DIGITAL CONTENT MANAGEMENT AND USE AT MOI UNIVERSITY

By

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DECLARATION

Declaration by the Candidate

This research thesis is my original work and has not been presented for a degree in any other University. No part of this thesis may be reproduced without the prior written permission of the author and/or Moi University.

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DEDICATION

This work is dedicated to my family; Jones Nyachiro, Sonya Morara and Benjamin

Morara.

Thanks for all the prayers, encouragement and support.

God bless you!!!

ABSTRACT

Content management poses challenges to institutions of higher learning due to inadequate infrastructure, poor content organisation and management, underutilisation of content, lack of preservation plans and poor e-content security. Consequently, interventions are necessary to mitigate the challenges and enable public universities to achieve academic excellence. The purpose of this study was to examine the types of content generated at Moi University and the strategies for their management. The specific objectives were to: examine the nature of digital content generated at Moi University; analyze the existing methods and strategies for its creation, updating, publishing, translating, archiving and retrieving; and develop a Content Management Framework that will assist Moi University to plan for content management. The study was informed by the OCLC Collections Grid and the Conway Digital Landscape Model. It adopted a mixed method research design which provided an in-depth understanding of the issues investigated. Data was collected from a sample of 4 schools of Moi University from which 40% of lecturers, administrators and ICT staff were purposively selected. Data was collected using both questionnaires and interviews. Key policy makers were interviewed while creators and users of digital content in the respective schools were given questionnaires to complete. Data collected was analyzed qualitatively and quantitatively. The major findings revealed that majority of the respondents have access to computers and related accessories to facilitate their work. Various types of digital content are generated including lecture notes and presentations, course syllabi, theses and dissertations, and examination results. Although the university has no formal content management, it was found that an average number of respondents have personal content management strategies. It is recommended that policies should be formulated to govern creation, access to and use of digital content within Moi University. Training should be done to equip users of ICT in the management of digital content, and workshops and seminars should be carried out to create awareness on content management. The study illustrates the importance of content management and emphasises areas that policy makers should consider. The study concludes that Moi University is actively involved in building and implementation of information systems but the digital content is poorly managed. Consequently, there is need to enhance and facilitate the use of this content among users in Moi University by implementing effective content management strategies and systems.

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LIST OF ABBREVIATIONS AND ACRONYMS

AOL	America Online
ARIS	Academic Register Information System
AVOIR	African Virtual Open Initiatives and Resources
CD-ROM	Compact Disk –Read Only Memory
CMS	Content Management System
IBM	International Business Machines
ICT	Information and Communication Technology
KENET	Kenya Education Network
LMS	Learning Management System
MU	Moi University
MUMB	Moi University Management Board
MU-LIMS	Moi University Learning Information Management System
MU-AIMS	Moi University Administrative Information Management System
MU- HIS	Moi University Hostel Information System
MU-MRMS	Moi University Medical Records Management System
OA	Open Access
OCLC	Online Computer Library Centre
PHP	Hypertext Preprocessor
RDF	Resource Description Framework
TCP/IP	Transfer Control Protocol/Internet Protocol
VLIR – IUC	Flemish Inter-University Council
XML	Extensible Markup Language

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

Institutions of higher learning are custodians of intellectual capital for various professions at different levels. As a result, they need to identify effective strategies for capturing and managing these intellectual assets alongside other types of information that they interact with. With the advent of Information and Communication Technology (ICT), authors of different intellectual works, for example researchers, have advanced tools at their disposal to help them put together and present their ideas in better ways. They are facilitated to store these materials and access it more easily than has been the case before these tools were available. Tools such as word processors, data analyzers, presentation graphics and publishing tools among others have enabled individuals and institutions to capture, manipulate, store and retrieve their intellectual works more efficiently.

ICT has permeated most institutions of higher learning in Kenya albeit at different levels. These institutions seek ways of integrating these technologies into their day-to-day activities ranging from administration to teaching and learning.

In the arena of information capture and management, technological advances have now moved on to Content Management Systems (CMS). Content is generally understood as the subject, idea(s) or story that a piece of writing or a radio or television program deals with. It is also any material, such as writing, pictures or music that appears on a website or CD-ROM (Macmillan Dictionary, 2009). Content can also be defined as everything

that is included in a collection and that is held or included in something for example cultural content, proverbs, art, music, etc. (Ndemo, 2008).

According to Siemens, in Mutula (2008), the term content in literature has generally been used to refer to e-Content such as; e-journals, images, graphics, video, sound, documents, records (e-records), movies, websites, e-government content, online databases, emails, online news and advertisements, software, animations, among others. Besides government, providers of such content to citizenry include, among others: the media, Internet service providers, artists, publishers, mobile phone operators and bloggers. Elsewhere, Mutula (n.d.), defines e-Content as information and knowledge products that are generated, stored, transmitted and retrieved in digital formats.

In the context of this study, content refers to the pieces of information in the organisation (in particular its Web sites, databases and Local Area Networks), and would include theses and dissertations, research papers, lecture notes and presentations, course syllabi, information on structure and duration of academic programs, faculty and administrative staff, advertisements and news, electronic communication to name but a few.

This content is generated as a result of short-term and long-term activities at the institution and includes the ideas and strategies generated at administrative meetings to plan for the successful running of the institution. Content is also created at academic sessions such as lectures, examinations, presentations, workshops, and conferences. Such content can be regarded as local content which Ballantyne in Mutula (2008) refers to as locally-owned and adapted knowledge. This content may be in print and/or electronic formats and enables people to draw on resources in their immediate

neighbourhood making them less dependent on outside supplies, which may be costly, scarce and irregularly available. As Mutula (ibid.) further puts it, local content provides the means of satisfying internal needs, enhances self-reliance, helps bridge intra and extra digital divide, enhances community access to content and in general gives a community identity as it mirrors real life situations and operations.

Mutula and Wamukoya (2007) define content management as a set of processes and technologies that support the generation, dissemination and use of content. They define 'content' as any type of digital information comprising text, e-journals, images, graphics, video, websites, online databases, and software. According to Cox (2002), it is perhaps easiest to define content management in terms of the benefits that organizations seek from it, namely that it allows anyone to contribute content to a website, without any prior technical knowledge, and yet allows for control (workflow and approval) to be maintained. It also gives organizations the ability to maintain a website more efficiently by being able to quickly change the look and feel or structure of the site, while maintaining the integrity of internal links. Further, it allows easy reuse of the same data in multiple places or its presentation in multiple forms such that the same content can appear as a word document or in html or pdf or other yet unthought-of formats.

As noted by Cox (2002), content management is most obviously concerned with text, and especially with managing a website, but the requirement exists equally to manage other content such as bibliographic data, digital images, learning materials and links.

According to Byrne, in Souer *et al.* (2007), a Content Management System (CMS) is a system that supports the collection, creation, administration, publication and distribution of information. A CMS can be defined as a group of business rules and editorial

processes applied to content by people and organizations to align efforts of online publication with the business goals.

Mutula and Wamukoya (2007) further define a CMS as computer software used to assist its users in the process of content management. The authors, quoting Software Perfect (2005) say the primary purpose of software in content management is to manage the organization's content effectively by combining rules, processes, and/or workflows in such a way that the electronic storage is deemed to be managed rather than unmanaged.

Generally, CMS can take various forms including web content management systems which manage websites, document management systems, systems for the management of newspaper and editorial information, workflow for article publications, or single source content management system where content is stored in chunks within a relational database.

1.2 Background Information

According to Kashorda and Waema (2007), the use of Information and Communication Technologies (ICT) in higher education institutions has the potential to enhance the quality of teaching and learning, the research productivity of the faculty and students, and the management and effectiveness of institutions. Kenya has already developed policies that articulate the significance of ICT in higher education.

ICT is an enabler for Content Management. It facilitates creation, manipulation, publishing, and use of content in multiple forms including text and multimedia. In many of the public universities today, several initiatives are ongoing to introduce ICT to the day-to-day activities of the institutions including teaching and learning, administrative

work, research work among others. An example is the ongoing VLIR-IUC-Moi University project that seeks to improve ICT facilities and curriculum at the university. Initiatives such as the Kenya Education Network (KENET) also seek to create awareness of various ICT issues and importance of implementation of the same in educational institutions in Kenya. Moi University is currently in the process of introducing open and distance learning programs and without well developed ICT infrastructure, the programs may flounder.

According to Mutula (2008), academic activities at most universities worldwide are no longer centred on the use of printed materials only as has historically been the case where libraries with their physical collections of books, journals and documents were at the heart of universities. Academic work is being transformed as the shift takes place from print media such as books to the Internet and digital media including graphics, audio and video. Foot, in Mutula (2008), says that the rapid development of digital technologies, open courseware, Open Access (OA) publishing and the emergence of Web 2.0 is revolutionizing scholarship, publishing, and the storing and preservation of information. Increasingly now than before, most knowledge or art is being created, produced, analyzed, distributed, published, and/or displayed in a digital medium, for the purpose of research or teaching, entertainment and general information.

Further, as Mutula (2008) puts it, ICT has created opportunities and platforms for scholars to work collaboratively and increasingly now, universities that are highly rated are judged on the quality and applications of their digital technologies, their web content output and their web presence. According to Cybermetrics Lab (2009) which does global ranking of universities, web presence measures the activity and visibility of

the institutions and it is a good indicator of impact and prestige of universities. Rank summarizes the global performance of the university, provides information for candidate students and scholars, and reflects the commitment to the dissemination of scientific knowledge.

Unfortunately, most universities in Africa, excluding some in Southern Africa, continue to be poorly rated on the global scene. Many of them have poorly developed ICT infrastructure, continue to use chalk and board technologies in the delivery of academic materials, have underdeveloped and or underutilised Internet technologies and have little or no web presence. As this study reveals, very few (about a third) of the academic staff at Moi University regularly publish their research findings on the web. This contributed to the reason why in 2009, Moi University was ranked 86 in Africa and 7,965 globally by the Cybermetrics Lab. As the Lab advises, if the web performance of an institution is below the expected position according to their academic excellence, university authorities should reconsider their web policy, promoting substantial increases of the volume and quality of their electronic publications.

1.3 Content Management Infrastructure at Moi University

Moi University (MU) was established in 1984 as the second public university in Kenya, by an Act of Parliament, the Moi University Act of 1984 (www.mu.ac.ke). Initially started with the pioneer Faculty of Forest Resources and Wildlife Management, the number of schools has since grown to fourteen in 2008. The university has established 4 major campuses (as at 2009), namely Main Campus, Chepkoilel Campus, Town Campus and Eldoret West Campus. In addition to these, between 2007 and 2008, several satellite campuses have been established in various towns in Kenya, namely Nairobi, Kericho, Rongo, Kitale, Karatina, and Yala. According to the Moi University

Website (2009), the current student population stands at over 20,000 while staff are 3,253 spread out on 3 campuses (Main, Town and Eldoret West) and 3 constituent colleges (Kabianga, Chepkoilel and Narok). The administration and management of the university comprises the Chancellor, the University Council, Vice Chancellor, two Deputy Vice Chancellors, Chief Administrative Officer, Chief Academic Officer, Principals of the respective satellite campuses and a Finance Officer (Moi University Strategic Plan, 2005-2015)

In 1998, Moi University established an ICT Centre whose mission is "to effectively conceive, develop, implement, utilize, and manage appropriate information systems in order to provide integrated and coordinated quality ICT services to MU in line with its vision, mission and objectives" (Moi University Website, 2009). Some of the services offered to the university community by the ICT Centre include: E-mail services and Internet access, data communication, infrastructure (backbone network) maintenance, ICT training to end-users, database administration and software development, ICT consultancy, end – user support and help desk services (hardware, software and general ICT), Management of Information Systems (MIS) and maintenance of the Moi University Website.

Implementing ICT and related services at Moi University has led to generation of enormous amounts of digital content in the daily functions of the institution. The university maintains a functional website that is currently hosted by Linkoping University, Sweden. The ICT Centre staff, working in collaboration with the Public Relations Office and the individual schools and departments, is in charge of updating the Web content. Generally, content on the website includes information about the

academic programs in different schools of the university, current and upcoming events such as workshops and conferences, staff lists, and links to the different schools, departments and the library.

However, the ICT centre is currently facing some challenges that have compromised the quality of content on the MU Website, namely lack of updated content/information from some sections in the university whereby these departments send in updated information late or some not at all. This means that much of the time, the content on the website is out of date and sometimes even wrong. Another challenge has been the inadequate technical staff at Directorate of ICT (few staff working campus wide). This has compromised the amount of time and effort available to ensure that the data and information on the website is correct and up-to-date. It was observed that the university currently has no clear policy or guidelines to provide comprehensive and sufficiently adequate content that should be posted to the Internet.

In addition to content on the website, other content is generated by individuals across the different departments of the university. This includes electronic and manual databases containing student and personnel information, course content generated by the academic staff, electronic mail communications between members of the university and with the outside community, examination and continuous assessment materials, students' projects, theses and dissertations, student performances in the arts (held in audio and video formats), bibliographic data, software, among others.

Some of the existing and planned information systems of the university and the content they handle are discussed below.

1.3.1 Information Systems at MU

The university currently has a variety of Information Systems projects which are either already undergoing development or are yet to be initiated. These include:

Academic Register Information System (ARIS)

This is an integrated application software for managing student academic data, degree programs, academic departments, curriculum/courses, examinations, timetabling and academic staff data. The software is grouped into three main modules namely: ARIS Students Records Manager, ARIS Students Performance (Examination) Module, and ARIS Rostering Module, which is the timetabling module. The initiation of this project dates back to 2001 but to-date it has not yet been implemented. According to the ICT centre staff, this delay in implementation has been due to several challenges, such as lack of connectivity to some ARIS end-user functional units e.g. the constituent campuses, lack of adequate knowledge in ICT for some end-users, inadequate staffing in the functional units, lack of funds to support implementation of ARIS and ICT and resistance to change by some end-users. ARIS also had some technical problems that caused its failure. These included poor internet connectivity, the design of the system was not web-based and was therefore too demanding to install. The system required Delphi and SQL and other utilities to be installed and could not work with Windows 98. Another major setback was that the development of the system was not completed. The project was cut short before completion and upgrade of the ARIS system therefore it was not fully functional. For example, the system could not produce transcripts, consolidated mark sheets and nominal rolls in spite of capturing the requisite data. It could only produce simple reports such as student and course lists.

Moi University Learning Information Management System (MU-LIMS)

The aim of MU-LIMS is to manage academic business, library and research processes. The project is currently in place and involves the development of open source solutions for academic records, Library automation and e-learning. The stakeholders of this project are Moi University Management Board (MUMB), ICT Center, Directorate of Open and Distance Learning, Library, Student Affairs, Admissions, Teaching staff, Examinations and decentralized units within the schools that are charged with the responsibility of student performance monitoring.

Moi University Administrative Information Management System (MU-AIMS)

The aim of MU-AIMS will be to automate the general administrative functions and manage staff records. The system will be confined to the central administration and the main stakeholders in this project are University Council, MUMB, Council and Senate committees, ICT Centre, the relevant sections responsible for both academic and non-academic staff recruitment, academic staff development and non-academic personnel department.

Moi University Hostel Information System (MU- HIS)

Among the project objectives will be to ensure efficient and effective room searching and allocation of university hostels and other halls of residence within the university, to account for residential/non-residential status of all university students and to monitor catering utilization and provision of meals.

The stakeholders of this project are MUMB, ICT Center, Student Affairs, Catering and Hostels sections at the Main Campus, Town Campus and Chepkoilel Campus and Administration (by the time of the study).

Moi University Medical Records Management System (MU-MRMS)

The Moi University Medical Records Information System (MU-MRMS) will support health facilities' administrative functions related to drugs, staff and student medical records.

The objectives of the proposed information system will be to: track drugs from acquisition to dispensing stages, maintain a real-time record of drug stocks and prompt re-order(s), maintain up-to-date records of student and staff medical status and facilitate data querying for purposes of planning and research.

The system will be administered at Clinic and Administration levels and the stakeholders of this project are MUMB, ICT Center, clinics at the Main Campus, Town Campus and Chepkoilel Campus and Administration.

In general, it is evident that at Moi University, a lot of content is currently being generated by the existing systems whether manual or automated. Many information systems are also being planned for whose information and knowledge products will add to the content already being generated. An effective strategy is therefore necessary to manage the large amounts of content that will be generated and used.

Chisimba

According to the African Virtual Open Initiatives and Resources (AVOIR) (2008), Chisimba is a Web 2.0 enabled Free Software development framework for creating web and distributed applications. Written in PHP5 using the Model-View-Controller (MVC) architectural paradigm, and implemented via the front controller to facilitate cross modular functionality, it has over 100 modules available. As Chisimba uses a PHP-based templating system, developers can easily make extensions. Customizing skins is a

simple process allowing developers to alter the look and feel to suit their preference. AVOIR further explains that the Chisimba framework provides the functionality to create a variety of systems and platforms such as: Content Management System (CMS), Learning Management System (LMS), Collaboration Platform, Blog, Podcasting Solutions, Wikis and many others.

At the moment, Moi University is using the LMS platform of the Chisimba framework to implement its e-learning programs. The platform is referred to as MUSOMI and was implemented as from 2007. The platform is connected to the university intranet and Internet thus can be accessed from any location (Tarus, 2010). In the implementation, several training sessions were carried out to introduce both e-learning concepts in general and use of the Chisimba system to implement and manage e-learning. Most notably, the training focused on content generation and targeted both the ICT technical staff (configuration of the system) and lecturers from the different schools to pilot the e-learning (Shitote, 2009).

1.4 Statement of the Problem

In institutions of higher learning in Kenya, digital content exists arising from the intellectual and administrative activities of the faculty members of these institutions. The academic communities in these institutions engage in various pursuits such as research, teaching, and communication that generate content in the form of information and knowledge products. Currently, organizations are increasingly positioning themselves on the Internet through a Website, which according to Answers.com (2009), is a set of interconnected web pages. These pages usually include a homepage, are generally located on the same server, and are prepared and maintained as a collection of information by a person, group, or organization. Moi University has a corporate website

and maintains intranets which provide access to information about the institution, the programs and services it offers, news and upcoming events, partnerships and ongoing projects among others. Unfortunately, this content on the institutional website is not effectively and efficiently managed. Fragmentation of information due to poor strategies of collecting, capturing and managing content is common in the university. A spot check on the website reveals information on activities that have long passed but are still categorized as upcoming events. This suggests that the institution is experiencing problems with information capture, access and management and requires a more effective strategy to facilitate this. As Robertson (2002) puts it, a Content Management System is a necessity when maintaining a large corporate website or intranet. Moi University does not have such a system in place.

Presently, Moi University lacks a formal coherent strategy and framework to identify the digital content generated at its different units of operation and by its staff and students. Furthermore, once the content has been identified, strategies for its management must then be implemented and relevant software for this developed. The study sought to identify the types of content generated and used in the university and to formulate a content management framework that will help the institution to adequately manage its content.

1.5 Aim of the Study

The aim of the study was to examine digital content management at Moi University and propose a framework to enhance its management in line with international best practice.

1.6 Objectives of the Study

The specific objectives that guided the study were to:

a) Examine the nature of digital content generated at Moi University.

b) Analyze the existing methods and strategies for creation, update, publishing, translating, archiving and retrieving digital content in Moi University.

c) Assess user satisfaction with the existing content management strategies in facilitating access and retrieval of digital content

d) Examine global best practices in content management.

e) Establish the challenges experienced in managing digital content in Moi University.

f) Develop a Content Management Framework that will assist Moi University to plan for content management.

g) Develop a prototype to demonstrate the use of CMS to manage digital content at Moi University.

1.7 Research Questions

In order to realise the objectives outlined above, the study concentrated on the following research questions:

a) What types of digital content are generated at Moi University?

b) What methods and strategies are there for creating, updating, publishing, translating, archiving and retrieving digital content in Moi University?

c) To what extent are users satisfied with the existing methods of digital content management at Moi University?

d) What are the global best practices in content management?

e) What are the challenges of managing digital content at Moi University?

f) How can content management be improved at Moi University?

g) What content management framework can be proposed to assist Moi University implement content management strategies and systems more effectively?

