total Variance Explained based on responses from AVU library employees

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.269	31.346	31.346	6.269	31.346	31.346	4.223	21.116	21.116
2	2.738	13.690	45.036	2.738	13.690	45.036	2.658	13.291	34.407
3	2.399	11.993	57.029	2.399	11.993	57.029	2.537	12.686	47.092
4	1.942	9.712	66.741	1.942	9.712	66.741	2.364	11.820	58.912
5	1.398	6.992	73.733	1.398	6.992	73.733	2.272	11.359	70.271
6	1.218	6.090	79.823	1.218	6.090	79.823	1.717	8.583	78.854
7	1.146	5.731	85.555	1.146	5.731	85.555	1.340	6.701	85.555

Extraction Method: Principal Component Analysis

Table 4.7: Total Variance Explained based on responses from AVU library Users

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.246	36.230	36.230	7.246	36.230	36.230	3.645	18.224	18.224
2	2.299	11.496	47.727	2.299	11.496	47.727	2.962	14.809	33.033
3	1.912	9.561	57.287	1.912	9.561	57.287	2.401	12.004	45.037
4	1.713	8.564	65.851	1.713	8.564	65.851	2.332	11.661	56.698
5	1.377	6.884	72.735	1.377	6.884	72.735	2.327	11.636	68.333
6	1.150	5.748	78.483	1.150	5.748	78.483	2.030	10.150	78.483

Extraction Method: Principal Component Analysis

Hair et al (1995) suggested a means of determining the minimum loading necessary to include an item in its respective construct. According to Hair et al (1995) the variables with loadings greater than 0.3 are considered significant, loadings greater than 0.4, more important and loadings 0.5 or greater were very significant. During principal component analysis, only variables with factor loadings of 0.40 or higher were retained. The results of factor analysis are shown in Tables 4.8 and 4.9 for employees and users respectively. Seven components were used to build the key factors based

on 18 items from the employees' data (Table 4.8) while the users' data generated six components based on 19 components.

Table 4.8: Rotated Component Matrix Based on Employees' data

No.		Component						
		1	2	3	4	5	6	7
1.	Lack of reliable system power UPS	.919						
2.	Poor Reliability of Information System running the digital facility	.841						
3.	Absence of established standards for documents preservation	.802						
4.	Lack of awareness about the digital library	.645						
5.	Outdated acquisition policies	.588						
6.	Resistance of users from paper to digital	.586						
7.	Inappropriate search engine		.858					
8.	Poor presentation of data digitally		.643					
9.	High Cost of accessing relevant materials		.580					
10.	Poor user interface of the system		.540					
11.	Lack of preservation policy			.859				
12.	Poor infrastructure or migration technology			.628				
13.	Lack of knowledge in the use of the information system				.921			
14.	Slow speed of information search and retrieval				.659			
15.	Lack of Standby generators					.697		
16.	Poor internet connectivity						.862	
17.	Technological obsolesce in terms of cost security and Number of connections						.535	
18.	Lack of training							.895

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 10 iterations.

Table 4.9: Rotated Component Matrix Based on Users' data

No.	Item	Component					
		1	2	3	4	5	6
1.	Technological obsolesce	0.865					
2.	Lack of Copyright laws	0.742					
3.	Poor user interface of the system	0.710					
4.	Resistance of employees to use digital	0.646					
5.	Lack of preservation policy	0.616					
6.	Lack of reliable system power UPS		0.885				
7.	High Cost of accessing relevant materials		0.750				
8.	Poor internet connectivity		0.570				
9.	Slow speed of information search and retrieval		0.519				
10.	Outdated acquisition policies			0.796			
11.	Lack of Stand-by generators			0.607			
12.	Absence of established standards for documents preservation			0.575			
13.	Inappropriate search engine				0.920		
14.	Poor presentation of data digitally				0.489		
15.	Good access to Connecting to global academic environment					0.807	
16.	Poor Reliability of Information System running the digital facility					0.764	
17.	Poor infrastructure and migration technology					0.640	
18.	Lack of awareness about the digital library						0.843
19.	Lack of knowledge in the use of the information system						0.707

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 8 iterations.

By examining the results of Table 4.8, it is evident that the items loaded significantly. Components 7, 6, 5, 4 and 3 had few items. This led to the extraction of 7 factors after the first round of rotation. Table 4.10 shows that the 7 factors explained total of 85.55% of the variance. It also shows that Factor 1 represents 21.116% importance, whereas Factors 2, 3, 4, 5, 6 and 7 represent 13.291%, 12.686%, 11.820%, 11.359%, 8.583%, and 6.701% of variance across all items respectively.