1.8 Assumptions of the Study

The study was guided by the following assumptions:

a) There is need for the use of digital content among various stakeholders in Moi University.

b) Digital content in Moi University is poorly managed due to lack of a policy framework for management and coordination.

1.9 Significance of the Study

In an academic setting such as Moi University, a lot of data, information and knowledge is generated daily. It has been found that content management is vital to improved access to organization-wide information and knowledge assets which can be utilized effectively for competitive advantage. To this end, the findings and recommendations of this study and the resulting framework that were developed are expected to demonstrate the usefulness and increase understanding of content management systems in preservation and management of intellectual assets and other related information in digital format.

The framework that was generated by the study will chart the way forward for knowledge and content management activities in the institution. It will help lay the foundation structures for information creation and access among members of the university community and will, by extension, enhance research activities in the university. The findings from the study and the resulting framework are also significant

for practitioners who may take them up for implementation in different settings where content management is important.

The findings of the study contribute to knowledge by providing useful data for baseline studies in the area of content management especially regarding an academic setting. With regard to availability of local content on the topic of content management, the findings go a long way to enhancing the otherwise limited literature. Additionally, these findings and the resulting framework can be replicated in other similar public universities as they seek to be centres of excellence in knowledge dissemination.

The study suggests further studies in content management that could impact on shaping future research in this area. These include an assessment of the readiness of the institution for digital scholarship and administration; and the extent of the use of Web 2.0 technologies amongst students and staff and how the benefits of such user generated content could be harnessed more effectively.

1.10 Scope and Limitations of the Research

Scope

The study concentrated on content management in Moi University. The study covered two campuses of the university, Main Campus and Chepkoilel Campus. However, Chepkoilel Campus has since January 2011 changed status to a constituent college of Moi University.

Content management at the university was chosen because of the high level of intellectual output that results from the academic activities of the institution and the important role that this information is expected to play in the development of the country as a whole. In addition, it is the universities that are expected to be at the

forefront of research activities and therefore they need to manage whatever data and information they have in order to facilitate research activities at that level.

The study concentrated more on the teaching staff who are actually the key personnel in creating and using digital content at the institution. This they do in their day-to-day teaching, research and communication activities which are the core business of the institution. An additional perspective on content creation and use was obtained from the administrative personnel of the institution.

On aspects of content, the study was more interested in the content available on the website since this was more accessible to scrutiny by the researcher as opposed to content found on personal computers, CD-ROMS, communications such as emails among others. The researcher did not require any permission to peruse the university website which activity was definitely not possible for other storage areas of digital content.

Limitations

Moi University was purposively selected out of the Kenyan public universities to narrow down the otherwise wide scope of the study. This university was conveniently sampled because of the proximity to the residence of the researcher who is also an employee of the university. The researcher found that studying the university as a case would enable her to carry out the study more conveniently and obtain the required information more easily. The study can, however, be replicated at similar institutions of higher learning.

The researcher experienced limitations in terms of availability of local literature on the topic under study. It was evident from the available literature that was reviewed that a

similar study has not been carried out locally and thus the researcher had to rely on studies conducted in other geographical areas to conceptualise the study. This information was available almost exclusively through the Internet.

1.11 Definition of Operational Terms

Content: In this context, it is defined by Siemens, in Mutula (2008), to refer to e-Content such as: e-journals, images, graphics, video, sound, documents, records (e-records), movies, websites, e-government content, online databases, emails, online news and advertisements, software, animations, etc.

Content Management: Mutula and Wamukoya (2007) define content management as a set of processes and technologies that support the generation, dissemination and use of content

Content Management Systems: According to Byrne, in Souer, Honders, Versendaal, Brinkkemper & Nijmegen (2007), a content management system (CMS) is a system that supports the collection, creation, administration, publication and distribution of information.

Data: The Pocket Oxford Dictionary defines data as known facts used for inference or in reckoning.

Extranet: The Free Dictionary (2010) defines an extranet as an extension of an institution's intranet, especially over the World Wide Web, enabling communication between the institution and people it deals with, often by providing limited access to its intranet.

ICT Infrastructure: According to SearchDataCenter.com (2010), infrastructure in IT and on the Internet refers to the physical hardware used to interconnect computers and users. It includes the transmission media, including telephone lines, cable television lines and satellites and antennas, routers, aggregators, repeaters and other devices that control transmission paths. It also includes the software used to send, receive and manage the signals that are transmitted.

Information: Information is summarized data or otherwise manipulated data that is useful for decision-making.

Information and Communication Technology (ICT): The Free On-line Dictionary of Computing (2010) defines ICT as the study of the technology used to handle information and communication. It encompasses areas such as telephony, broadcast media and all types of audio and video processing and transmission

Information Architecture: The Institute of Information Architecture (2007) defines Information Architecture (IA) as the art and science of organizing and labeling websites, intranets, online communities, and software to support usability and findability.

Infostructure: This is the layout of information so that it can be navigated. It is the result of organising information in a useful fashion and includes examples such as a table of contents, a bibliography or an index (Tilton, 1994).

Intellectual Capital: According to SearchCRM.com (2009), intellectual capital is knowledge that can be exploited for some money-making or other useful purpose. The term combines the idea of the intellect or brain-power with the economic concept of

capital; the saving of entitled benefits so that they can be invested in producing more goods and services. Intellectual capital can include the skills and knowledge that a company has developed about how to make its goods or services; individual employees or groups of employees whose knowledge is deemed critical to a company's continued success; and its aggregation of documents about processes, customers, research results, and other information that might have value for a competitor that is not common knowledge.

Intranet: Intranet is defined by The Free Dictionary (2010) as a privately maintained computer network that can be accessed only by authorized persons, especially members or employees of the organization that owns it.

Knowledge: The Compact Oxford English Dictionary (2010) defines knowledge in different ways. First, it is the expertise and skills acquired by a person through experience or education, i.e. the theoretical or practical understanding of a subject. Secondly it is 'what' is known in a particular field or in total, facts and information, and thirdly, it is the awareness or familiarity gained by experience of a fact or situation.

Knowledge Management: von Krogh in Alavi and Leidner (2001) says Knowledge Management (KM) refers to identifying and leveraging the collective knowledge in an organization to help the organization compete

Portal: According to PC Magazine Encyclopedia (2010), a portal is a web "supersite" that provides a variety of services including Web search, news, blogs, discussion groups, shopping and links to other sites. The major general-purpose portals are Google, Yahoo!, MSN and AOL, all of which offer free Web-based e-mail accounts.

Website: According to Answers.com (2009), a website is a set of interconnected web pages, usually including a homepage, generally located on the same server, and prepared and maintained as a collection of information by a person, group, or organization.

1.12 The Organization of the Rest of the Thesis

The remaining part of the thesis comprises Chapter Two which presents the literature review, Chapter Three which describes the methodology, Chapter Four which covers data presentation, analysis and interpretation, Chapter Five which is the systems analysis and design and Chapter Six which gives the summary, conclusions and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature on the subject of the study. It reports on works by different authors on diverse approaches to the subjects of content management and information management in the light of their emerging importance in modern organizations. It is imperative to examine global best practices in content management with a view of better understanding accepted methods and approaches to the subject. This chapter also addresses one of the objectives of the study namely 'to examine global best practices in content management'.

Rowley and Slack (2004) point out that a literature review is a summary of a subject field that supports the identification of specific research questions. Further, it distils the existing literature in a subject field and is important in identifying the literature to which the research will make a contribution and contextualizing the research within that literature. According to LeCompte, Klinger, Campbell, and Menke, in Randolph (2009), conducting a literature review is a means of demonstrating an author's knowledge about a particular field of study, including vocabulary, theories, key variables and phenomena, and its methods and history. They further elaborate that conducting a literature review also informs the student of the influential researchers and research groups in the field.

Analysis of various works on the critical role of content management systems in modern organizations formed a focal point around which this study was formed. Santa, in Adeyinka (2008), suggests that that review of relevant empirical literature should be placed in the context of its contribution to the understanding of the subject under study;

describe the relationship of each work to the others under consideration; and identify new ways, interpret, and shed light on any gaps in previous research.

Much of the documentary review for this study focused on research papers accessible online via the Internet in addition to books and journals in print format.

2.2 Theoretical Framework

Theories and models which support the need for adaptation of content management systems are an important focus of this chapter. Kerlinger, in Cresswell (2002), defines a theory as "a set of interrelated constructs (variables), definitions and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena". Cresswell (ibid.) explains that the theory would provide an explanation as to why an independent variable, X, would influence or affect a dependent variable, Y.

According to Cresswell (2002), theories develop when researchers test a prediction many times, usually in different settings and with different populations. Thomas, in Cresswell (2002), further explains that theories develop as explanations to advance knowledge in particular fields. Theories can serve as a basis for further research in some fields of knowledge and as Gilbert (2001) emphasizes, they highlight particular features of the world as significant thus directing the researcher's attention towards certain forms of behaviour. They can suggest certain kinds of research questions as well as directly influencing the kinds of research method used.

As Cresswell (2002) explains, researchers can state their theories in several ways. They can be represented as a series of hypotheses, "if … then" logic statements or as visual models that can be used to portray associations among variables in a relationship.

The main models that guided the literature review in this study were the OCLC Collections Grid by Lorcan Dempsey and Eric Childress of OCLC Research and the Conway Content Landscape Model by Paul Conway. These models were important to the study as they provided a guide to isolation of digital content that would be relevant in an academic setting and then pointed out the management issues that are critical for effective administration and use of this content.

The Collections Grid from OCLC

The collections grid was developed by Lorcan Dempsey and Eric Childress of OCLC Research as a simple way to represent an increasingly complex universe. The realisation is that the spectrum of materials that currently comprise the actual and potential collections of libraries of all types, museums, archives and historical societies is increasingly diverse. The grid provides a spatial framework for these collections of content (OCLC, 2003).

The grid divides collection materials into four general categories (quadrants), each representing a distinct group of resources. The vertical axis of the grid represents the degree of "uniqueness" of the content; the horizontal axis represents "stewardship" or the degree of custodial care that the resources require.
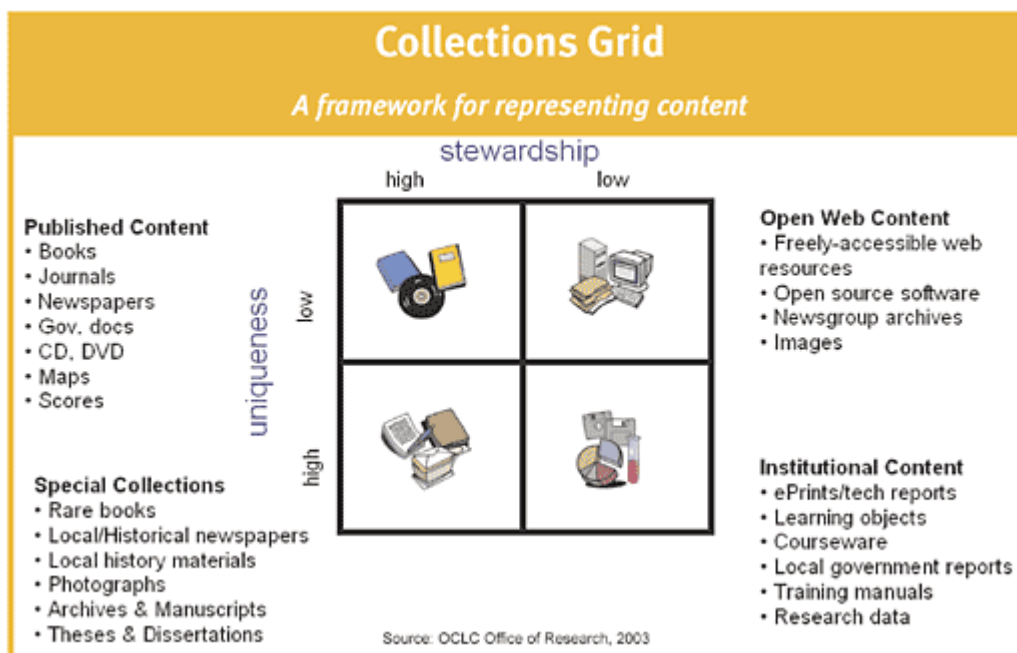
Figure 2.1: The OCLC Collections Grid

Source: OCLC (2003)

Collections Grid Definition

Dempsey and Childress describe the quadrants according to different types of content that could be found for example in a collection such as that in a library. The upper left quadrant illustrates "published" information. Published content includes books, magazines and newspapers, scholarly journals, government documents, CDs, DVDs/videos and published maps and scores. These materials can be either print, electronic or both. The authors explain that libraries traditionally have been focused on acquiring, managing and presenting these published resources, whether they are purchased, licensed or linked to. Well-established practices have facilitated management of these non-unique, published materials, and mature, fully developed standards have reduced libraries' burden of metadata creation. In short, the library's role in this domain has been clear.

The grid's upper right quadrant illustrates resources available on the Web to anyone. Dempsey and Childress observe that Open Web Content includes freely accessible Web sites, open-source software, newsgroup archives and images. According to them, although these materials are not unique, they're not published in the traditional sense. These materials are likely to be unmanaged (and may be unmanageable). They opine that libraries' role in acquiring, managing and presenting this content is not clear yet. Emerging standards are immature at best, and there are no established practices for collection management of these materials.

The lower left quadrant houses 'Special Collections', which according to Dempsey and Childress, represents content often found in the special collections of libraries. For museums and historical societies this material comprises a substantial proportion of their collections. In this category, the authors describe content which includes rare books, local and historical newspapers, local history materials, photographs, manuscripts, theses and dissertations. They explain that, often unique, these materials are usually "high maintenance," requiring special physical environments, access (both bibliographic and physical) and preservation. The authors caution that immature standards mean a high burden of metadata creation for libraries and archives. In this domain, they observe that the institutional focus moves from acquiring, managing and distributing published materials to acting as "publisher" and curator. Since these resources "belong" to the institution, the institution's new role as knowledge creator is less clear.

The Lower right quadrant, according to Dempsey and Childress, is the 'Institutional Content' quadrant where, for academic libraries, learning and research materials dwell,

including such resources as learning objects, courseware, e-portfolios, e-prints, technical reports and research data. On the other hand, for public, state or school libraries, these materials might include local government reports, internal training manuals and tutorials, minutes of board meetings, budget reports, vertical files and so on. Additionally, in a corporate library this content could include e-mail, proprietary financial reports and information, and policies and procedures.

The authors clarify that most institutional content is unique to the institution, and traditionally, libraries have not managed it by formally collecting or by providing bibliographic control. They observe that the lack of standards, or at best the presence of very immature emerging standards, means there is a high burden of metadata creation. Of note is that institutional content is often unpublished, but it belongs to the creators who are faculty, researchers, trainers, elected officials, committees, employees and advisory boards.

Conway (2008) observes that the OCLC Collections Grid gives priority value to those special collections materials with high stewardship and uniqueness values – the very sort of materials that endow research institutions with distinctive collections identity. Hazen, Horrell and Merrill-Oldham in Conway (2008), however, note that on the surface, the OCLC Collections Grid's embedded value system encompasses the traditional view of preservation that emphasizes long-term preservation needs over short-term user needs. They emphasize that the Grid reflects the traditional archivist's perspective that the value of unique research collections trumps redundant physical or digital collections of books and web resources. The authors state that although the Collections Grid appears to be an accurate snapshot of the collection behaviors of

research libraries that are increasingly focusing their collection efforts and their university's collection dollars on digital resources, the Collections Grid may be less useful for engaging the broad array of campus stakeholders who may not value investment in library-oriented stewardship that is not related to immediate scholarly need.

This model is particularly relevant to the study since it adequately describes the different categories of content that would be found in an academic setting (such as Moi University) and the degree of stewardship required for each. However, stakeholders may not value the library oriented stewardship model that does not address immediate scholarly need. The usefulness of the model may not extend beyond this since stake holders in the modern academic setting are rapidly moving away from seeking information in the traditional library oriented model and prefer the decentralized nature of the internet and digital libraries that allow them to access global information irrespective of their geographical locations.

The Stanford Model of Digital Collections and Services

Conway (2008) observes that the Stanford Model shares with the OCLC Collections Grid awareness of stewardship responsibilities ranging from short-term need to long-term preservation. On the contrary however, he notes that the Stanford model, however, plots the second dimension in terms of the "compass direction" or the evolving orientation of digital services from individual to institutional need.

He states that the strength of the Stanford model, represented in Figure 2.2, is the way it maps emerging academically oriented digital content on a suite of library digital repository and preservation services. The model explicitly presumes the library's role as

campus repository but does not address the management of digital assets that fall outside the library's self-defined scope.
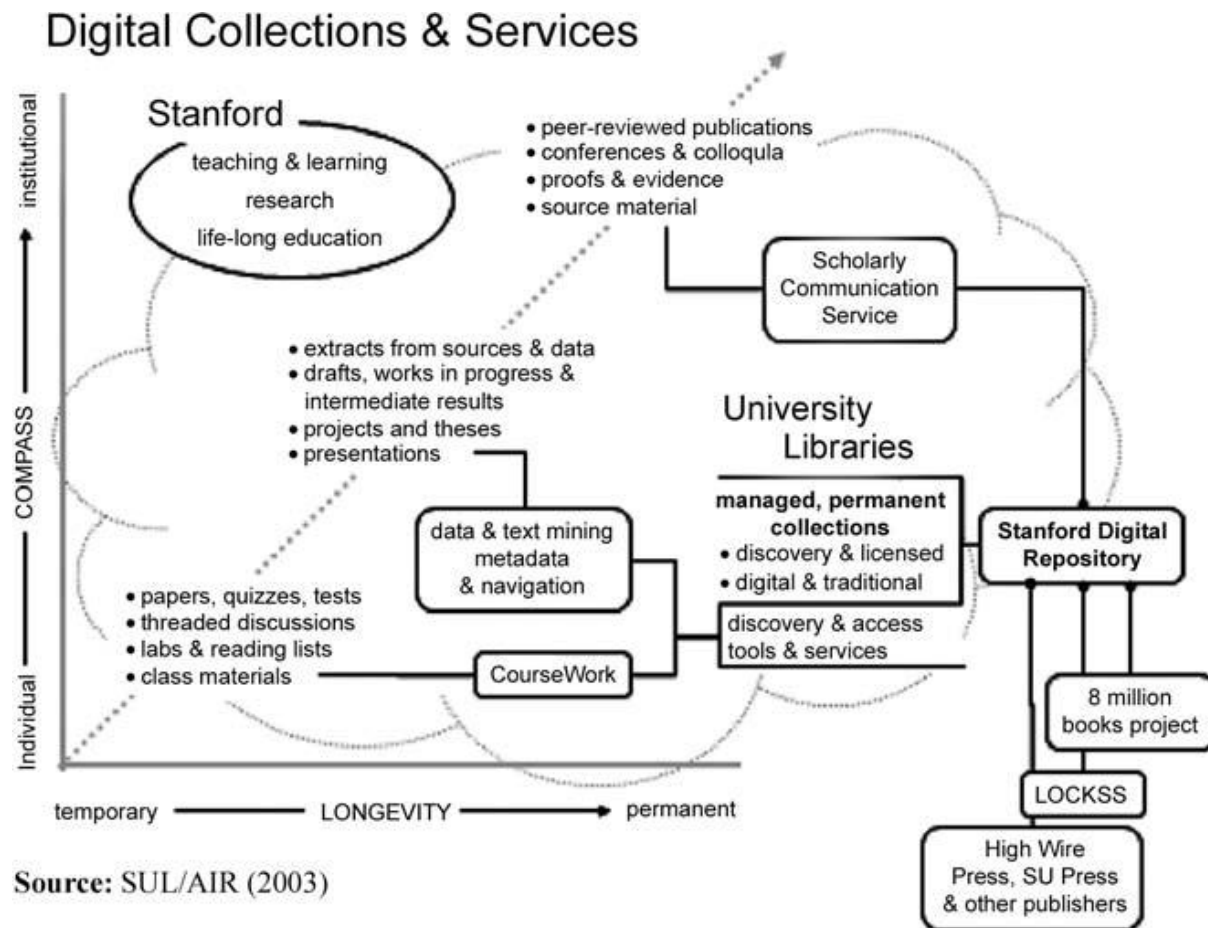
Figure 2.2: The Stanford Model of Digital Collections and Services

Source: Conway (2008)

Conway Content Landscape Model

Conway (2008) presents an alternative content landscape model. He says the Conway model was first developed at Duke University, by himself, to support campus conversations on the scope of digital library activities. The model was presented and refined at a series of workshops and symposia, including the OCLC Distinguished Seminar Series (Conway, 2008). It was applied to the specific Duke context during a year-long exploration of digital content generated by interdisciplinary research centers

and academic departments. According to Conway, The Conway Content Landscape Model (CLM) is a multi-dimensional framework that addresses three outstanding issues with digital asset management in universities. First, he says, the model acknowledges the broader academic mission within which digital content is created, acquired (bought and licensed), managed and preserved, and distributed and used. Second, the model provides for selection processes and priority setting exercises based on the dual perspectives of content creator/stakeholders and content user/stakeholders. Third, the model identifies four digital content property scales that provide an analytical foundation for assigning management priorities to particular classes of digital content.