Table 4.10: Total Variance Explained from Factors Based on AVU library Employees

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	4.223	21.116%	21.116%
2	2.658	13.291%	34.407%
3	2.537	12.686%	47.092%
4	2.364	11.820%	58.912%
5	2.272	11.359%	70.271%
6	1.717	8.583%	78.854%
7	1.340	6.701%	85.555%

Extraction Method: Principal Component Analysis.

Source: Researcher (2006)

Similarly, the results of Table 4.9 indicate that all the items loaded significantly with only component 4 and 6 having few items. This led to the extraction of 6 factors after the first round of rotation. Table 4.11 shows that the 6 factors explained total of 78.483% of the variance. It also shows that Factor 1 represents 18.224% importance, whereas Factors 2, 3, 4, 5 and 6 represent 14.809%, 12.004%, 11.661%, 11.636%, and 10.150% of variance across all items respectively.

Table 4.11: Total Variance Explained from Factors Based on AVU library Users

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	3.645	18.224%	18.224%
2	2.962	14.809%	33.033%
3	2.401	12.004%	45.037%
4	2.332	11.661%	56.698%
5	2.327	11.636%	68.333%
6	2.030	10.150%	78.483%

Extraction Method: Principal Component Analysis.

Source: Researcher (2006)

4.3. Challenges Facing Usage of AVU Digital Library

4.3.1. Challenges facing users

The challenges facing users are based on the six factors extracted from the users' responses as tabulated in Table 4.9. The interpretation of the six factors follows:

Factor 1: Consists of five items. The items were all significant with loadings of between 0.616 and 0.865. These are represented in Table 4.9 by items 1, 2, 3, 4 and 5. These challenges are related to the nature of policies applied in the management of digital libraries.

Factor 2: Consists of four items. The items were all significant with loadings of between 0.519 and 0.885. These are represented in Table 4.9 by items 6 through to 9. These challenges are associated with the nature of ICT at the AVU digital libraries. They can therefore be treated as infrastructure-related factors.

Factor 3: Consists of three items. The items were all significant with loadings of between 0.575 and 0.796. These are represented in Table 4.9 by items 10 through to 12. These challenges explain the standards observed in management of the AVU digital libraries and unreliable power supply.

Factor 4: Consists of two items. Both items loaded significantly with loadings of 0.489 and 0.920. These are represented in Table 4.9 by items 13 and 14. These challenges explain the perceptions of users towards design and interactivity of the library management systems applied at the AVU digital libraries. They can therefore be regarded as system design factors.

Factor 5: Consists of three items. The items were all significant with loadings of between 0.640 and 0.807. These are represented in Table 4.9 by items 15, 16 and 17. These challenges explain the

reliability and connectivity of the library management systems applied in the AVU digital libraries. They are hence regarded as connectivity and reliability factors.

Factor 6: Consists of two items. Both items loaded significantly with loadings of between 0.707 and 0.843. These are represented in Table 4.9 by items 18 and 19. These challenges are associated with lack of training to users on usage of AVU digital libraries. They are therefore treated as training-related factors.

4.3.2. Challenges facing Employees

The challenges facing employees are based on the seven factors extracted from the employees' responses as tabulated in Table 4.8. The interpretation of the seven factors follows:

Factor 1: Consists of six items. The items were all significant with loadings of between 0.586 and 0.919. These are represented in Table 4.8 by items 1 through to 6. These challenges refer to reliability of library management systems, standardization, training and attitude towards usage.

Factor 2: Consists of four items. The items loaded significantly with loadings of between 0.540 and 0.858. These are represented in Table 4.8 by items 7, 8, 9 and 10. These challenges refer to human-computer interaction. They can therefore be grouped as system design factors.

Factor 3: Consists of two items. They are serialized in Table 4.8 as items 11 and 12. Both items loaded significantly with loadings of 0.859 and 0.628 respectively. The items jointly address the reliability and connectivity of the library management systems. They are hence regarded as connectivity and reliability factors.

Factor 4: Consists of two items. They are serialized in Table 4.8 as items 13 and 14. Both items loaded significantly with loadings of 0.921 and 0.659 respectively. The challenges associated with lack of training and the infrastructure related factors.

Factor 5: Consists of item 15 only. The item loaded significantly with a loading of 0.697. This stand-alone factor can be regarded as lack of reliable power supply to support library systems within the digital libraries.

Factor 6: Consists of two items. They are serialized in Table 4.8 as items 16 and 17. Both items loaded significantly with loadings of 0.862 and 0.535 respectively. The challenges are associated with the nature of infrastructure at the AVU digital libraries. They can therefore be regarded as infrastructure-related factors.