The author goes ahead to explain that at its most abstract level, seen in Figure 2.3, the model recognizes the information environment within which universities carry out their four-part mission to foster research, teaching, publication, and preservation (Waters , in Conway (2008)). He elaborates that this wider environment of e-research, e-teaching, e-publishing, and e-recordkeeping is similar in structure and perspective to the digital framework that motivates the research and development activities of the UK Joint Information Systems Committee (JISC).

More specifically, he observes that the CLM articulates four interacting variables that together describe the core asset management challenges that universities face with digital content: property rights, structure, source and possession.

Content Landscape Model
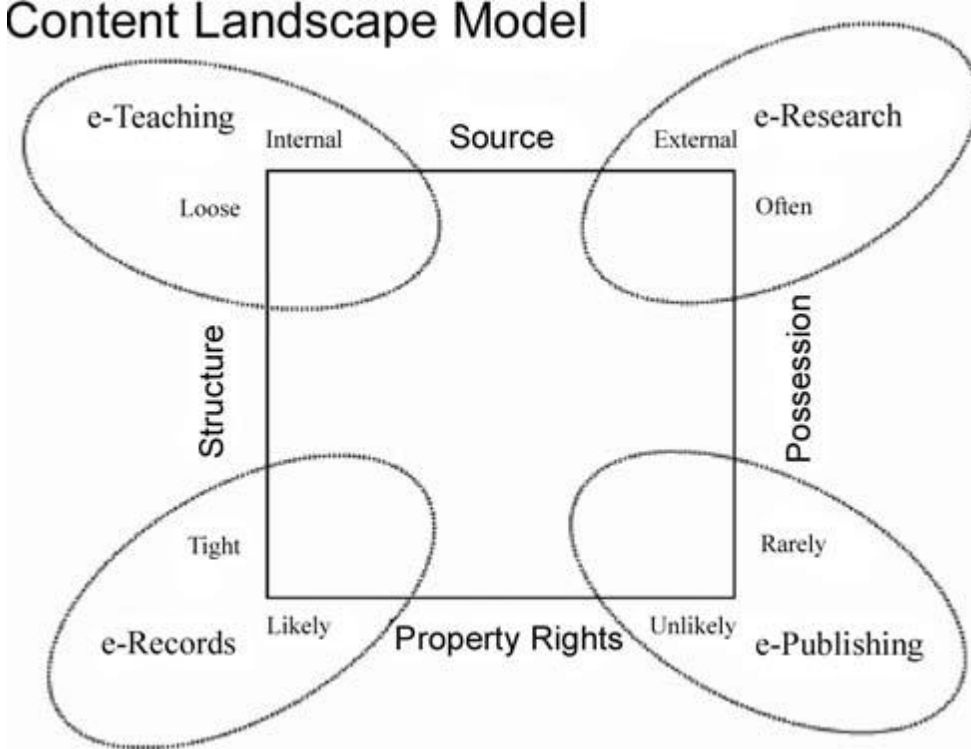
Figure 2.3: The Variable World of Digital Content

Source: Conway (2008)

He notes that the first, Property rights, distinguishes campus digital assets based on the likelihood that the university can retain the rights to capture, store, preserve and make available digital content to its academic community. In the present environment, the rights of a university vis-a vis digital content are not a dichotomous proposition, but rather depend on a number of factors that limit options for preservation and access. Furthermore, he states that complexity is lightened in situations where a university has unambiguous rights to manage digital content.

He explains that Structure, the second variable, recognizes that digital objects range from tightly structured, highly relational database elements to loosely affiliated items assembled for varying purposes. In his view, tight structure improves the likelihood that

valuable assets can be identified and managed actively while dispersed and loosely affiliated objects add complexity.

Conway opines that the third variable, source of digital assets, plays a significant role in determining management priorities. He points out that digital content that originates on a university campus (internal), either through digitization or through acquisition, may be simpler to identify and more technically capable of effective management than externally generated content. In addition, digital content that originates locally has the value of "uniqueness" that adds distinctive character to a university, much like a library's special collections have done through the past century.

Possession, as the fourth variable of the content landscape, points to the diversity of campus access models. Although some digital content of critical value to the academic mission is secured on campus-managed servers, the author observes that the university rarely possesses some of the most significant digital resources in which the university has a continuing stake, particularly licensed electronic journals and books. He notes that access is most likely through links to external data providers (journal publishers, database contractor, multimedia conglomerate) with limited or no commitment to preservation. Possession is quite often unassociated with property rights.

Conway posits that the digital content landscape is populated with overlapping clusters of digital content whose existence in a management framework are due to specific actions taken by the university. Some content is digitized surrogates of physical objects; some content may have been "born digitally" and may be managed to varying degrees as university records. Other digital content has been purchased or otherwise acquired by university units, ranging from libraries to academic departments, specifically to support

research and learning. Yet other digital content is merely licensed for use under sometimes highly restrictive access provisions. The model assumes that nearly all digital content is accessible through a browser-based web gateway, even if the university limits access to local users as a way of dealing constructively with the present intellectual property regime.

These clusters overlap in the model to illustrate that the characteristics or functional origins of digital content on a university campus are rarely clear cut. For example, the university might retain the right to mount significant licensed resources on a local server; the university library might purchase and manage directly a significant collection of digitized artwork and may or may not deliver this asset to campus users from its own servers. Placing digital assets appropriately within the landscape is the first important step in establishing asset management priorities (Figure 2.4).
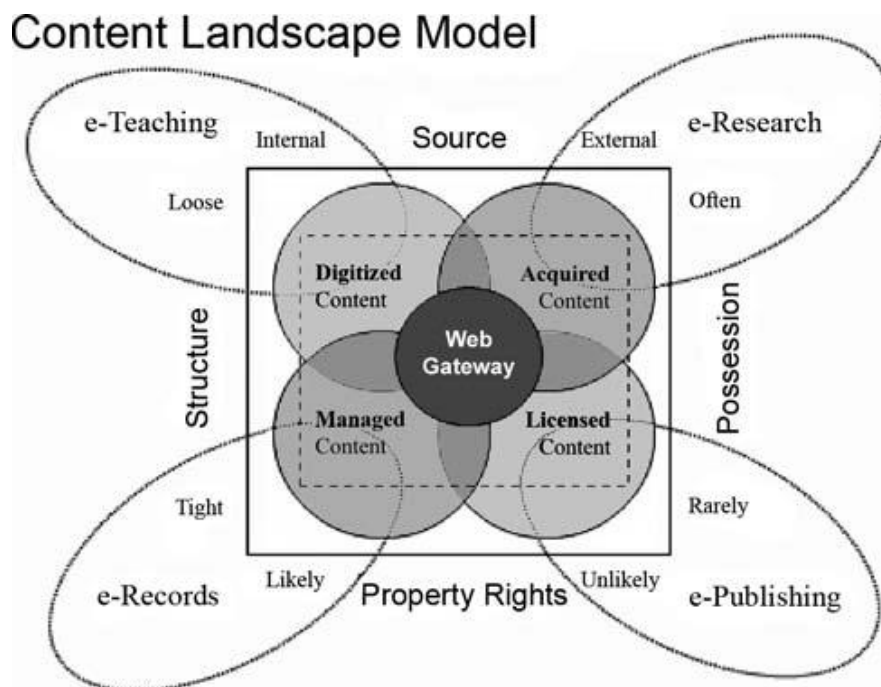
Figure 2.4: Digital Asset Clusters on the Content Landscape

Source: Conway (2008)

Figure 2.5 provides examples of the types of digital content that a university community typically produces and plots this content on the landscape.

In the domain of digitized content (upper left) live digital objects and resources usually created locally to support teaching and learning. Digitized content that is more aggressively managed, represented by the overlapping section at centre-left, encompasses growing image and text databases, multimedia "warehouses," and portfolios of student produced content. In the more fully managed sector (bottom left) are the output of campus research centers, faculty and university publications, and the contents of enterprise systems, most especially university electronic records systems and the increasingly important web content management systems.
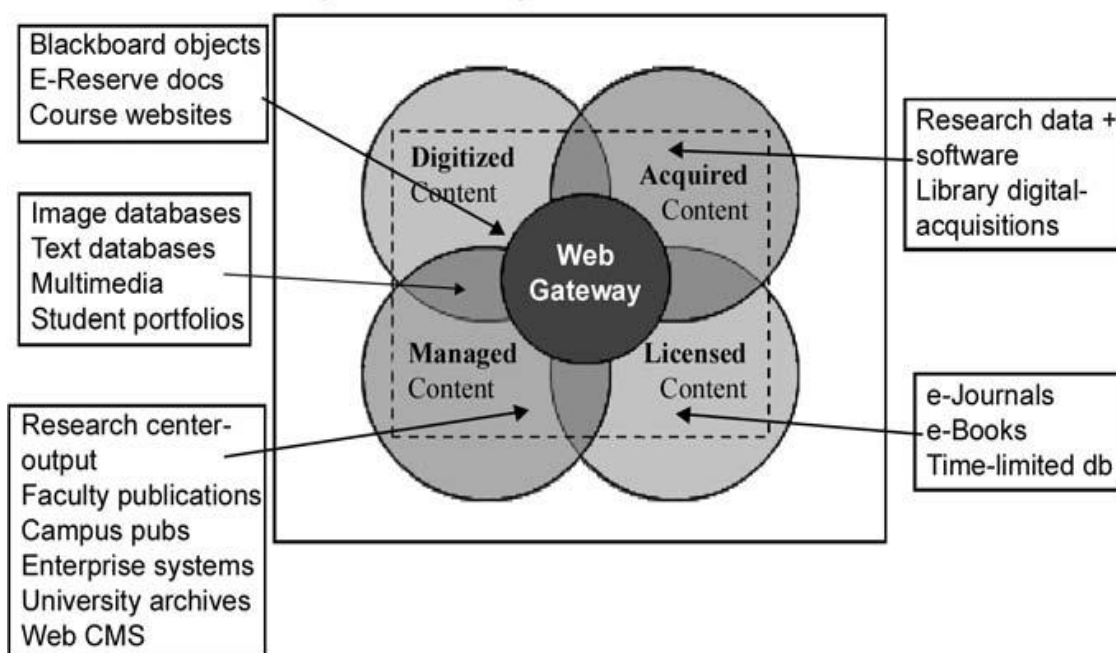
Figure 2.5: Examples of Digital Content Plotted On the Landscape

Source: Conway (2008)

The domain of acquired content (upper right) encompasses research data and associated software, the digital acquisitions of the library (often on portable or fugitive media) and other digital resources purchased or otherwise obtained to support the research mission of the university. Finally, the domain of licensed content (lower right) is the large and growing world of digital books and electronic journals that have become the academic lifeblood of the campus.

The General Knowledge Model

The General Knowledge Model was initially developed by Brian (Bo) Newman and published in 1999. Newman and Conrad (1999) defined knowledge management as a discipline that seeks to improve the performance of individuals and organizations by maintaining and leveraging the present and future value of knowledge assets. In this perspective, they clarify that knowledge managers must understand and address the needs and interests of various stakeholders and the interrelated knowledge flows that unite them. They point out that knowledge flows comprise the set of processes, events and activities through which data, information, knowledge and meta-knowledge are transformed from one state to another. To simplify the analysis of knowledge flows, the authors use the General Knowledge Model that organizes the knowledge flows into four primary activity areas namely:

> *Knowledge Creation* which comprises activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture.
>
> *Knowledge Retention* which includes all activities that preserve knowledge and allow it to remain in the system once introduced. It also includes those activities that maintain the viability of knowledge within the system.

Knowledge Transfer which refers to activities associated with the flow of knowledge from one party to another. This includes communication, translation, conversion, filtering and rendering.

Knowledge Utilization which includes the activities and events connected with the application of knowledge to business processes.
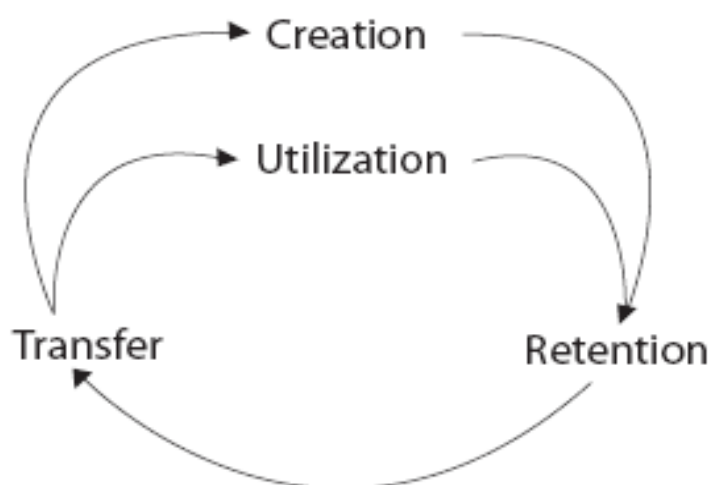
Figure 2.6: The General Knowledge Model

Source: Newman and Conrad (1999)

The authors say that the model is valuable precisely because it relates the individual, highly dynamic behaviours and processes to general activity areas and, by association, to each other. In addition, they affirm that the model allows analysts to trace individual knowledge flows by helping them to examine and understand how knowledge enables specific actions and decisions. Further, the authors elaborate that within each activity phase exists other, smaller knowledge flows and cycles. These layers span a wide range of macro- and micro-behaviours, ranging from broad organizational and multi-

organizational processes to discrete actions and decisions, and include all the various intervening layers: activities, tasks, workflows, systems, interfaces and transformations. Specifically, the model relates to Content Management in that knowledge can be captured and handled digitally in a system right from creation to transfer to retention. This can be done through the creation of knowledge bases which then directly draw upon content management strategies and techniques to ensure that this knowledge is accessible to those who need it as and when the needs arise. The model was therefore useful for the study which sought to address content management and use in an institution of higher learning. The model helps conceptualise the activities surrounding knowledge creation, use, transfer and retention in an academic setting given that the end products of the knowledge cycle are forms of content that then has to be formally managed.

In summary, the models considered above were selected for their appropriateness to the general areas of knowledge and content management. The models are deemed suitable to the extent that content management for example mainly focuses on creation of content in its various forms. Specifically in a university setting, such as Moi University, each of the models accommodates the different types of content generated and or acquired for use in the academic setting. The overlapping characteristics and functions of digital content in the academic setting and the unique requirements for management are well captured by the models. However, the OCLC model and the Stanford Model tend to be limited to formal digital collections and services such as the university libraries and digital repositories. In addition to this formal setting, the modern setting for content management has to consider aspects such as user generated content and other decentralised information sources such as the internet and other digital sources.

These are the weaknesses of these models. The Conway model opens up the content landscape to encompass more items but also does not incorporate emerging technologies such as the Web 2.0 that has given ordinary users more capacity to create, access and share information and content in the modern digital environment

2.2 The Concepts of Data, Information, Knowledge and Content

Mutula and Wamukoya (2007) state that there are various interpretations of the concepts of data, information and knowledge. In their view, 'data' simply refers to raw facts or observations. According to O'Brien, in Mutula and Wamukoya (2007), data can be defined as facts, events or transactions that have been recorded. Mutula and Wamukoya explain that data can also be regarded as raw material that has no meaning unless it is converted into information by analysis, interpretation and being put into context.

Fleming, in Bellinger (2004), observes that a collection of data is not information, a collection of information is not knowledge, a collection of knowledge is not wisdom and a collection of wisdom is not truth. The idea, according to him, is that information, knowledge, and wisdom are more than simply collections. He explains that, on the contrary, the whole represents more than the sum of its parts and has a synergy of its own.

According to Bellinger (2004), data is just a meaningless point in space and time without context, thus data is without a meaningful relation to anything else. He explains that when we encounter a piece of data, if it gets our attention at all, our first action is usually to attempt to find a way to attribute meaning to it. He clarifies that we do this by

associating it with other things and thereby we create context which, more often than not, is somewhat akin to conjecture, yet it fabricates meaning.

Once refined, data can then be regarded as 'information'. The Knowledge Management Glossary in Mutula and Wamukoya (2007) defines information as data organized within a context and translated into a form with structure and meaning. That a collection of data is not information, as Fleming indicated, implies that a collection of data for which there is no relation between the pieces of data is not information. The pieces of data may represent information, yet whether or not it is information depends on the understanding of the one perceiving the data. In summary, information relates to description, definition, or perspective (what, who, when, where) (Bellinger, 2004).

On the other hand, Mutula and Wamukoya (2007) acknowledge that the concept 'knowledge' seems confusing to many people and is still not clearly understood. They clarify that some people perceive knowledge as the interpretation and action that follow the understanding of stored texts, notes or information. Nickols, in Mutula and Wamukoya (2007,) says that the term is also used to refer to codified, captured and accumulated facts, methods, principles and techniques, such as books, papers, formulas, procedure manuals and computer code. Menne-Haritz, in Mutula and Wamukoya (2007), observes that knowledge is the difference between knowing and not knowing and that it cannot simply be stored in books or read; instead it needs interpretation of intentions, reliability and scope.

Bellinger (2004) suggests that when a pattern relation exists amidst the data and information, the pattern has the potential to represent knowledge. According to him, it only becomes knowledge, however, when one is able to realize and understand the

patterns and their implications. He indicates that the patterns representing knowledge have a tendency to be more self-contextualizing. That is, the pattern tends, to a great extent, to create its own context rather than being context-dependent to the same extent that information is. Furthermore, he elaborates that a pattern which represents knowledge also provides, when the pattern is understood, a high level of reliability or predictability as to how the pattern will evolve over time, for patterns are seldom static. He points out that patterns which represent knowledge have completeness to them that information simply does not contain and concludes that knowledge comprises strategy, practice, method, or approach (i.e. how).

Content is defined by Mutula and Wamukoya (2007) as any type of digital information such as text, e-journals, images, graphics, video, sound documents, records (e-records), movies, e-mails, news, and software among others. The authors indicate that there are a number of content creators and developers who include, but are not limited to, the media, Internet service providers, artists, publishers, mobile operators, community information gatekeepers, bloggers, researchers, government, the private sector and NGOs. On the other hand, contentmanager.eu.com (2000) defines content as any type or 'unit' of digital information or anything that is likely to be managed in an electronic format such as text, images, documents, records, and others.

Stuhler (2009) says that as IT becomes ever more prevalent in nearly every aspect of our lives, the amount of data generated and stored continues to grow at an astounding rate. Quoting IBM, he further says that worldwide data volumes are currently doubling every two years. He observes that a major trend over the last few years has seen many organizations implementing enterprise resource management and customer relationship

management solutions. This, in turn, has caused a dramatic increase in the amount of data stored in organizations about customers, prospects, partners and suppliers. In an increasingly competitive marketplace, he explains that the ability to base business decisions on solid, reliable and timely management information is becoming a key differentiator. In this scenario, he reiterates that organizations are faced with not only managing all of their own data, both historic and current, but also an influx of additional data from other parties.

Stuhler (ibid.) also notes that technical trends such as new capabilities within the databases used to store corporate information are another major driver of data growth. For example, DB2 now supports XML and LOBs ("large objects" such as audio, video, images, etc). The ability to store this kind of data alongside more traditional structured information can be very useful but can also have a huge impact on the overall size of the database. He adds that technical trends that are contributing to database growth include storage of data in Unicode format (which can often expand overall database size by 10 to 50 percent depending on the data), and duplication of databases due to replication requirements and/or backup strategies.