Factor 7: Consists of item 18. This is identified as lack of training to employees on the usage of digital libraries. The item loaded significantly with a loading of 0.895. It is a stand-alone factor explaining the challenges relating to lack of training.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The chapter provides the summary of findings derived from the study. The chapter also provides a discussion of findings, conclusions and recommendations.

5.2. Discussion of Findings

The broad objective of the study was to establish the challenges facing the use of digital libraries in Kenya. The challenges facing the employees and users of digital libraries at the K.U AVU centre were identified to be caused by broad factors namely: management policies, infrastructure-related factors, issues related to attitude of the users towards digitalization, connectivity and reliability, training-related and system design issues.

Lack of skilled employees is evident at the K.U AVU library.. Most of the employees lack the skills required in the use of the digital library. The proliferation of the internet, security, data growth and data management at the university also poses the challenge to the users. This challenge exists due to constant change in I.S. To counter the challenge, training and skill profiling is required to the library employees and users. This would ensure the library has highly skilled staff and it would also increase self-esteem, commitment and motivation to the employees.

Resistance by the users towards the digital library is evident at the K.U AVU library. This is attributed to the lack of awareness about the importance of the digital library and knowledge in use of the Information systems in the search and retrieval of information as compared to the paper based library and users need to be sensitized on the importance of the use of the digital library.

ICT infrastructure at K.U AVU library is also a major challenge to the access of information. The computers are few and users are forced to share or to wait for long periods. Internet connection at the university is also slow.

Copyright right at the university AVU library is being violated since there are no stringent measures on copyright laws at the centre and control of the digital collection copies is lost as the users at the library can easily copy and make the work even available remotely to multiple users. The library needs to come up with copyright laws to help provide protection for the digital collections at the library. According to Smith (2001) he described copyright as the “single most vexing barrier to digital library development”.

Unreliable power supply at the AVU centre affects the use and access of the information at the library by the users. Although UPS have been installed there is need to implement backup power supply for the library to cater for the power blackouts.

The analysis also shows that K.U AVU library is also facing preservation problems. The library digital materials are vulnerable to deterioration and loss since there is lack of preservation policies which would otherwise guide in the establishment of effective preservation programmes. In the absence of these policies it is impossible to establish preservation standards and apply the necessary preservation methods to help reduce the loss and deterioration of the digital collections. Jewell (2001) discussed the issue of digital preservation as the planning , resource allocation and application of preservation method to ensure that digital information of continuing value remains accessible and usable.

5.3. Conclusions

The study established that the challenges of digital library are generated by factors based on the nature of ICT infrastructure, lack of policies, reliability of internet connectivity, unreliable power supply and attitude of both employees and users. While the short-term objective of the library component of the AVU is to provide access to on-line journals and archived materials, medium- and long-term goals of the library component should be to act as a catalyst for the automation of universities libraries so as to preserve rare collections through scanning and digitization thus making materials available on-line to students, the academic community and the wider public and finally promoting on-line publishing of scholarly work by the university scientific community. These objectives will be easily achieved if the library and institutional administrators provide channels to address the challenges identified by this study.

5.4. Recommendations

5.4.1 Recommendations to the management of AVU libraries

There is need for librarians in-charge of digital libraries to orient and train users and employees on the usage of computers, internet and computer-based library management systems. The management should also seek to equip the libraries with reliable power supplies, provide reliable internal and external connectivity systems, establish appropriate policies to manage information within the digital libraries, acquire friendly and interactive library management systems and run change management programmes for both users and employees.

5.4.2. Recommendations for further research

In spite of the challenges confronting the advancement of digital libraries in Kenya, there is a growing interest in the concept. A similar study can be done with a wider scope which will incorporate other AVU libraries in the country so as to establish whether there are variations in challenges faced by users and employees from one AVU digital library to the next.

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Appendix I: Questionnaire for Library Employees

The questionnaire is meant to collect information on the challenges facing the use of digital libraries in Kenya. A case study of Kenyatta University AVU Library. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as will be applicable.

SECTION A: Demographic Information

1. Which section do you work in? _____

2. What is your age category

1) Less than 29years

2) 30-34 years

3) 35-39 years

4) Over 40years

3. What is your highest level of education?

1) Primary

2) Secondary

3) Tertiary college

4) University

5) Others _____

4. For how long have you been working with this AVU library? (In years)

a) Less than one year

b) 1-2 years

c) 3-5 years

d) 6-10 years

e) Above 10 years

Section B: Challenges facing the use of Digital Library

5. The following section indicates various challenges facing the use of digital library. Please respond by indicating the extent to which you agree or disagree with the challenges highlighted.