Stuhler (ibid.) states that this unprecedented growth in data volumes is having a significant effect on many organizations, the most obvious being operational costs. According to him, this comprises more staff time required for routine maintenance and data-related exception handling such as out-of-space conditions and repartitioning. He adds that as the database increases in size, so too does the central processing unit cost of running batch operations and routine housekeeping. Furthermore, he notes that ongoing running costs also increase due to the additional disk space required, and storage and

processing capacity upgrades may be needed even though they often have not been budgeted for.

He proposes data archiving as an important solution to these data explosion problems. According to a Gartner report that he quotes, database archiving significantly lowers storage costs for primary storage by moving older data to less costly storage. Archiving also reduces the size of primary storage, resulting in improved application performance and lower storage requirements for copies of the database for testing, backup and other purposes. In the same report, Gartner states that performance and cost improvements can be sizeable, even with applications that have less than 200GB of data. Stuhler (2009) concludes that by implementing a thorough archiving policy and an intelligent archiving system, data can be managed throughout its lifecycle.

The observations and recommendations by Stuhler are significant for the current study, which in part focused on the strategies for archiving the data and information (i.e. content) created at Moi University.

2.3 Stages of the Content Lifecycle

CMS Review (2009) opines that to better understand the otherwise complex business of content management, one needs to break it down into the major stages or phases involved in managing the content lifecycle:

a) Organisation - Information is structured using tools such as XML (Extensible Markup Language) or RDF (Resource Description Framework) which allows arbitrary metadata to be added to all information elements. This further allows this information to be retrieved in multiple ways and reused or repurposed in many more ways. In this stage, categories are created, vocabularies controlled,

taxonomic hierarchies designed and classification schemes developed. Without such structuring, information will be collected haphazardly and stored in the wrong places possibly never to be found by those who need it, and may then require to be recreated at great expense.

b) Workflow - For the successful creation and use of content, there must be carefully designed but flexible rules that keep the content moving consistent with the organisation's business requirements and rules, policies and procedures.

c) Creation - In this stage, all content is classified into the architectural categories designed in stage one. This is irrespective of the methods used to capture the information into the system.

d) Repositories- In this stage, decisions are made on how the content will be stored, whether in relational database structures, as file system objects, as unstructured text and binary graphic images or as XML elements tagged with the metadata from stage one.

e) Versioning- Changes to content and presentation of the content are inevitable. Versioning needs to be managed to allow (authorised) people to make changes to content so that conflicts are resolved and critical content can be rolled back when inevitable errors creep in.

f) Publishing- The finished content is delivered to users in many ways both pull and push. Some will be through the traditional print formats, others via the web, email, or over mobile devices such as PDAs and cellphones. All these delivery methods must be tested to insure the quality of user experience that stage one prepared.

g) Archives- Finally, the author points out that in spite of publishing content as a major objective of the system, some of the content is not short-lived and needs to be protected as part of 'institutional memory'. This captures the organisation's business knowledge and can be shared with the future generations of workers as a permanent knowledge base.

This cycle is shown in Figure 2.7.

Figure 2.7: Stages of the Content Lifecycle

Source: CMS Review (2009)

2.4 Information Architecture and Infostructure

The Institute of Information Architecture (2007) defines Information Architecture (IA) as the art and science of organizing and labeling websites, intranets, online

communities, and software to support usability. They emphasize that good IA lays the necessary groundwork for an information system that makes sense to users. To achieve this, best practices in information architecture support the development of interfaces that facilitate the flow of useful and relevant information to the user. The institute notes that IA is still an emerging community of practice focused on bringing principles of design and architecture to the digital landscape.

Batley (2007) emphasizes that "No matter how well designed and aesthetically pleasing the IA, it is only going to be of benefit if it includes all the documentation and information its users need, and if that information and documentation can be easily retrieved. Architecture is not only about creating robust structures, it is also about functionality."

On the other hand, Maurer (2004) points out that information architecture primarily relates to the design of information spaces such as sites (websites, intranets, extranets, search systems) and interactive spaces (business applications and browser-based transactional systems) in such a way as to enable users navigate the system and locate the information they need. To this end, she says, information can be arranged in ways such as by date, alphabetically, by geography, by topic, by hierarchy, in a faceted manner, organically and/or a combination of ways to allow multiple access methods. The designer should arrange information according to the needs of the users so that the most appropriate content organization scheme is selected, for example, geography as an organising scheme would be more appropriate where the content relates to spatiality e.g. for travel maps.

Infostructure is the layout of information so that it can be navigated. It is the result of organising information in a useful fashion and includes examples such as a table of contents, a bibliography or an index (Tilton, 1994). The author further explains that the important things in an infostructure are to present a clear ordering of information by subject, make a document just as long as it needs to be and no more, ensure a document is richly cross-referenced and provide a clear consistent navigation structure.

These concepts are important for content management at Moi University. There needs to be an information architecture and infostructure defined during the creation of digital collections to enable ease of access to the digital content.

2.5 Moi University ICT Infrastructure

Moi University has in place several local area networks linked up to the central backbone networks. The networks are connected via different media such as fibre optic cables, radio links and UTP connections. The LANs that exist in the different schools and buildings are linked via fibre optic while the campuses are also interconnected via wireless media. The university is linked to the external public communication network via satellite and VSAT (Very Small Aperture Terminal). Table 2.1 summarises the different types of connections and media available in different parts of the university network.

Table 2.1: Moi University ICT Infrastructure

Name of School /Campus	Connection Status	Mode of Connection	Proposed Mode of Connection
Inter-Campus Connection with Main Campus			
Main Campus	Connected	Radio	
Chepkoilel Campus	Connected	Radio	
Town Campus	Connected	VSAT /JamboNet	
Town Annex –LAW	Not connected	-	ADSL or Radio
Eldoret West Campus	Not connected	-	ADSL or VSAT
Inter-School Connection with Main Campus			
Main Admin Building	Connected	Fibre	
Margaret Thatcher Library	Connected	Fibre	
Information Sciences	Connected	Fibre	
Student affairs – Main Campus	Connected	Fibre	
Engineering	Connected	Fibre	
Environmental Studies	Connected	Fibre	
Arts and Social Sciences	Not connected	-	Fibre
Education	Not connected	-	Fibre
Economics and Business	Not connected	-	Fibre
Human Resource Development	Not connected	-	Radio or Fibre
Inter-School Connection with Main Campus			
Medicine	Connected	Radio	
Public Health	Connected	Radio/VSAT	
Law	Not connected	-	ADSL or Radio
Inter-School connection with Principal's office Chepkoilel Campus			
Library	Connected	UTP LAN	
Agriculture and Biotechnology	Not connected	-	Radio
Natural Resource Management	Not connected	-	Wireless LAN
Science	Not connected	-	Wireless LAN

Source: Information Communication Technology Center, Moi University (2008)

2.6 Content Management – An Overview

According to the BitPipe Research Guide (2000), data, documents and content are the lifeblood of the business. They carry messages and information as they circulate from department to department, satellite offices to headquarters and from company to

supplier. Successful businesses learn to build once and re-use many times. The research guide goes ahead to say that CM is an amalgamation of many different applications with the purpose of leveraging enterprise or companywide knowledge assets for competitive advantage. According to the research guide, the content in question can include, but is not limited to, text documents and memos, spreadsheets, diagrams, Web-based HTML or XML documents, and images, as well as moving video files. These assets may reside within a single department in a single location or in multiple departments throughout the organization.

Bitpipe Research Guide (2000) further opines that the key forces that drive businesses to Content Management are the need for collaboration among multiple departments and offices, the need for industrial compliance to regulation and the need for consolidation of organizational data in its different classes.

Content is a key resource of the information economy. Everything has a cost, one way or another. Although often considered to be freely available, McGovern (2001) says that from the free content perspective, the key cost is time. We pay with our time by having to deal with badly organized or badly written content.

On the content of websites, Muigai (2008) explains why content is king online. He says that visitors arrive at a website through search engines, online ads, links, and URLs found offline. According to him, search engines are the most efficient and cost effective way to drive visitors to a website. He explains that search engines find information by crawling websites and therefore if content on a website is skimpy or of poor quality, it will not be indexed or will rank low. As he puts it, an organization's website content must be part of its online marketing effort.

According to Muigai (ibid.), good content is engaging, timely, accurate, useful, detailed, and focused. He explains that it should be search engine friendly i.e. it can be found and ranked well. In addition, he points out that good content creates confidence, enriches user experience, and encourages repeat visits. In this light, he emphasizes that editorial guidelines are necessary to produce and maintain good content.

For an institution of higher learning like Moi University, these guidelines on the quality of good online content are very important. The university, like many other similar institutions, is now turning to online technologies to market its services and programs. It must strive to repeatedly attract visitors to its site. They must also be aided to find the information they are looking for once they are on the site. As has been stated elsewhere, the quality of academic institutions' content on the web is used to rank them globally (CCHS-CSIC, 2009). Therefore, Moi University cannot afford to be careless about the quality of content it houses on its website.

Chin (2003) opines that content will still exist without an intranet - whether in the form of electronic documents or hard copies - but an intranet will not exist without its content. He advises to shift focus away from the technology and instead take a look at what all this technology is meant to support. As he poses, 'after all, when you're thirsty, what good is a gold-plated cup filled with sand?' In line with this study, the technological infrastructure within Moi University was not given paramount focus but rather, the focus was on the content that this technology is supposed to support.

Chin also points out that technology in an organisation is supposed to support the Internal Knowledge Assets (IKAs) which are a company's intellectual property - its employees' knowledge and expertise put onto paper or into bits and bytes. He explains

that these IKAs usually consist of information that's unavailable to the general public and is produced through the efforts of an internal knowledge community. He indicates that IKAs may include business strategies, market trend analyses, financial information, inter-departmental communiqués, or details regarding specific projects and contracts. For purposes of this study, the IKAs considered included operational strategies, lecture notes and presentations, financial information and analysis, inter-departmental communications, details of proposed and ongoing projects, among others. As Chin (ibid.) notes, IKAs are highly focused and very specific to a company's industry. He adds that in this respect, IKAs have the most added-value because they are produced internally by content owners who specialize in their discipline and are aware of the requirements of the company.

Chin (2003) further explains that technology also supports External Information Sources (EIS) which include any type of information that can be obtained through a public medium or purchased externally through third party vendors. He explains that they can be in the form of information collected from the Internet, hard copy documents such as press kits or newspaper and magazine clippings and information obtained through a news feed or content delivery service such as LexisNexis, Profound or Factiva (a joint venture between Dow Jones and Reuters). Chin observes that the greatest advantage of an EIS is volume which, however, if not controlled would lead to clutter. Any potential post should be reviewed with a critical eye to ensure an intranet doesn't become a dumping ground.

On the subject of quality of content, Chin (ibid.) explains that content engineering is critical to avoid messy content management. He clarifies that content engineering is the

process of filtering raw data into more usable, value-added information. He notes that engineered content has been pared down, thus eliminating as much "white noise" as possible. As an example, he explains that, rather than posting an entire 60-page financial report onto an intranet, an internal financial analyst could filter out all of the superfluous information and create a one- or two-page summary of the results. This process, he explains, can save employees the time and effort that would, otherwise, have been spent digging through the report. In his view, engineered content, therefore, is extremely focused and specific to a discipline or topic while on the other hand, non-engineered content covers a wider spectrum and is most useful when one is not looking for anything in particular.

2.7 Types of Content

There are different types of content that an organisation can create and/or acquire in their efforts to share or make information accessible by its members. These types of content include but are not limited to the following:

2.7.1 Websites

Answers.com (2009) defines a website as a set of interconnected webpages, usually including a homepage, generally located on the same server, and prepared and maintained as a collection of information by a person, group, or organization.

Muske, Stanforth and Woods (n.d) note that with the web so visible to us in writing, advertisements and casual conversation, many business owners believe that a website is crucial to business growth. However, they advise that those thinking about setting up organisational websites need to answer the following questions: Is it necessary? Will it help? How can it be done? They note that the web market available to businesses

considering online presence is potentially huge and a website allows the business owner to reach this market using only limited resources. They also point out that the numbers of people transacting business on the web is bound to grow as more people come online.

Muske, Stanforth and Woods (n.d) also describe the advantages and disadvantages of marketing via a website. Advantages include meeting a growing audience, having a world-wide presence and access to buyers, and possible low cost marketing. On the other hand, disadvantages include tremendous competition since competitors can also be found anywhere in the world, attracting people to one's site, continual need to refresh and update one's site, and changing business operations to handle website business. The authors cite issues to consider when building a website including the need to understand your market, defining your site purpose before you build it, considering website design elements that will facilitate the customer's ability to use the website and find relevant information, and site production issues such as expertise available to man the site and resources required for set-up and continuous maintenance.

2.7.2 Blogs and Wikis

These form part of the digital landscape now known as Web 2.0. The term Web 2.0 is commonly associated with applications for the Internet and web that facilitate interactive information sharing, interoperability, user-centred design, dynamic content, collaboration and generally give users a richer online experience (Sharma, 2008). A Web 2.0 site gives its users the free choice to interact or collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to websites where users (consumers) are limited to the passive viewing of content that was created for them. Examples of Web 2.0 include social-networking sites,

blogs, wikis, video-sharing sites, hosted services, web applications, mashups and folksonomies (Wikipedia, 2010).

According to Ramos and Piper (2006), the introduction of blogs and wikis (user-edited, collaborative websites) has brought to fruition some of the earliest hopes for the Internet - a democratic, accessible community of users responsible for its own content, supported by an open model of knowledge creation and communication. They further note that by supporting users who want to shape and share their content, while allowing other users access to the tools and means to modify the original contents, blogs and wikis continue to grow in utility. They also point out that their ease of set-up and use adds thousands of new pages of information, opinion and observation to the worldwide web on a daily basis. They opine that by allowing users to contribute to and edit content created by others, new authoritative and comprehensive information results from the efforts of many rather than the few.

Blogs and wikis are proving to be a powerful tool by which creators can create and communicate content and users can tap into these resources for their own information needs. However, as Chin (2006) points out, User-Generated Content (UGC) is likely to contain biased information, blurring the line between fact and interpretation. He explains that this is because as opposed to engineered content which is created and edited by established knowledge experts, UGC is created by users and is more of personal opinions on a topic. The credibility of the person and content being posted is not obvious. However, he also discusses the pros of UGC including the fact that it utilizes many more methods of content entry, making it less restrictive and it provides knowledge experts who are not part of the intranet team with a medium in which to

share their knowledge. Chin (ibid.) further explains that UGC can be moderated (especially in a corporate environment) to make it more credible whilst maintaining the advantages it offers. Moi University needs to further explore the use of these media.

2.7.3 Intranets and Portals

O'Brien (2002) defines an intranet as an Internet-like network within an organisation. He adds that in an intranet, web browser software provides easy access to internal websites established by business units, teams, and individuals, and other network resources and applications.

On the other hand, the businessdictionary.com (2010) defines an intranet as an internal or private network of an organisation based on internet technology (such as hypertext and TCP/IP protocols) and accessed over the internet. The dictionary adds that an intranet is meant for the exclusive use of the organization and its associates (including customers, employees, members, and suppliers) and is protected from unauthorized access with security systems such as firewalls. Further, intranets provide services such as email, data storage, and search and retrieval functions, and are useful in disseminating policy manuals and internal directories for the employees, price and product information for the customers, and requirements and specifications for the suppliers. Some intranets are confined to a building whereas others span continents.

The same Businessdictionary.com (2010) defines a portal as a website that serves as a gateway or a main entry point (cyber door') on the internet to a specific field-of-interest or an industry. A portal provides at least four essential services: (1) search engine(s), (2) email, (3) links to other related sites, and (4) personalized content. It may also provide facilities such as chat, members list, free downloads, etc. Portals such as AOL, MSN,

Netcenter, and Yahoo, earn their revenue from membership fees and/or by selling advertising space on their web pages. It is also called a portal site or web portal.

2.7.4 Institutional Repositories

Depending on whom you ask, the idea of the Institutional Repository (IR) in higher education means anything from "innovative solution" to "irrelevant curiosity". To librarians, archivists, programmers, and the faculty who are building systems and contributing publications, an IR is, at least, a more convenient and more reliable place to hold the output of scholarly communication (Smith, in Conway, 2008). Davis and Connolly, in Conway (2008), observe that critics of the IR movement have their own arguments, including that the technologies and associated policy frameworks are too limited, too narrowly construed, too political or unconvincing. Further, the authors note that the vast majority of academics appear to be largely unaware of or uninterested in a suite of technologies that have too little impact on their lives as scholars or administrators.

Crow, in Hockx-Yu (2006), defines institutional repositories as "digital collections that capture and preserve the intellectual output of a single or multi-university community". Accordingly, the author opines that while some repositories focus on particular subject domains, an institutional repository stores and makes accessible the educational, research and associated assets of an institution. Although most of the currently established institutional repositories are 'e-prints' repositories providing open access to the research outputs of a university or research institution, the content does not need to be limited to e-prints but could potentially include research data, learning material, image collections and many other different types of content (Hockx-Yu, 2006).

Lynch, in Conway (2008), establishes the IR as a set of services provided by a university to its community. He purposefully takes a broad approach to digital content, suggesting that an IR supports the management and dissemination of "digital materials created by the institution and its members". Lynch's emphasis on locally produced content places clear boundaries on the content domain, initially eliminating from consideration content acquired from external sources to support research and teaching.

Branin, in Conway (2008), sees IR activities as analogous to the collection development efforts of traditional libraries. While confining IR digital content to faculty and student output, Branin equates digital content with digital information and knowledge assets, using streaming video and audio as an example of an asset management need that transcends the scholarly preprint. Markey, Rieh, Jean, Kim, Yakel, in Conway (2008), note that universities are not only managing locally produced publications but are expanding their use of IR technologies to assemble and manage over three dozen document types, including electronic theses and dissertations, learning objects, digitized images, software, and other types of content that may be deemed valuable for long-term retention. The observations by these authors are of particular relevance to the study, seeing that all these different types of digital content exist at Moi University and their management and dissemination in the long-term is important in achieving the key objectives of the organization, namely to excel as a center of research and teaching.

Conway (2008) notes that as the concept of IR stretches to accommodate an ever expanding array of formats and sources, some have begun adopting the term "digital asset management" as a broader concept capable of encompassing the active

management of any form of digital content. He points out that in digital asset management, the concept of value is a critical factor.

Ross, in Conway (2008), writing from the UK/European Union perspective, provides one of the earliest and most complete definitions of digital asset management applied to the higher education environment. He says that digital assets have the very unique characteristic of being both product and asset. Some digital assets exist only in digital form while others are created through the digitization of analogue materials such as text, still images, video and audio. In addition, he asserts that content has the same value to institutions as other assets such as facilities, products and know-how. In his opinion, just as an organization seeks to make efficient and effective use of its financial, human and natural resources, it will now wish to use its digital assets to their full potential without reducing their value.

The University of Kansas, as noted by Fyffe, R., Ludwig, D., Roach, M., Schulte, B. and Warner, B.F. in Conway (2008), adopts an "asset management" perspective in its IR initiative, KU ScholarWorks. The university states that "A digital asset is an electronic object that has value for some purpose". The KU definition explicitly places digital preservation at the core of its management approach. "To become part of the University's digital preservation program, a digital asset must support (directly or indirectly) the University's fundamental instructional, research, or public service missions". The authors add that asset management is criteria driven, focusing on three support functions: the academic mission of the university, university administrative needs, and the acquisition by license or purchase of data for continuing use.

Waters, in Conway (2008), reflects deeply on the trend toward stewarding digital assets and provides the most insightful description of the challenges and opportunities of expanding the content landscape. He states that digital assets "are resources for research and teaching in higher education and that the aim of academic institutions in managing them is to advance knowledge and improve education". Waters challenges universities to invest in the necessary and significant costs of repository development, including "compelling rationales for collecting, preserving, and providing access to these kinds of scholarly output". He predicts that demand in universities "will grow for deepening connections between digital library systems used for managing digital assets in various forms and combinations of licensed, digitized, and open source materials and learning management systems". In his approach, Waters calls for an integrated and balanced approach to the wide range of digital materials that exist in various distributed forms and function fluidly as repurposeable raw material for the emerging world of cyber scholarship (Conway, 2008).

Hayes (2005), in her briefing paper for the higher education sector, advises universities and colleges to set up digital repositories, which are a type of content management systems, which will help them to manage and capture intellectual assets. The advantage of these repositories, she affirms, is that they help institutions to develop coherent and coordinated approaches to the capture, identification, storage and retrieval of their intellectual assets. She says that such assets include audiovisual objects, datasets, presentations, learning materials and research works. As an institution of higher learning, Moi University definitely needs to define strategies for implementation and operation of an institutional digital repository to manage its intellectual assets.

Through free and unrestricted online availability, IR make it easier for researchers to disseminate and share research outputs and thus support the open access goal of scholarly communication. In addition to authors, who gain visibility, and users, who find information more easily, the potential benefits of institutional repositories extend to institutions, which increase their research profile, and funders, who see wider dissemination of research outputs (Hockx-Yu, 2006).

Heery and Anderson (2005) propose that a digital repository is differentiated from other digital collections by the following characteristics namely content is deposited in a repository, whether by the content creator, owner or third party, the repository architecture manages content as well as metadata, the repository offers a minimum set of basic services e.g. put, get, search, access control, and the repository must be sustainable and trusted, well-supported and well-managed. The authors give various examples of international repository initiatives including: ARROW (Australian Research Repositories Online to the World), CORDRA (Content Object Repository Discovery and Registration/Resolution Architecture) which is a joint initiative of Australia and the US, Johns Hopkins University Digital Knowledge Centre, USA, and the Digital Academic Repositories (DARE), a joint initiative of the Dutch universities to make all their research results digitally accessible. Mutula (2008), gives examples of universities within Southern Africa who have set up digital repositories and are harnessing local content within their vicinity and beyond to support research and teaching. Such universities include: University of Pretoria, University of Johannesburg, University of Western Cape, Rhodes University, University of Stellenbosch, and University of Botswana.

Mutula (2008) says that the requirements and resources needs for digital repository include, content developers, scanners such as Digibook 10000RGB scanner, and software (the most commonly used software is the open source product known as D-Space which enables institutions to capture and describe digital works using a submission workflow module to distribute an institution's digital works over the web through a search and retrieval system, and to preserve digital works over the long term. D-Space is an internationally reputed digital repository solution widely used in more than 233 institutions worldwide. Within the region, universities in Namibia, South Africa, Zimbabwe, Botswana and Uganda are using it.) He adds that the other cyber-infrastructure needed to facilitate development of digital repository includes digitisation equipment, hardware (servers), networks, and related policies. In setting up a digital repository for Moi University, it would be necessary that the institution acquires the necessary equipments and resources and also sets up relevant policies to support the venture.

2.8 Types of Content at Moi University

Conway (2008) notes the challenging technology developments that have created nearly ubiquitous digital content on and off the modern university campus and the relentless shift to digital based and tool-rich scholarship within and across disciplinary boundaries.

The content landscape at Moi University is highly dynamic and ever growing as the use of ICT at the institution also improves. At the moment most of the units at the institution are using ICT in varying degrees to create, access and use digital content. The academic staff is also increasingly outputting their intellectual material in electronic form. Some of the digital content at Moi University includes digital library materials

such as electronic journals, e-books, theses and dissertations, scholarly communication, online course materials (such as course descriptions and syllabi, course modules) and business documents such as internal and external communications.

The university maintains a website and some of the mentioned content is accessible via the Internet or on the Local Area Network. These include advertisements and notifications for upcoming and past events, information on academic programs and events, departmental information and other general information.

2.9 Content Ownership

On ownership of content, Chin (2003) opines that the technology behind an intranet lies within the domain and responsibility of the IT departments. However, he says that an intranet's content needs to have an owner as well - someone responsible for ensuring that information is accurate and kept up-to-date. In his opinion, as a rule of thumb, this owner should be someone within the information's originating department. He explains that this ensures that those best suited to represent their discipline are the ones responsible for managing their content. He warns that dumping this duty onto a third party is not only a bad idea, but a dangerous one as well. The reason for this is that, in his view, third parties have no vested interest in seeing that an organization's information is relevant or up-to-date. As a result, he points out that orphaned content will grow stale, users will lose confidence in the system, and the intranet will eventually die a slow death.

This concept was crucial for this study in that while developing a framework for content management in Moi University, it was important to define the ownership of the digital content generated and used within and outside the institution.   As Chin observes,

predefined ownership of content ensures that the information is always updated and its relevance is important to the owner who will then do what it takes to ensure relevance of content.

Chin emphasizes that it is important that all content management facilities be in place - in the form of in-house written applications or off-the-shelf software tools - for content owners to update and modify their information. He elaborates that this will go a long way in helping those who are not very technically inclined. In his view, the easier the management process, the more likely content owners will maintain their information on a regular day-to-day basis.

2.10 Qualitative Characteristics of Content

As discussed earlier, content is actually digital information. Gupta (1996) notes that information has several characteristics that make it very different from other commodities. These are that information is reproducible and its theft does not deny the original owner its ownership. Its cost of reproduction is also low and it can be transported easily. In addition, it has a brief lifetime (probably in terms of usefulness) and its value is not additive.

Mohammadi and Moghaddam (2008) explore the qualities or features of information that make it valuable and a source of wealth. These include immortality whereby information is permanent and can be increasingly produced over time; it can be used simultaneously by several people (including competitors) at the same time, especially in the technology age; it creates value addition in products and services; it can be used and re-used repeatedly without losing its original value or qualities; it can be shared several

times over thus optimizing its use and this has greatly been facilitated by computer technology and networks.

According to Muigai (2008), good content is engaging, timely, accurate, useful, detailed, and focused. He explains that it should be search engine friendly i.e. it can be found and ranked well. In addition, he points out that good content creates confidence, enriches user experience, and encourages repeat visits. In this light, he emphasizes that editorial guidelines are necessary to produce and maintain good content.

Oppenheim, Stenson and Wilson (2001) generally observes that information is an asset and adds value to organizations that have it. He notes that information assets have various attributes that impact on the effectiveness of organizations. These include attributes relating to economy, quality and value. Others are currency, accuracy, comprehensiveness, and verifiability. He also clarifies that information is on the one hand, dynamic and on the other hand, it needs constant upkeep, maintenance and checks to ensure quality is maintained. Additionally, information may act as a catalyst; it has the ability to enhance productivity and reduce risk in innovation and so increases the value of traditional organizational resources.

2.11 Content Management Best Practice

Mutula and Wamukoya (2007) state that increasingly, corporate organisations are harnessing content to enhance competitiveness and productivity. The authors explain that among other actions, meeting these goals will require creation and sharing of content within organisations by all people, requisite infrastructure for accessing the content, production and dissemination of local content, online education and support, promotion of user-centred methodology in building systems, human resource

development strategies, free flow of information and knowledge, using open standards to create and share content and building institutional capacities to collect, organise, store and share information and knowledge.

Goodwin, Burford, Bedard, Carrigan, & Hannigan (2005) recommend that for a big and far-reaching project such as the implementation of a Content Management System, upper level management involvement and support are needed to insure that decisions are made, implemented and communicated. They opine that a project this significant needs direct participation of upper management for authority, subject specialists for content, collection managers for organization, in addition to people who understand the software and its capabilities. In their paper, whose purpose was to describe the systematic implementation of a CMS at Texas A&M Libraries, they found that the effort of developing a unified web presence reveals where the organization itself lacks unity. They recommend that the opportunity could be used to examine what the (library) communicates to its public and how that presents (or does not) a unified organization. They suggest that this is an opportune time to uncover outdated, inaccurate and inconsistent information.

Further, Goodwin, et al. observe that effective use of a content management system requires an organized and comprehensive consolidation of (library) resources, which emphasizes the need for a different organizational model and culture – one that promotes thinking about the (library) as a whole, sharing, and collaboration. In addition, they state that it is a paradigm shift to change from an internal organizational focus to a user focus and recommend that the impact of this change should not be minimized. Rather, implementers should pay attention to, empathize with, and actively engage staff

while encouraging them to focus on the importance of improved access for all users. Moreover, the authors suggest that implementers should challenge all staff to flex their "customer service" muscles, not just those directly involved in or impacted by the implementation of the CMS. Finally, they advise implementers to regularly communicate with the system users to ensure the system implementation is successful. As they say, communication is a continuous process, critical to the success of both the web site implementation and the change process. They advocate the use of external and internal feedback mechanisms for "reality checks" about what really is or is not working as expected. The recommendations by Goodwin *et al* are critical for successful implementation of Content Management Systems in Moi University.

On digital preservation, Williamson (2005) advises that consideration must be given at an early stage to ensuring the longevity of digital resources, in order to protect and maximize the return on the investment in content creation. He notes that one of the key components in ensuring resource longevity is the choice of file and media formats used to create, store, and deliver digital content, and the strategies that are employed to manage these in the long term. He points out that guidance from funding bodies and advisory services now generally recommends, and in some cases mandates, a standards-based approach to the entire process, arguing that electronic content should be created, stored, maintained and disseminated using open standards whenever possible. He states that an example of such guidance can be found in UKOLN (2003). The author says that the UK Joint Information Systems Committee (JISC) quality assurance focus (QA Focus, 2003) identified the characteristics of open standards namely, that they are the product of an open standards-making process, documentation of the standard is freely available, the standard can be used unrestricted by patent or license issues and that the

standard is ratified by a recognised standards body, such as National Information Standards Organisation (NISO). The author goes further to state that an open standards approach brings a wide range of benefits among them that resources are freed from dependence on a single application, or particular hardware platforms and that resources can be preserved and accessed over the long term.

On the other hand however, the author observes that, while preference should always be given to an open standards approach, it is important to realize that situations will arise where an open approach is not possible and proprietary formats will be chosen instead. These formats are owned by an organization or group (e.g. Microsoft), may sometimes be accepted as de facto standards through sheer ubiquity, and might even be referred to as standards, but cannot be regarded as open since the owner could theoretically choose to change the format or the conditions of usage at any time. The author also notes that the choice of media and file formats for the storage of electronic content could cause serious problems for the long-term accessibility of the materials, particularly where a proprietary format has been used. The problems he cites include obsolescence of media and changes in functionality of file formats and software. He goes on to outline strategies that would serve to raise awareness among readers as to the options available to those practitioners engaging in the long-term management of digital resources. The strategies include documentation, whereby he stresses that quality documentation is a key component of any preservation strategy and it is important that information about the technical decisions taken at each stage of the creation, storage and maintenance process is available in the long term, possibly after those staff that had direct knowledge and experience of the process have moved on.

Another strategy he proposes is migration, which involves ensuring that all electronic content is held in a format which is useable and accessible by current software and hardware as well as keeping content up to date with the latest developments and guarding against format obsolescence. He cautions however, that migration is potentially time-consuming, complex and expensive, and could represent a significant drain on organizational resources in the long term, particularly as the need to migrate may depend on the progress of a volatile technology industry. Moreover, he adds that migration can potentially inhibit any functionality inherent in the original. He therefore advises that such costs must be balanced against the initial investment in content creation and the value of long-term access to the content.

He also proposes refreshment, a strategy that means the periodic transfer of electronic content to newer storage media (e.g. CD/DVD/DAT tape). This helps to guard against data loss due to media degradation. The author explains that the timing of refreshment cycles should be informed by manufacturers' information on, and practitioners' experience of, the typical lifespan of their physical media. In addition, he proposes that organizations use emulation, a strategy that uses software to mimic the behaviour of obsolete hardware and operating systems, and enable use of legacy software. Another strategy put forward by Williamson is to control storage of media and access devices by storing and operating them in suitable environmental conditions ideally within the environmental tolerances specified by manufacturers. Finally, he proposes that resources must therefore be allocated to the backup and recovery requirements of an organization. He explains that initial backups should be created at the time a resource is created, with a regular routine implemented so that further backups are created during the lifetime of the resource.

In view of the current study, these strategies proposed by Williamson are important for the long term management of electronic content at Moi University and will go a long way to ensuring that this content is available for use irrespective of technological changes.

2.12 Content Management Tools and Systems

Contentmanager.eu.com (2000) says that many organizations are now urgently turning to content management because of three main factors namely internal pressure to create and manage content in a more efficient manner, an awareness that solutions are available at affordable prices, and as a response to governments that are forcing organizations to comply to legislative requirements on issues of accessibility to information. The authors add that CMS solutions have also evolved to the point where they are now genuinely easy to use, easier to deploy, stable products, less costly and strategically significant to an organization's operations. They observe that with information being seen as an 'asset' (whether through legislation and/or an organizations strategy), the only real method of storing and retrieving information is in electronic format, which in turn creates the need for a solution - or a combination of solutions - to manage the process and the content held - also known as Content Management Systems. They warn that those companies that choose not to adopt CMS technology will suffer the same fate as those that thought they could carry on using the typing pool instead of implementing word processing systems. In their opinion, the ability of the organisation to function at the same rate as its competitors and its ability to comply with legislation will require more resources and be less productive than if they had purchased a CMS.

Contentmanager.eu.com (2000) defines a CMS as a tool that enables a variety of (centralized) technical and (de-centralized) non technical staff to create, edit, manage

and finally publish (in a number of formats) a variety of content (such as text, graphics, video, documents etc), whilst being constrained by a centralized set of rules, process and workflows that ensure coherent, validated electronic content.

CMS exist in different forms or types. Mutula and Wamukoya (2007) describe the following examples namely: Weblog Software e.g. Blogger from Google and Bloglines from Ask Jeeves; Web Content Management Software (WCMS) which manages content in various formats such as text, graphics, graphics and links, for ease of distribution to the web server. Contentmanager.eu.com (2000) says that a WCMS typically enforces a structure on the pages being created – often referred to as templates. The structure (representing the layout 'code' for the web page) is typically concealed from the editor or author – so that the only task they have to complete is the insertion of content into a 'blank structured web page'. The authors add that a WCMS enables online information to be fresh, consistent and of a high quality, enables decentralised content creation thereby avoiding the IT bottlenecks that would delay the publishing of web content and facilitates the re-use of content.

Mutula and Wamukoya (2007) also describe a Document Sharing and Management Software which performs the functions of scanning, storage, management and retrieval of records. They explain that this software is critical to enterprises or organizations that rely on fast access to their records. According to Contentmanager.eu.com, a DMS revolves around a centralised repository that is used to manage the storage of any type of information that could be of value to an organisation - and protect the same against loss. Another type of CMS is the Enterprise Content Management System, which as they explain, supports both the web and content publication lifecycle. According to

these authors, it focuses on managing the capture, storage, security, revision control, distribution, preservation and destruction of documents and content. Finally, they describe Digital Asset Management software which manages digital media e.g. graphics, photographs, video and multimedia presentations. It employs browsers and cataloguing software.

There are lots of content management systems in the market that an organisation can choose from. Many are designed to give users flexibility to customize to suit their needs. Many are open source such that users have access to source code making it easy to build customized web sites and other applications. Examples of CMS include Joomla, Drupal, MODx, WordPress, Cushy CMS, ExpressionEngine, Concrete5, SilverStripe, among others.

2.14 Conceptual Framework

The diagram below is an illustration of the researcher's formulation on the major concepts that formed this study and the relationships between them. These are the concepts that arose from the literature review and will guide the data collection in this study.
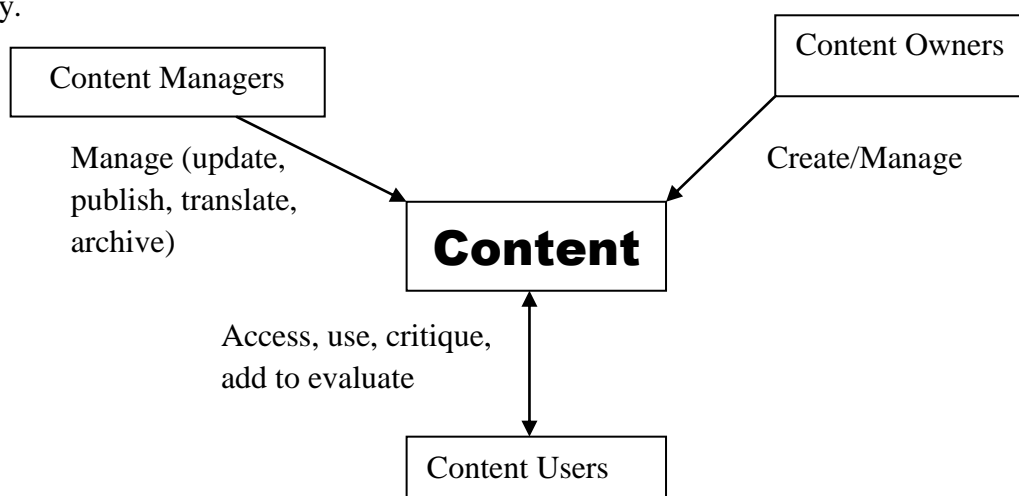
Figure 2.8: Conceptual Framework

The framework depicts four main components of importance to the study. They are:

Content Owners who create content from scratch. They are involved in conceptualising the content as it should appear in terms of the message in the content, format of storage and delivery and how it will be used. In the context of the study, they include teaching and administrative staff of the university who create teaching material, digital communications, course syllabi, advertisements and other content. These owners are also sometimes involved with management of the content they create by updating, translating, gate keeping, storing and publishing the content for others to use.

Content, which is the main focus of this study. This is basically information in digital formats and in the context of the study includes teaching materials, communication materials, electronic journals, theses and dissertations, among others.

Content Managers who are the personnel involved with active management of the content created. They carry out updates, publication using various media, translation, archiving and facilitation of general accessibility of the content.

Content Users who are the individuals and groups who are interested in content that has been created and made accessible via various media. In the context of the study they include teaching staff, administrators, students, alumni and other stake holders outside the university. These users access content, use it, add to it (if given rights) and also evaluate it.

2.15 Conclusion

In the discussion and review of literature above, several themes have been studied including the concepts of data, information, knowledge and content; ownership of content; content management best practices; knowledge management; Content Management Systems; institutional repositories and the theoretical models that support content and knowledge management. The conceptual framework was also described.

In the review of literature considered, some gaps were evident namely that most of the available literature is mostly in the context of the developed world. Very little of the literature available covers the developing countries. One of the reasons for this could be attributed to the fact that content management is still a relatively new concept, traditional information management notwithstanding. The literature on this subject is almost entirely available online. Given the fact that digital infrastructure in the developing world is still growing, much of the literature from this setting may not have been adequately captured on the Internet. It was also realized that most of the literature available is in the context of traditional business settings and less of it is in the context of academic institutions which was the main concern of this study.

The study addresses these gaps by highlighting content management in the context of an academic institution of higher learning and brings to the fore the relevant issues in such a setting. It also points out gaps and shortcomings in content management in this setting.

The literature review addressed the objective on global best practices in content management and shed light on this important issue setting the stage for analysis of the

same in Moi University. In other words, it sets a benchmark for content management practices at Moi University.

The key variable that emerges from the literature review and is addressed by this study is the concept of content management *per se* whereby the study seeks to understand what content management actually entails and its parameters. Further, the study undertakes to find out whether this is actually going on at Moi University and the challenges towards successful management of content at the institution.

The next chapter describes the methodology used in the study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the procedures that were followed in conducting the study. It discusses the research design, target population, sampling methods and the data collection instruments that were used.

In this study, a number of research methods, tools and analytical techniques were employed to suit specific situations.

3.2 Research Design

Kothari (2004) argues that an effective research design should be able to yield maximum information and provide an opportunity for considering many different aspects of a problem. He further says that the research design must consider the following factors: the means of obtaining information; the skills of the researcher and his/her assistants; the objectives or the problem under scrutiny; the availability of time; and the funds available for the research work.