{1=Strongly Agree,2=Agree, 3=Neutral, 4=Disagree 5=Strongly Disagree}

	Challenges	1	2	3	4	5
1.	Resistance of users to change from paper to digital					
2	Lack of reliable system power (UPS)					
3	Lack of Stand-by generators					
4	High Cost of accessing relevant materials					
5	Poor user interface of the system					
6	Lack of knowledge in the use of the information system					
7	Lack of Copyright laws					
8	Poor internet connectivity					
9	Poor infrastructure /migration technology					
10	Poor presentation of data digitally					
11	Lack of awareness about the digital library					
12	Poor Reliability of Information System running the digital facility					
13	Good access to Connecting to global academic environment					
14	Slow speed of information search and retrieval					
15	Lack of preservation policy					
16	Outdated acquisition policies					
17	Technological obsolesce in terms of cost security and no. of connection					
18	Absence of established standards for documents preservation					
19	Inappropriate search engine					
20	Lack of training					

21	Others (Please specify)						
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6. To what extent would you agree to the following aspects as relates to the digital library? Rank as follows; (1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree)

Aspects Of Digital Libraries		1	2	3	4	5
A	The development of digital library has improved research work in this institution					
B	Digital library has increased the access to knowledge					
C	Poor infrastructure has hindered the establishment of digital libraries in Kenya					
D	The leadership of the library has contributed to low adoption of ICT library.					
E	Adoption of digital library has lead to improvement of quality of Services Offered by the libraries					
F	Cost of access of digital library discourages the service users					
G	Others (Please specify)					

7. What recommendations would you make to both the management of the library and the university as pertains to digital library?

THANK YOU FOR YOUR RESPONSES

Appendix II: Questionnaire for Library Users

The questionnaire is meant to collect information on the challenges facing the use of digital libraries in Kenya. A case study of Kenyatta University AVU library. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as will be applicable.

Section One: Demographic Information

1. For how long have you been using the AVU digital library services? (In years)

- 1) Less than one year
- 2) 1-2 years
- 3) 3-5 years
- 4) 6-10 years
- 5) Above 10 years

2. Which category do you fall in?

- 1) Full time student
- 2) Part time student
- 3) Others (specify) _____

3. Please indicate your age category

- 1) Less than 20 years
- 2) 21-25 years
- 3) 26-30 years
- 4) 31-40 years
- 5) Over 40 years

4. What is your highest level of education

- 1) Primary
- 2) Secondary
- 3) Tertiary college
- 4) University
- 5) Others _____

5. How often do you use the digital library?

- 1) Daily
- 2) Weekly
- 3) monthly
- 4) Yearly
- 5) Never use at all

Section Two: Challenges Facing the Use of Digital Library

6. The following section indicates various challenges facing the use of digital library. Please respond by indicating the extent to which you agree or disagree with the challenges highlighted.

{1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree}

	Challenges	1	2	3	4	5
1	Resistance of employees to use digital					
2	Lack of reliable system power (UPS)					
3	Lack of Stand-by generators					
4	High Cost of accessing relevant materials					
5	Poor user interface of the system					
6	Lack of knowledge in the use of the information system					
7	Lack of Copyright laws					
8	Poor internet connectivity					
9	Poor infrastructure and migration technology					
10	Poor presentation of data digitally					
11	Lack of awareness about the digital library					
12	Poor Reliability of Information System running the digital facility					
13	Good access to Connecting to global academic environment					
14	Slow speed of information search and retrieval					

15	Lack of preservation policy					
16	Outdated acquisition policies					
17	Technological obsolescence					
18	Absence of established standards for documents preservation					
19	Inappropriate search engine					
20	Others (Please specify)					

7. To what extent would you agree to the following aspects as relates to the digital library? Rank as follows **(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly Disagree)**

	Aspects Of Digital Libraries	1	2	3	4	5
A	The development of digital library has improved research work in this institution					
B	Digital library has increased the access to the general knowledge					
C	Poor infrastructure has hindered the establishment of digital libraries in Kenya					
D	The poor leadership of the library has contributed to low adoption of ICT library.					
E	Adoption of digital library lead to improvement of quality of Services Offered by the libraries					
F	Cost of access of digital library discourages the service users					
G	Others (Please specify)					

8. What recommendation would you make to the management of the AVU digital library that would enhance efficiency in library service delivery?

THANK YOU FOR YOUR RESPONSES