Cantrell, in Neill (2006), examines three basic research paradigms - positivism (quantitative, scientific approach), interpretivism (or qualitative approach), and critical science. On the other hand, Johnson and Onwoegbizie (2004) propose a mixed method research as the natural complement to traditional qualitative and quantitative research. They define this paradigm as the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or languages into a single study. These authors emphasise that mixed methods research is an attempt to legitimate the use of multiple approaches in answering research

questions rather than restricting or constraining researchers' choices. They further contend that many research questions and combinations of questions are best and most fully answered through mixed research solutions. Johnson and Turner, in Johnson and Onwoegbizie (2004), refer to the fundamental principle of mixed research. According to this principle, researchers should collect multiple data using different strategies, approaches, and methods in such a way that the resulting mixture or combination is likely to result in complementary strengths and non-overlapping weaknesses. Further, Morgan (1998) and Morse (1991) in Johnson and Onwoegbizie (2004) explain that one may also consider the dimension of paradigm emphasis (deciding whether to give the quantitative and qualitative components of a mixed study equal status or to give one paradigm the dominant status).

For purposes of this study, the mixed method research paradigm was deemed appropriate for this study since the issues of importance were found to be of both qualitative and quantitative nature. Qualitative issues in the study included areas where the respondents were given freedom to explain in detail various issues and were captured using open ended questions such as 'What strategies do you have to ensure that the content you create is accessible to your users in the intended format?' and 'How useful do you find the university website as an information source? Briefly comment on your answer.' On the other hand, quantitative issues were captured using closed ended questions where the respondents were required to select responses from a given list. An example is the use of the Likert Scale that was used to measure the degree of satisfaction with the levels of support provided by the university for creation, dissemination, storage and use of digital content. The choices of responses ranged from strongly agree to strongly disagree.

However, in line with the proposition of Morgan and Morse above, the qualitative component was given more prominence in this study. According to Strauss & Corbin, in Neill (2006), broadly defined, qualitative research means "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification". Neill (2006) notes that qualitative research explores the richness, depth, and complexity of phenomena. Wilmot (n.d.) observes that qualitative research aims to provide an in-depth understanding of the world as seen through the eyes of the people being studied. According to her, it aims not to impose pre-ordained concepts; hypothesis and theory are generated during the course of conducting the research as meaning emerges from the data. She notes that statistical inference is not the objective, although within government, results are used to inform policy and, therefore, some form of generalization or transferability is implicit.

Spratt, Walker, and Robinson (2004) observe that quantitative research places the emphasis on measurement when collecting and analysing data. They also note that quantitative research is defined, not just by its use of numerical measures but also that it generally follows a natural science model of the research process measurement to establish objective knowledge. It generally makes use of deduction, that is, research is carried out in relation to hypotheses drawn from theory.

In line with the mixed method research approach, this research adopted a survey research design. The Health Communication Unit at the Centre for Health Promotion (1999) defines a survey as a systematic method of collecting data from a population of interest. They explain that it tends to be quantitative in nature and aims to collect information from a sample of the population such that the results are representative of

the population within a certain degree of error. This is achieved through the use of a structured and standardized questionnaire.

The infostructure and information architecture at Moi University were examined as they are critical in content management. The researcher further carried out a survey of the various functional MIS at the institution to establish the layout of information and how it was organized to make it useful and accessible to its intended users. Of special interest was the Moi University Website on which a content analysis was carried out to examine its organization, access and navigational issues.

Thereafter, a model of a Content Management System was developed using the prototyping method. Sauter (2000) defines prototyping as the process of building a model of a system. He says that in terms of an information system, prototypes are employed to help system designers build an information system that is intuitive and easy to manipulate for end users. Prototyping is an iterative process that is part of the analysis phase in the Systems Development Life Cycle (SDLC).

Further, he says that during the requirements determination portion of the systems analysis phase, system analysts gather information about the organization's current procedures and business processes related to the proposed information system. In addition, they study the current information system, if there is one, and conduct user interviews and collect documentation. This helps the analysts develop an initial set of system requirements.

Prototyping can supplement the systems development process because it converts these basic, yet sometimes unclear and intangible, specifications into a tangible but limited working model of the desired information system. The user feedback gained from

developing a physical system that the users can touch and see facilitates an evaluative response that the analyst can employ to modify existing requirements as well as develop new ones.

3.3 Study Population

Cox and West, in Lunsford and Lunsford (1995), describe a population as a well-defined group of people or objects that share common characteristics. A population in a research study is a group about which some information is sought. Most researchers cannot include all members of the population in their studies and must resort to limiting the number of subjects to only a sample from the population.

The target population in this study comprised staff of Moi University involved in creation, use, and organization of digital content. The population profile was as follows:

a) The total number of staff members was 3,662 distributed as administrative and academic staff.

b) Academic staff were 934 distributed in the 15 schools of Moi University. These were of interest to the study.

c) Administrative staff targeted were heads of administrative units in the university. These are approximately 16 people in number.

d) Administrative staff of interest to the study also included the staff at the ICT Directorate and the librarians who are organizers of the content generated.

Document review was carried out to establish the nature and usability of different types of digital content available in the institution. These were mainly limited to the departmental pages found on the institutional website.

3.4 Sample and Sampling Procedures

Trochim (2006) notes that sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen. He further explains that there are two main types of sampling. First is probability sampling which, he says, is any method of sampling that utilizes some form of random selection. He elaborates that, in order to have a random selection method, the researcher must set up some process or procedure that assures that the different units in the population have equal probabilities of being chosen. On the other hand, he explains that the other type of sampling, non-probability sampling, does not involve random selection and can be divided into two broad types: accidental or purposive. Trochim explains that purposive sampling is done with a purpose in mind and the researcher usually has one or more specific predefined groups he/she is seeking. He further asserts that purposive sampling can be very useful for situations where one needs to reach a targeted sample quickly and where sampling for proportionality is not the primary concern. Gilbert (2001) is of the view that purposive sampling is where the chance of selection for each element in a population is unknown and for some elements is zero.

Patton, in Coyne (1996), notes that 'the logic and power of purposeful sampling lies in selecting information-rich cases for in-depth study. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research. The respondents selected for the study were deemed key informants and were considered to be the information-rich cases that could provide much detail on the issues of importance to the study, that is, creation, use and management of digital content.

Wilmot (n.d) observes that qualitative research uses non-probability sampling as it does not aim to produce a statistically representative sample or draw statistical inference. Indeed, as she elaborates, a phenomenon need only appear once in the sample. She further states that with a purposive non-random sample, the number of people interviewed is less important than the criteria used to select them. The characteristics of individuals are used as the basis of selection, most often chosen to reflect the diversity and breadth of the sample population.

Because of the technical nature of the study, purposive sampling was preferred. This was used to select specific departments and individuals of Moi University who, as was earlier noted, are directly involved in creation, use and organization of digital content in the institution. These were recognized as the information-rich cases that would provide insights into the issues central to the study and were identified to be lecturers, librarians, staff in ICT department, and administrators. The sampling frames for this study were the web pages on the Moi University website with data showing academic staff enrolment in the 15 schools, the members of the administration, ICT Directorate staff and library staffing. It was from these pages that sampling was done to obtain respondents for the study.

Selection of a sample from the administrative unit was also done purposively whereby the following six individuals were earmarked for inclusion in the study. They were Deputy Vice Chancellor (Research and Extension), Finance Officer, Senior Principal Administrative Officer (Academic), Chief Administrative Officer, University Librarian, and ICT Director. These formed /represented approximately 37 % of the entire administrative team of the university. The criterion that guided the purposive sampling

was to select the information-rich key personnel who would contribute most effectively to the study. This being a qualitative study, representativeness of the sample size is not a key aspect in sampling. This sample size was therefore selected based on convenience to the researcher and budgetary constraints.

From the 15 schools of the university distributed in the campuses of Moi University which at the time included Main Campus, Town Campus and Cheploilel Campus, a sample of 27% was purposively selected. This was 4 out of 15 schools. The schools were purposively selected to include School of Information Sciences and School of Engineering (Main Campus), School of Public Health (Town Campus), and School of Natural Resource Management (Chepkoilel Campus). The selection criteria was the level of development of ICT in the selected schools which implies that there is creation and use of digital content.

Sampling in the selected schools was done on the teaching staff who had already been identified as the information-rich respondents in that they were directly involved in creating, disseminating and using content in the institution. It was carried out as follows:

a) School of Information Sciences has 26 lecturers out of whom 40% were selected for inclusion in the study. These were a total of 11 lecturers.

b) School of Engineering has 50 lecturers. 40% of these, numbering 20 lecturers, were selected for the study.

c) In School of Public Health, there are also 26 lecturers and 40% were picked numbering 11 lecturers.

School of Natural Resource Management has 40 lecturers. 40% numbering 16 lecturers were selected. In each case, 40% of the population was selected as it was considered representative and adequate to yield the required information. This number was chosen at the discretion of the researcher based on convenience and budgetary constraints, since the number of lecturers had to be reduced to a manageable size and still consider reliability of data. In addition several scholars (Nachmias & Nachmias (1996); Kerlinger (1973) observe that a sample of 20% -30% is sufficient so 40% was deemed high enough to obtain reliable data. Other methods of data collection were used to minimize the error margin and cater for generalizability of results and replicability of the results.

The selected respondents included Heads of Departments who were required to give the relevant information. In the researcher's opinion, 40% was sufficient to give the required saturation threshold of information such that additional respondents would not add much value to the already collected information (Leech, 2005).

Further to this, it was found necessary to include administrators and ICT personnel in the schools selected because they are directly involved in creation and management of content. For this purpose, one administrator and one system administrator/ICT staff were purposively picked from each school. This was an additional 8 respondents.

The sample selection is summarized in Table 3.1:

Table 3.1: Sample Selection

School	Information Sciences	Engineering	Public Health	Natural Res. Mgt	Total	% of Total
Lecturers	11	20	11	16	58	80.5
Admin.	1	1	1	1	4	5.6
ICT staff	1	1	1	1	4	5.6
Top Mngt.	-	-	-	-	6	8.3
Total	**13**	**22**	**13**	**18**	**72**	**100**

3.5 Data Collection Procedures and Instruments

The central, totally indispensable, part of a real world enquiry is the collection of data; no data - no project (Robson, 1993). Different methods of data collection are available to the researcher but he/she must bear in mind that there is a need for systematic and organized procedures to the whole activity.

Triangulation was used in data collection. Saunders et al., in Dalcher and Brodie (2007), define triangulation as 'the use of different data collection methods within one study in order to ensure that the data are telling you what you think they are telling you.' The authors emphasize that the idea is that different methods will have different effects, so by using different methods, the 'method effect' can be cancelled out.

Tools for data collection in this study were face-to-face interviews, questionnaires and content or documentary analysis. The choice of data collection tools was informed by previous similar studies, such as those in information systems and other information-related studies e.g. in Heery and Anderson (2005), Fuller (2004) among others. By taking advantage of their individual strengths and mitigating on their disadvantages, the researcher was able to collect adequate data and information to meet the objectives of the study and answer the research questions. The researcher also monitored the Moi

University website at various stages in the study in order to assess the type of content, currency of the content and how long it was retained on the website among other issues.

3.5.1 Interviews

Semi-standardized (or semi-structured) interviews were used to collect qualitative data from administrators (See Appendix 2). The projected sample size was six individuals. Fielding and Thomas, in Gilbert (2001), say that in this type of interview, the interviewer asks major questions the same way each time but is free to alter their sequence and to probe for more information. The interviewer can thus adapt the research instrument to the level of comprehension and articulacy of the respondent, and handle the fact that in responding to a question, people often also provide answers to questions that are going to be asked later. Kothari (2004) says that for an intensive investigation like the present one, personal interviews are important to collect information personally from the sources concerned.

An interview schedule was used for all the face-to-face interviews and was necessary to guide the questioning. Simmons, in Gilbert (2001), says that a schedule contains set questions in a pre-determined order that is adhered to in each interview. The schedule used was in the form of open-ended questions which allowed the respondents to answer in any way they wished and to provide as much detail as they deemed necessary.

The responses to the questions on the interview schedule were recorded using a tape recorder once permission had been sought and granted from the respondents. During the interview, as the recording went on, supplementary notes were also taken in a note book. This was necessary to guard against loss of data in case of failure of the recording

machine. Later, after the interview, the responses were reviewed and any gaps corrected so that later analysis would not be compromised.

The interview method offered many advantages that benefited the study. Robson (1993) says that the interview is a flexible and adaptive way of finding things out. Face-to-face interviews in particular offer the possibility of modifying one's line of enquiry, following up interesting responses and investigating underlying motives in a way that postal and other self-administered questionnaires cannot. During the interviews, it was possible to probe for more detail. As Fielding and Thomas in Gilbert (2001) put it, probing is all about encouraging the respondent to give an answer and as full a response as the format allows. This was done and the researcher was able to obtain more information than just that directly covered by the interview schedule.

The interview was also useful for this particular area of study which is not very common and it was realized that other than the ICT Directorate who were already familiar with the topic, most of the other respondents had not heard of it before. Thus, in the face-to-face encounter, the researcher was able to begin by explaining in simple terms what content management actually entailed.

In addition, considering that all the key informants selected for the study were very busy people, semi-structured interviews were preferred for their high level of flexibility in sequence of questions, exact wording and in amount of time and attention given to the different topics. This helped the researcher to tailor the interview according to the amount of time allocated to each interview.

On the other hand however, the respondents' busy schedules meant that many of the interviews had to be postponed and/or rescheduled.

3.5.2 Questionnaires

Questionnaires were used in the study to collect data from the 58 lecturers, 4 school administrators and 4 schools' ICT staff who could otherwise not easily be reached by use of interviews (See Appendix 3). The design of the questionnaire and the choice of questions were guided by the aim of the study, study objectives, literature review, and research questions. The questionnaire consisted of both open and closed questions. In describing closed questions, Nigel (2001) says that they are developed in advance, complete with a number of possible answers that can be given. Each respondent is asked to choose from one of the listed options. On the other hand, he says that open questions are those that allow individuals to respond in any way they wish.

The questionnaire was made up of 23 items whose aim was to collect personal data such as age, category of staff, and department where they belonged. The questionnaire also collected data on their work practices and the data they create and/or use; their use of the Moi University Website and its appropriateness and the challenges they face in management of digital information. Five-point Likert scales were used for some of the closed questions ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

The questionnaire was distributed by hand to respondents (lecturers) from School of Information Sciences, School of Engineering, School of Public Health and School of Natural Resource Management. Some of the questionnaires were also distributed by e-mail to respondents in School of Engineering who could not be found in their offices because the university was closed at the time of data collection.

3.5.3 Document/Content Analysis

Data was also collected from various documents such as information policy documents, strategic plans for the university as well as the Moi University Website and departmental web pages (See Appendix 4). These documents were obtained from the selected departments and also from the Internet. These data and statistics were useful for the researcher to be able to analyze the content management practices and future plans for the same in the university. The researcher was also able to assess current problems and factors influencing content management and accessibility of organizational and academic information. In this way, the researcher was in a better position to give recommendations as to the way forward in using ICT in content management

The framework used for content analysis involved perusing documents both in soft and hard copy which were deemed relevant to point to strategies, plans and activities directly related to content creation use and management in Moi University. Some of these were documents availed during interviews with key informants e.g. the systems Librarian who stood in for the university librarian and availed the information systems and electronic resources: best practice and use policy document. The documents and web sites were perused to find out issues relevant to content in terms of arrangement and accessibility. It involved analysis in terms of content, relationship among different types of content, content accessibility, and logical layout generation. The content analysis heuristics of Leise (2007) were an important guideline for analysis of web content. Leise (ibid.) points out that issues such as completeness and collocation of content in web pages is of key importance in influencing the experience of the users of these web sites.

3.6 Reliability and Validity of Research Instruments

According to Mugenda and Mugenda (1999), reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials, i.e. the relevance of the instrument. Reliability in research is influenced by random error which is the deviation from a true measurement due to factors which have not effectively been addressed by the researcher. This includes errors due to inaccurate coding, ambiguous instructions to the subjects, interviewee and/or interviewer fatigue and, interviewer bias.

The authors also define validity as the accuracy and meaningfulness of inferences which are based on the research results, i.e. validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study, i.e. the correctness of the data as given by the research instrument.

The reliability and validity of the research instruments was tested in a pilot study involving teaching staff and ICT staff in two schools of the university, namely School of Information Sciences and School of Engineering. The instruments were also tested on the technical staff in the ICT Directorate.

A pilot test of the questionnaire was done on some of the teaching and technical staff in the population to determine its validity and reliability. The respondents in the pilot study were specifically identified as individuals who would have prior experience with the topic of study i.e. content management e.g. in creating, accessing or using digital content in various forms. Once these individuals were identified and the questionnaire designed, it was issued to a small sample of respondents from the identified groups. They were requested to take note of or ask about any items in the questionnaire that they had difficulty understanding. Thereafter, the researcher took time with each of the

respondents to obtain feedback on the questionnaire and the different items that needed rephrasing to ensure that the instrument actually obtained the information as intended. Based on this feedback, the instrument was revised accordingly.

The questionnaire was also pretested with the supervisors who advised on question choice and construction and flow of the items to ensure appropriate design of the instrument.

By trying out the draft of the interview schedule on the lecturers and supervisors, it was possible to make corrections on the questions to ask and critical areas to include in the interviews. It also enabled the researcher to arrange the questions more systematically and to deal with any unforeseen ambiguities in the questions.

3.7 Data Analysis and Presentation

Robson (1993) says that analysis of data is necessary because, generally speaking, data in their raw form do not speak for themselves. The messages stay hidden and need careful teasing out. He goes ahead to state that the process and products of analysis provide the bases for interpretation.

Since the study was both qualitative and quantitative in nature, both qualitative and quantitative methods of data analysis and presentation were used. In this study, qualitative data collected from the open-ended questionnaires and interviews was analyzed using content analysis. Data was presented in prose form according to themes that the researcher was able to identify after the coding. The quantitative data was analysed and presented using statistical methods such as totals, averages, frequencies and tables.

3.8 Development of the Prototype

The CMS Prototype was developed by customizing MODx which is an open source content management system and web application framework. The customization was done after downloading the MODx framework available at http://modx.com/download/. MODX enables developers and advanced users to give as much control as desired to whomever they desire for day-to-day website content maintenance chores. The framework allows you to focus on usability, design, business logic, content and building great sites, not on the tools that build them (MODx, 2005; http://modx.com/why-modx/applications/content-management-framework).

3.9 Ethical Considerations

Gilbert (2001) emphasizes that there are no cut-and-dried answers to many ethical issues which face the social researcher. He adds that the fact that there is no right or wrong answer does not mean that ethical issues can be ignored. Instead, he advises that the best counsel for the social researcher is to be constantly ethically aware. The researcher beforehand sought to explain the essence of the study to the respondents by including a brief introduction on the opening page of the questionnaire. During interviews, researcher also politely introduced herself to the respondents and the topic of study whose purpose was also explained. The respondents were assured that their responses and information they provided would be held in utmost confidentiality and would not be used to the detriment of the participants.

In addition, permission was sought to gain access to and use official documents that were required to provide information for the study.

There was no personal gain from the study other than obtaining increased knowledge and experience for the researcher. On the other hand, however, the society at large and the participating educational institutions in particular stand to benefit greatly from the research findings after completion of the study and the findings published. Barnett (2001) opines that for researchers, part of their responsibility is to disseminate their research findings as widely as possible. She says that if a researcher does a study and writes an article then it sits on a shelf in the library, then the researcher really has not done the work because he/she has not disseminated the findings far and wide. This will help people to make more informed decisions based on the information from the findings of the research.

To this end therefore, the researcher intends to take advantage of several avenues available to be able to disseminate the findings of the research so that interested parties can benefit from new knowledge gained from the research. The researcher plans to use avenues such as:

Publishing the Findings in Refereed Journals
The researcher intends to disseminate the findings of this research via publication in relevant refereed journals in the field of Information Sciences.

Local ICT Events, Conferences, Workshops or Seminars
This is an effective way through which research findings can be effectively disseminated to stakeholders. By attending these events and presenting talks and papers or articles derived from the research, it is possible to reach a wide audience of interested parties.

Sending Research Findings to Study Participants

The researcher intends to send a summary of findings to all the key informants who willingly took their time to participate in the study and provided valuable information for the study. In this way policy makers (such as the ICT directorate) and other stakeholders who took part in the study and who may benefit directly with information from the study findings will gain access to this information without much effort on their part.

3.10 Problems Encountered in Data Collection

A major problem that was encountered in data collection was that many of the selected respondents proved to be very busy individuals. This meant that the researcher had to make several repeat visits to the concerned individuals' offices before the actual interviews could materialize. In some cases, this was such a serious problem that two interviews were called off altogether because the respondents concerned were totally unable to make time for the researcher. Thus a lot of time was spent trying to get respondents to provide information for the study.

It was also noted that some respondents showed some apathy towards participation in research and in spite of the researcher's persuasion, some absolutely refused to participate in the study. Many of these commented that the timing was not appropriate given the fact that they were busy administering and marking examinations at the time this data was being collected. Quite a number of respondents could not be found in their offices and the researcher opted to send some questionnaires by email. In spite of this effort, very few respondents responded through email.

3.11 Conclusion

This chapter has presented the methodology that was used to carry out the study. It has discussed the research design and methods applied to obtain relevant information for the study. It has discussed the population of the study, sampling techniques that were applied, the actual data collection tools and procedures and the data analysis and presentation techniques that were used. The next chapter presents, analyses and interprets the data collected from the respondents.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

The aim of the study was to examine the types of content generated at Moi University and the strategies for their management with a view to designing a framework to effectively manage digital content in the institution.

The study was undertaken using the mixed method research design whereby both quantitative and qualitative methods complement one another. Both questionnaires and interviews were used to elicit information from the respondents. Specifically, the study was a survey of content management practices at Moi University. The target population was the staff of Moi University categorized broadly as administrative and academic staff. The different types of digital content at the institution were examined and these included the Management Information Systems, the institutional website, research data and theses and dissertations among others.

Out of the general population, a sample was selected to participate in the study and this was done using non-probability sampling technique. Specifically, a purposive non-random sample was used whereby different characteristics of the individuals in the population (that were deemed relevant to the objectives of the study) were used as the basis of selection. A sample size of 40% was selected from each participating category/department in the university. The key informants were drawn from these departments. The sample was selected from a total population of 150 people which comprised teaching staff, ICT staff and administrators in the selected departments. Data was collected from this group using questionnaires. A total of 66 questionnaires were

distributed and this yielded a 70% response rate. Interviews were used to collect data from members of the university management. Out of the 6 scheduled interviews, 4 materialised giving a response rate of 67%. The members of the university management who were interviewed were the Senior Principal Administrative officer (Academic), an officer in the Office of the Chief Administrative Officer, the Systems Librarian and the ICT Director.

The total number of questionnaires returned from each school is summarized in Table 4.1:

Table 4.1: Response Rate

School	Issued	Returned	% returned
Information Sciences	13	13	100
Engineering	22	15	68
Public Health	13	8	62
Natural Resources Management	18	10	56
Total	**66**	**46**	**70**

These findings show that 28% of the respondents who participated in the study were from the School of Information Science while 17% were from the School of Public Health. Twenty two percent of the participants were from the School of Natural Resource Management and 33% were from the School of Engineering.

Both the interview schedule and the questionnaire were based on the research objectives some of which were to examine the nature of digital content generated at Moi University, analyze the existing methods and strategies for creation, update, publishing, translating, archiving and retrieving digital content in Moi University and develop a

Content Management System Framework and that will assist Moi University to plan for the management of digital content.

4.1.1 Categorization of Respondents by Task

Respondents were asked to indicate the main tasks they were involved in at their workplaces. Table 4.2 summarizes their responses:

Table 4.2: Categorization of Respondents by Task

Task	Frequency (n=46)	Percentage of Total
Administrative	21	46
Teaching	41	89
Research	35	76
Technical	9	20

The findings indicate that 21 of the respondents (46%) were involved in administrative tasks, 76% were involved in research work and only 20% undertook technical tasks at their workplaces. Eighty nine percent were involved in teaching as their main task at work. Further scrutiny of the responses revealed that 30% of the respondents combined administrative, teaching and research activities as their main activities at work, a similar number (30%) concurrently undertook teaching and research, 13% were involved in administrative, teaching, research and technical activities at their workplace, 2% undertook teaching, research and technical work activities while 15% were engaged in teaching only.

These results show that a majority of the staff in the different departments who participated are largely involved in administrative duties alongside their teaching and research activities. However, an equally large number of staff (30% of respondents) are

involved in teaching and research activities which would be said to be the core business of teaching staff in such an institution of higher learning.

These findings are supported by Van Houweling, in Wainwright (2005), who points out that universities assemble people together in the creation of new knowledge and the transmission of previously developed knowledge. Further, Wainwright observes that universities have needs to maximize research and learning outcomes including those achieved through the facilitation of teaching approaches and the facilitation of learning opportunities. According to Wainwright (ibid.), it is being accepted that all universities are involved in both teaching and research.

4.1.2 Role of the Departments

This question was targeted at the administrators who were interviewed. They are members from different departments each of which is charged with specific duties and responsibilities within Moi University. The department in which the Senior Principal Administrative Officer (Academic) falls is under the office of the Chief Academic Officer and the specific role played is overseeing admission of undergraduate and postgraduate students into the various degree programs of the university. In addition, the section deals with issues relating to student loans, bursaries and student disciplinary matters. The section is also a custodian of student records and data and facilitates the student inter and intra school and department transfers.

The officer in the Chief Administrative Officer's office who participated in the study was from recruitment and training. The section oversees recruitment of new staff in all academic and administrative departments. In addition, the section is responsible for facilitating training of staff both locally and internationally and in ensuring that staff on

training is regularly contacted to provide their academic progress reports to the University.

The Systems Librarian represented the university library whose primary objectives are to expand capacity to facilitate the university's core business of teaching, learning, research and extension. They aim to do this by acquiring and managing relevant information materials and by providing information services to the university community.

Finally, the ICT directorate is charged with the responsibility of provision of quality ICT services to the university and the management, control and maintenance of ICT. It is the official university advisory body on all ICT matters and is also responsible for formulation and interpretation of ICT policies for the university.

4.1.3 Facilities at the Workplace

Respondents were asked to indicate the facilities provided at the workplace to assist them in performing given tasks and achieve work-related objectives.

As shown in Table 4.3 below, 98% of the respondents have computers and associated tools to facilitate their work, 65% work with computer networks of one type or another, while 87% indicated they have communication facilities to support them in their work.

Table 4.3: Facilities Available to the Respondents (N=46)

Facility	Frequency	Percentage
Computers and associated tools	45	98
Computer networks	30	65
Communication facilities	40	87
Well defined work processes and procedures	15	33
Filing cabinets	25	54
Text books	2	4
Field stations	1	2
Lab equipment	1	2

N/B: Table shows multiple responses

Fifteen respondents (33%) pointed out that they have well defined work processes and procedures to help them achieve given work objectives. Twenty five respondents (54%) mentioned that they have filing cabinets which are physical facilities to facilitate their work and this could be specifically filing of records and paper documents. Two respondents (4%) revealed that they also use text books in the course of their work while 1 respondent (2%) cited use of field stations. Another 1 respondent (2%) indicated availability of laboratory equipment to help them achieve their given task objectives. The results indicate that almost all respondents (98%) use computers and associated facilities in their work practices. This, in turn, implies that quite a lot of digital content is created and/or used in the schools that participated in this study. However, these findings also revealed that manual methods and structures are still important and useful to respondents to facilitate creation and management of content for example in storage.

From interviews with the members of management, additional information was gleaned on the existing facilities available to facilitate staff work. Concerning ICT infrastructure, it was found that the Office of the Senior Principal Administrative Officer (Academic) has computers in all the subsections and offices which assists the personnel to carry out their work objectives more efficiently and effectively. For example, in generating transcripts, they use a software program that was developed by a former student. Most of their transactions are actually facilitated by the ICT infrastructure available.

In the Office of the Chief Administrative Officer in charge of recruitment and training, it was found that the department is computerized but they have insufficient number of computers. The officer admitted that in most offices in this department, it is only the secretaries who have computers for use. This means that the other personnel have to do their tasks manually or get the secretaries to do the work on their PCs. This tends to overwork the secretaries.

In the Library, it was established that ICT infrastructure is highly developed. The PCs are networked and the staff have a variety of software to facilitate their daily transactions. The Librarian explained that the department has just acquired a new open-source software package to manage library transactions (the ABCD) but he emphasized that these resources are still not adequate to serve the growing number of users.

According to the ICT Director, the ICT department is generally in charge of the university-wide networks and connectivity, hardware and software issues. Documents available from the department list the following as services offered by the ICT department (*ICT Centre in Brief*, unpublished):

a) E-mail services to Moi University community.

b) Internet access to Moi University community.

c) Data Communication Infrastructure (backbone network) maintenance

d) Information and Communication Technology training to end-users.

e) Database Administration and Software Development

f) Information and Communication Technology consultancy.

g) End – User support and Help desk services (hardware, software and general ICT).

h) Management of Information Systems (MIS)

i) Maintenance of Moi University Website

Thus it is evident that the department plays a crucial role in ensuring that ICT facilities and services in the university operate at optimized levels. The Directorate has to be consulted whenever a new network is laid in the different schools that will eventually be linked to the wider university network. They are in charge of issuing IP addresses to allow users throughout the university to access the Internet on the university backbone. According to the ICT Director, it is the dream of this department to make Internet accessible to all members of staff in the different locations of Moi University, expand the computer networks and develop data centres to facilitate creation and access to digital information by all members of the university community.

4.1.4 Awareness of Content Management

Respondents were asked if they were aware of the concept of 'content management'. The purpose of this question was to gauge the extent of awareness of the concept especially in the light of ever-increasing use of computers and related facilities to create and use digital content. Their responses are captured in Figure 4.1.

Awareness of Content Management
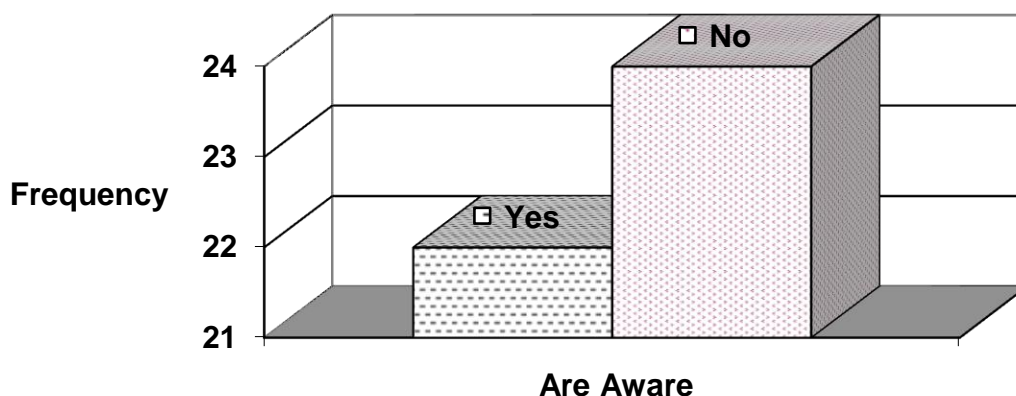
Figure 4.1: Awareness of Content Management

The results in the chart above show that out of a total of 46 respondents, 22 of them representing 48% indicated they are aware of the concept of content management while 24 of them representing 52% of the respondents said they were not aware of the concept. This shows that approximately half of the participants understand the concept indicating that this concept is not totally new among the members of the university community.

4.1.5 Types of Digital Content

Respondents were asked to indicate the different types of digital content that they created or used in the course of their activities within the university.

Table 4.4 summarizes the responses. 91% of the respondents create/use lecture notes and presentations. This high percentage is indicative of their core business in the university as these are mostly lecturers who are directly involved in preparing teaching material and documents in digital formats. Another 84.8% of the respondents pointed out that they create/use course syllabi. A further 60.9% of the respondents revealed that

they create/use theses and dissertations while 65.2% of the respondents indicated they create/use information on academic programs. Eleven respondents representing 23.9% pointed out that they are involved in creation/use of advertisements and news in digital formats. Further, 58.7% respondents create/use electronic communication in the course of their work.

Thirty six respondents (78.3%) indicated they create/use examination results while 26 (56.5%) showed that they create/use software. In addition to these, research papers and e-journals are created/used by 40 respondents (87%). Lastly, images, video, sound (multimedia) were created/used by 16 (34.8%) respondents.

Table 4.4: Digital Content Created/Used by the Respondents (N=46)

Digital Content	Frequency	Percentage %
Lecture notes and presentations	42	91.3
Course syllabi	39	84.8
Theses and dissertations	28	60.9
Information on academic programs	30	65.2
Advertisements and news	11	23.9
Electronic communication	27	58.7
Examination results	36	78.3
Software	26	56.5
Research papers and e-journals	40	87.0
Images, video, sound (multimedia)	16	34.8

N/B: Table shows multiple responses

From interviews with administrators, it was established that the digital content created and used varied depending on the core activities of each department. For instance, the Department of the Senior Principal Administrative Officer (Academic) handled content such as information on academic programs, electronic communication, examination results, graduation lists, student enrolment data and lecturer evaluation data. Feedback from users is captured manually using paper forms that users can complete during a visit to the department.

On their part, the Office of the Chief Administrative Officer in charge of recruitment and training mostly handles advertisements and news which they get in soft copy from Heads of Departments who want to advertise vacancies in their respective departments and electronic communication both from within and outside the institution.

The systems librarian confirmed that the library handles a wide variety of digital content ranging from theses and dissertations, advertisements and news, electronic communication, research papers, e-journals and multimedia.

This section addresses research objective 1 which was to examine the nature of digital content generated at Moi University. It is evident that a lot of digital content in various forms is generated and used in the institution. The section can be tied to research question 2 whose findings indicate that a large majority of teaching staff are involved in both teaching and research which by implication necessitates use of and creation of large amounts of digital content. It can also be tied in with research question 3 which was about the facilities available to help staff achieve their objectives. The findings in response to question 3 indicate that 98% of the respondents have access to computers and associated facilities and therefore are enabled to create and access digital content.

4.1.6 Users of the Content Generated

The respondents were asked to state users of the content they generated. This was necessary to shed light on the specific users of the content generated.

The findings indicate that majority of the users of the content generated are both students and staff (67.4%). Fifteen (32.6%) respondents showed that the users of the content they generate are students only. In addition to students and staff, 11 (23.9%) respondents revealed that their content is also used by other consumers in varying proportions, namely researchers (3 respondents), industry professionals (3 respondents), academic colleagues (2 respondents), themselves (1 respondent), friends and relatives (2 respondents), quality assurance unit and specifically Kenya Bureau of Standards (1 respondent), and former students (1 respondent). These results show that in line with their core business, the respondents produce content targeted at their primary clients i.e. students and also for consumption by other staff within the university.

4.1.7 Strategies for Content Dissemination

The purpose of this question was to establish the various methods used by the creators of digital content to disseminate their information and ensure the intended users could actually access it for use. It should be noted that answers to this question were not mutually exclusive so a respondent was able to cite more than one method of content dissemination.

Six (13%) respondents did not attempt to answer this question. They left the space blank or answered N/A. This could be interpreted to mean either they did not understand the question or have no strategies of ensuring access to the content they create. The responses are shown in Table 4.5.

Table 4.5: Strategies for Accessibility of Content (N=40)

Strategy	Frequency	Percentage %
None	4	10
Distribute via hardcopy	7	18
Train users	5	13
Avail in soft copy	22	55
Assume that they already know how to access	9	23
Preparing for online access	1	3
Publish in online scientific journals	1	3
Use Chisimba e-learning portal	1	3

Four (9%) respondents explicitly indicated they had no strategies to ensure that the content they created is accessible by the intended users. One (2%) of these respondents elaborated that the content she created was for self use therefore she had no need of strategy to ensure it could be accessible since she was able to use it herself.

Seven (15%) respondents said that they ensure the content they create is accessible by distributing it in hard copy printouts to the relevant users, whether class notes or memos to administrators. Two of these respondents also indicated that they inform users of availability of content via paper notices on notice boards.

Five of the 46 respondents representing 11% indicated that they ensure their content will be accessible by training the intended users to equip them with skills to use word processors, spreadsheets, and databases. One of these indicated: "I demonstrate in class how to access the content so that the students can later access it on their own". Some of these further indicated they train them on how to search the web and how to create and store digital content.

Twenty two respondents representing 48% said that they avail or distribute the content in soft copy via different channels such as emails, CDs, flash disks, PowerPoint presentations in class or in meetings, personal websites or the university website. Three of the respondents in this category further explained that they create the content, upload it into computer systems or web pages and then alert their users (in this case students) via SMS that there is content available for their use so that they can access it wherever it is.

It was interesting to note that nine respondents, representing 20%, said they expect their students and other users to know how to access the content on their own, i.e. it is assumed they have gotten the skills from the ICT courses taught in the respective schools or elsewhere. These respondents do not therefore concern themselves with strategies for ensuring the content can be accessed. They create the content and let the users worry about how to get it.

One respondent representing 2% of all respondents (who was the system administrator in the School of Information Sciences) said that "I am in the process of configuring an application server to enable online access to digital content by users". Another 1 respondent said, "I publish content in online scientific journals which are easily accessible to users via the university website". One other respondent said, "I use open and distance learning (the university's Chisimba portal) to disseminate my digital content to users. Further, another one respondent gave an unclear answer, i.e. 'by informing the staff'. This was not understandable.

This question addresses in part the research objective number 2 which is on the existing methods for creation, update, publishing, translating, archiving and retrieving digital

content in Moi University. It specifically addresses the strategies for publishing the content that creators create and ensuring that their target users can access it in the appropriate formats.

From the findings in the table, it is evident that a large percentage of creators of content (80%) take the time and trouble to personally ensure that the target users can access this content. The methods they use are varied as presented in the table and this shows that these creators are conscious of the fact that their users are important and that content that is created must be available to the user.

Crisp (2009) advocates for digital publishing and describes it as a 'create once, publish many' process. It offers the advantages of multiple formats in which digital content can be availed such as print pdf, screen pdf, CD-ROM, web, Sharable Content Object Reference Model (SCORM), eBooks and others. He also highlights current and emerging technologies in digital publishing such as internet and mobile, portable readers and print on demand kiosks. Other ways in which digital content can be distributed include social networking sites, websites and blogs (commonly known as Web 2.0). Crisp emphasizes the need to be ready for today's markets and tomorrow's emerging technologies. It is evident from the findings of the current study that the respondents at Moi University are not yet fully exploring and exploiting the existing digital publishing strategies as described by Crisp (2009). For example none of the respondents mentioned blogs and social networking sites as a publishing option that they are currently exploiting. The implication therein is that the respondents are probably not well exposed to these avenues of content dissemination and this is a gap that needs to be addressed.

4.1.8 Strategies, Policies and Plans for Managing Digital Content

The purpose of these questions was to find out whether there were formal systems or strategies personal, departmental or organized by the university to enable the creators of digital content to effectively manage the content they create.

When asked about the strategies for management of the content they create and/or use, 22 respondents representing 48% said they do have formal strategies to help them manage the content to keep it valid, accurate, correct and complete. The remaining 24 respondents representing 52% said they do not have any formal strategies to manage their content.

Out of the 22 respondents who have content management strategies, 19 indicated that these are personal efforts at managing the content they create and/or use. Two respondents representing 9% of these 22 respondents are involved in collaboration with an American university which provides strategies to help in content management. These are efforts at an international level which are above the institutional levels. Three other respondents out of the 22 (13%) also indicated that the content management strategies they use are efforts provided by the university. Another 9 of the 22 respondents, (40%), indicated that the efforts that help them manage their content are provided at the departmental level. These results show that the university as an institution and its departments are still not facilitating content management by formalizing the strategies and provision of tools for such management. This is seen in the fact that most individuals handle their own creation and management of digital content while an equally large percentage of respondents have no strategies whatsoever to manage the content they create and or use.

From interviews with members of management, it was found that most of the departments create and use digital content but have no independent strategies for its management. For instance, the Senior Principal Administrative Officer (Academic) pointed out that the ICT Department assists his department in handling some of the content such as advertisements and news whereby the admissions department will formulate the advertisements in hardcopy and pass them on to ICT for publication on the website. The department has no independent formal strategies such as databases or any software to facilitate the management of the content they create or use. The officer was aware of the concept of content management but the department relies on the policies and plans for content management devised by the ICT Department.

The office of the Chief Administrative Officer in charge of recruitment and training explained that the department has both automated and manual strategies for managing the digital content they create and use. For example, they have a database to store information such as the staff on study leave, extension of contracts and promotions. However, this officer was not aware of the concept of content management, and was meeting this term for the first time. The department also relies on the strategies and plans set by the ICT Department.

The Systems Librarian on his part elaborated that in the past, there was no policy requiring students to submit softcopy of their theses and dissertations alongside the hard copy but this is now changing and current requirements are that both soft and hard copy must be submitted to the custody of the university library. In the past, students have been hindered from submitting the soft copy due to fears that their work will be plagiarized and also the issue of ownership of the work. The system librarian also

verified that the university does not have an institutional repository in spite of a resolution to that effect having been passed several years ago but has not yet been implemented officially. He disclosed that there are small scale efforts going on within the library to establish this repository with the help of students on attachment from the School of Information Sciences. Further, he explained that there is a policy document that has been developed by the library to guide users on the use of the information systems and electronic resources within the library. The document is entitled '*Information Systems and Electronic Resources: Best Practice and Use Policy'* (Refer to Appendix 6).

On the side of the ICT Directorate, the director confirmed that he is aware of the concept of content management and was able to describe it adequately. He explained that there is currently no specific policy for content management in the university but acknowledged that a policy is important. However, there are specific standards that the Directorate tries to enforce to keep the content in uniformity; for example, documents submitted for uploading to the university website should be prepared in PDF format, using HTML or PHP as the programming languages where possible. The department has an information systems support officer who oversees development of content and its storage and distribution. Information systems assistants in the department modify the content to make it appropriate for display and posting onto the Internet. He also cited the fact that he is aware of the risk of litigation in case of wrong information appearing on the website. A policy will provide guidelines to prevent such incidents from occurring.

It was found that at the moment, the retention policies that apply to content and information on the university website are unspoken and unwritten. It is assumed that as long as there is no update from the concerned school for information about them on the website, then the particular school is satisfied with the content as it is. It will therefore be left on the website until such a time that the school submits an update. Newsletters will stay on the Website for approximately one year before they are removed from active display on the Website. The director further explained that once content is no longer actively useful on the Website, it is withdrawn from the web page and stored in a digital archive. Links to it will then be created to re-direct interested parties who may wish to access the same content. Another way is by creating mirror sites away from the website such that content is stored therein and an interested user is able to access the same.

The director explained that publishing on the web is simpler, more cost effective and provides faster delivery of information. The expertise to do this can be created internally as opposed to print publications which need more unique resources which in most cases can only be found outside the organisation. He emphasised the need to explore more uses of the Internet and websites to publish organisational content.

On policy issues, the ICT director pointed out that the university's ICT policy is currently under development and its principal concern is the effective and efficient (responsible) use of information and communication technology resources. It is intended to ensure among others, the integrity, reliability and good performance of university ICT resources, that the user community operates according to established policies and applicable laws.

The users of the content created in all the departments described above are students, lecturers, prospective applicants, researchers, parents, administrators and the general public.

4.1.9 Support of the University

Respondents were asked to give their views on a series of questions which was aimed at evaluating their satisfaction levels with facilitation by the university to create, access and use digital content. Their responses are captured in Table 4.6.

The results in Table 4.6 show that 34.5% of the respondents strongly disagree with the statement "Considering the ICT infrastructure available in my department, the facilities adequately support me in my creation, dissemination, storage and use of digital content." Eight respondents representing 17.4% were undecided about this statement while 22 (47.8%) respondents strongly agreed with this statement.

Looking at the results for the statement 'there is adequate support of the university to equip me to publish my research work on the Internet', they show that 45.6% of the respondents strongly disagreed with the statement while only 30.4% agreed with this statement. Eleven (23.9%) respondents of the respondents were undecided about this statement. It is clearly evident that more respondents felt that the support of the university towards their online publishing activities was inadequate as compared to those who were satisfied with the support given by the university.

When asked to evaluate the statement, 'The Internet connectivity enables me to easily access digital content on the Web', 37.0% of the respondents strongly disagreed with the statement while 47.8% strongly agreed with the statement. On the other hand 15.2% of the respondents were undecided about their agreement or disagreement with the

statement. The responses towards this statement show that more people were in agreement that the status of Internet connectivity in the university enabled them to access digital content on the web.

Table 4.6: Facilitation for Management of Digital Content (N=46)

S/N	Measure of satisfaction with facilitation for management of digital content	SD	D	U	A	SA
1.	The ICT facilities support me in creation, dissemination, storage and use of digital content.	3 (6.5)	13 (28.0)	8 (17.4)	16 (34.8)	6 (13.0)
2.	There is adequate support of the university to equip me to publish my research on the Internet.	6 (13.0)	15 (32.6)	11 (23.9)	14 (30.4)	0 (0.0)
3.	The Internet connectivity enables me to easily access digital content on the web.	4 (8.7)	13 (28.3)	7 (15.2)	13 (28.2)	9 (19.6)
4.	The university website enables me to access university information in a satisfactory manner.	7 (15.2)	10 (21.7)	5 (10.9)	19 (41.3)	5 (10.9)

Note: Strongly Agree and Agree were merged to Strongly Agree; Strongly Disagree and Disagree were merged to Strongly Disagree

The results on the evaluation of the statement 'The university website enables me to access university information in a satisfactory manner', show that 36.9% of the respondents strongly disagreed with this statement while 52.2% strongly agreed with this statement. A further 10.9% were undecided about their agreement or disagreement with this statement. These results show that majority of the respondents were satisfied with the availability of university information via the website.

This question was pertinent in addressing research objective number 3 which was on assessing user satisfaction with the existing content management strategies in facilitating access and retrieval of digital content. Looking at the findings from this set of questions, it is evident that most respondents were satisfied that the university has provided adequate tools (ICT resources and Internet connectivity) for content creation and access. As a result, most people in the university can then create and access digital information adequately. However, the findings also indicated that the institution has not done enough to facilitate publication of local content so that it can be accessed on the global arena. However, the university through the library is currently setting up an institutional repository that will facilitate dissemination of local content. Management of digital content encompasses much more than simply creating it. This content should also be kept up-to-date, archived, published and retrieved at access points remote from the points of creation.

4.1.10 *Frequency of Accessing the Moi University Website*

The purpose of this question was to assess the rate at which respondents accessed the Moi university website. The responses are captured in the Table 4.7 below:

Table 4.7: Rate of Access of the Moi University Website (N=46)

Access	Frequency	Percentage (%)
Daily	15	32.6
Weekly	15	32.6
Monthly	13	28.3
Never	3	6.5
Total	**46**	**100**

The findings indicate that 15 (32.6%) respondents accessed the MU website on a daily basis, while a similar number, (15 respondents) representing 32.6% accessed it weekly.

This rate of access can be considered rather low, considering that an institutional website is supposed to be an interface between the institution and the community both local and global. This indicates that there could be some reasons why the immediate Moi University community is shunning contact with the website.

Further, the findings revealed that another 13 respondents or 28.3% access the website on a monthly basis. Three respondents or 6.5% indicated that they never access the MU website. These results show that a majority of the respondents or 65.2% access the website at least every once week.

4.1.11 Usefulness of the Moi University Website

The next question provides insight into the differing frequencies of accessing the website by the teaching staff at Moi University. They were required to comment on the usefulness of the website as an information source. Their responses are illustrated in Table 4.8.

The results show on one hand that 15 respondents or 32.6% find the website useful, informative or adequate as an information source. Some of these respondents indicated that they visit the website to get updates on the current university activities, while one of them expressly stated that he feels 'the ICT department is really trying to continuously update it to report on current developments.' However, 2 of these 15 respondents emphasised that in spite of the usefulness of this information, the information on the website needs more frequent update to remain useful in the long term. Another 2 of these 15 respondents indicated that they use the website to access the electronic journals that the university subscribes to. In their own words, 'the e-journals

are especially great and useful' and 'access to e-resources is valuable to teaching and research'.

An additional 4 or 8.7% respondents out of the total 46 respondents indicated they find it fairly useful for their information needs.

Table 4.8: Usefulness of the MU Website (N=46)

Usefulness	Frequency	Percentage (%)
Useful/Informative/Adequate	15	32.6
Fairly useful	4	8.7
Not very useful	24	52.2
Not sure of relevance	1	2.2
Never use	2	4.3
Total	**46**	**100**

On the other hand, 24 respondents representing 52.2% of the respondents observed that the Moi university website is not very useful and they had varied statements to support their views. They noted that sometimes the website is not easily accessed due to connectivity problems including low bandwidth and interruptions in Internet connections thereby cutting off connection to the website completely. In addition, they observed that the information on the website is hardly ever updated in a timely manner, and consequently, users would not get current information on the website. This discourages would-be users from seeking information on the website. Some respondents noted that the information on the website is too general in approach and one would not get detailed information therein, neither can one get specific information pertaining to departments on the website.

One of these respondents also added that the website is not useful since applications for the academic programs cannot be done online and student's examination results cannot be checked online. One respondent also observed that the website contains too much administrative information which is not useful for his academic needs. Further, some respondents noted that there is not much information that is available on the website. Specifically, there is inadequate information on course content and syllabi pertaining to the academic programs and also no research output published by members of the university community. This response can be linked to the one respondent representing 2.2% who said he is not sure of the relevance of the information available on the website and therefore does not use it as an information source. 2 respondents representing 4.3% indicated they never use the website but did not give reasons for this.

These findings imply that most respondents would actively use the institutional website as a source of information if its shortcomings were addressed. They would also use it as a communication tool amongst themselves and with their clients (the students) if the scope of its usage was expanded, e.g. to allow students access their academic results and also register online. In other words, making the website more interactive and encompassing would go a long way in improving its usability and help the university realize its full potential to serve information for general consumption by staff, students and the public at large.

Fuller (2004) echoes these views saying that content is why customers come to an organisation. There are different kinds of content that require different kinds of management to adequately serve customers. Specifically, he advises that content posted on a website must be reviewed regularly, a task that is even more important than initial

content approval. In order to meet needs adequately, web analytics and customer feedback should be used in improvements to the web site. In addition, he notes that underused content must be found and fixed and web logs evaluated to find content that may be underused.

These findings are also supported by Powell in Grossniklaus and Norrie (2002) who observes that the job of managing a (website) is no longer the task of one single webmaster but rather of a team of content providers, editors and designers who strive to deliver up-to-date and correct information. This implies that for a website to be effective it is not only the technical aspects that are critical but also the content therein and how it will be accessible and useful to the intended users. Several team players including content editors, website managers, web engineers and others must join hands to ensure that information served on a website adequately meets the needs of the intended audience.

4.1.12 Design of the Moi University Website

The purpose of this question was to find out the views of the users of the MU website on its design, attractiveness, stability and reliability in usage. This question elicited a wide range of responses some of which are captured below:

a) It should have dynamic web pages and less graphics, should be as simple as possible (like the one of University of Nairobi) to hold a lot of content, it should be updated regularly in conjunction with various university stakeholders.

b) It looks ok on the surface but a deeper interaction with the site proves that it is shallow and un- updated hence unreliable. Seems like it was created for the university management!

c) The design is good. But to access the site from within the MU network is a very frustrating experience. When I want quick access I always resort to my modems.

d) The e-mail server is unstable. The webpage is a bit crowded because of trying to put a lot of information on the home page.

e) It could be made more attractive by applying different CMS.

f) It is fairly attractive but slow due to heavy graphics.

g) There has been great improvement in the design of the website, but there is still room for improvement.

In summary, the rating of responses is reflected in Table 4.9.

Table 4.9: Attractiveness, Design, Reliability and Stability of the MU Website

Website is:	Frequency	Percentage (%)
Attractive and Well-designed	14	30.4
Attractive but unstable and unreliable	8	17.4
Not attractive, unstable, unreliable, poorly designed	25	54.3
Ok but has room for improvement	4	8.7
Average on all points	2	4.3

The findings above imply that more respondents (54.3%) find the website unattractive, unstable and on the whole, poorly designed. In this connection, improving the design of the university website may generally eradicate the negative attitude that most people have towards it. This will attract more members of Moi university community towards

the website and encourage its use as a single access point for digital information on university wide activities and resources.

These views are reinforced by Middelfart (2002) who underscores the website design heuristics proposed by Jakob Nielsen. He emphasises that a successful website is able to provide a HOMERUN i.e. has **H**igh-quality content, is **O**ften updated, has **M**inimal download time, offers **E**ase of use, is **R**elevant to users' needs, is **U**nique to the online medium, and has **N**et-centric corporate culture. Middelfart explains that a HOME RUN is an all inclusive test that a website has to pass in order to meet the requirements defined by research of users' needs, when visiting websites.

It is important therefore that the unit in charge of design and maintenance of the university website consider using the HOMERUN as a benchmark to mitigate on the negative experience that users have so far had with the website. It will also encourage more people to visit the website knowing that their needs will be met.

4.1.13 Respondents' Web Literacy

The purpose of this question was to find out how the respondents rate themselves in the use of the web to access and use information available therein. The responses are captured in Figure 4.2 below.

From the findings, it is evident that only 9 respondents (19.6%) out of the total 46 respondents consider their web literacy as excellent. This means they are well versed with the skills to locate and retrieve information available on the World Wide Web and the Internet. 24 respondents (52.2%) rated their web literacy as being good while 12 respondents 26.1% rated their web literacy as average. Only 1 respondent (2.2%) regarded their web literacy as poor.
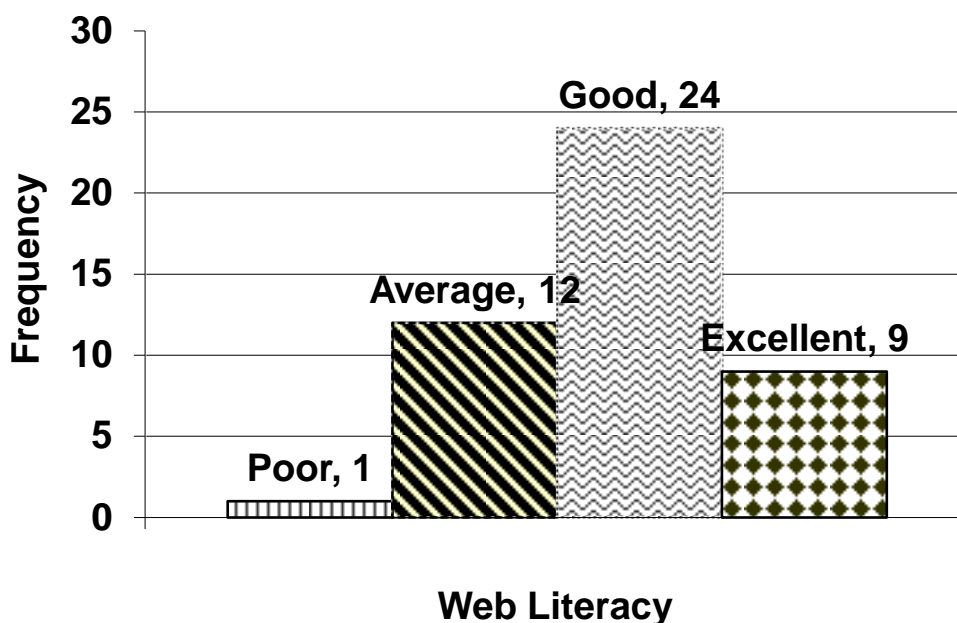
Figure 4.2: Rates of Web Literacy

The findings in the figure above indicate that a large majority of respondents, 33 respondents (71.8%) regard their web literacy skills as being good or excellent. This means they are able to search for and access digital information presented on the Internet and the web. This implies that they may already have some of the skill requirements for creation, update, archiving and retrieving information in digital formats.

However, the university still has to develop training programs for web literacy to equip those members of the community who indicated that their web literacy is average and poor.

4.1.14 Suggestion for Improving the University's Global Ranking

In 2009, Moi University was ranked No. 86 in Africa and 7,965 globally. This was based on Website content, currency, quantity, types of content, relevance and generally, their presence on the web. These are criteria that were considered the most relevant for

this study on content management. The purpose of this question was to find out what input the respondents as members of the MU community can give to improve their institution's global ranking.

To begin with 12 respondents (26%) left this question blank and did not attempt to provide any suggestions as to how they could help improve the institution's standing in the eyes of the ranking committee. Reasons for this could be that they lack awareness on how the ranking is done or conducted.

The responses from those who answered this question were as varied as the respondents themselves and are summarised in the discussion below.

First, a suggestion that was given by almost all respondents was that they would attempt to publish their research findings on the web. This includes the findings from all projects they are involved in and the reports they may be required to write which should ideally be available on the web. In addition to this, some of them emphasised that the university must provide incentives to enable their staff to publish on the web. They were categorical that the university must be more proactive in funding research and facilitating the quality and volume of e-publications resulting from such endeavours. One respondent expressly stated that there should be a section on the MU Website through which academic staff can upload their research findings. In connection to this was the suggestion that the relevant personnel should always update the MU website to provide current information. This was further collaborated by the Senior Principal Administrative officer (Academic) who when interviewed on the issue of university ranking, reckoned that "as an institution, we do not sell ourselves enough on the net, and therefore outsiders do not know much about us." He added that "people think it is

the administration only to be responsible but I think we all have a collective role to play to improve our institution's visibility. Many of our staff are involved in collaborations for research and other projects. This information should be obtained and uploaded onto the net". These views were echoed by the other members of management who also felt that further action needs to be taken to improve usage of the website in terms of design, content reliability and currency, availability of the site among other issues. This would encourage more people to use the website and improve on the visibility of the institution.

Another suggestion was that the university should provide staff with ICT resources including improved Internet connectivity. Tied to this is the suggestion to equip staff with web literacy to enable them use the web effectively to access information and also upload their own information onto it.

Two of the respondents suggested that they would be willing to participate in development and implementation of policy on content development and management. This will guide them (and others) to effectively create and manage digital content that by implication, should then improve the institution's online visibility.

Another suggestion from 4 of the respondents was that they will upload their Curriculum Vitae on the web and encourage their colleagues to do the same. This will directly promote the online visibility of the schools and departments they belong to, and therefore the visibility of the university as a whole.

Another suggestion from 1 of the respondents is that the university should develop an Institutional Repository (IR) to store all projects, theses and dissertations produced by its members. The university should also increase funding to sustain these efforts.

Another suggestion from another respondent is that the university should advertise its academic programs on the web. This can be tied to another suggestion that the university should enable students to apply online for the academic programs of their choice and also access examination results online. In addition, there was a suggestion that lecturers should be encouraged to upload lecture materials (in audio, text or video formats) on the web so that students and other users can freely access it from wherever they are located.

Four respondents suggested that the university management in different departments, sections, and divisions should be encouraged to provide updated digital information about their units as this is what comprises web content. The members of these units should be encouraged to be creative and proactive in assembling this information ready for posting on the web. This was further collaborated by the Director of ICT who conceded that the problem of inconsistent update of content on the university website has compromised the ranking of Moi University. He reiterated that schools need to be more proactive in the currency, quality and quantity of information appearing about them on the web. They should also encourage their members to inform ICT about any conferences they attend and the publications they make so that this information can be uploaded to the website and improve the university's visibility.

In connection with this, another suggestion was that the MU website should have updated data of all staff members and their qualifications.

One respondent suggested that each school in the university should start and sustain a refereed online journal that can be accessed freely from anywhere in the world. Another respondent confirmed that he publishes in international journals that upload his papers

on the web i.e. electronic publications and he always identifies himself with Moi University.

One respondent suggested that the members of staff should engage more in extension activities and have this reported online.

Another suggestion from those who answered through the questionnaires was that the Chief Administrative Officer, Chief Academic Officer, Vice Chancellor and other members of the university management should be educated on the use of ICT or else all other efforts are in vain.

These views are supported by Fuller (2004) who says that a web presence does not just happen. Content must be created, tested, approved, formatted, loaded onto servers and managed for years throughout the life cycle of the information. He explains that computer hardware and telecommunication networks are needed to provide access while designers and programmers are needed to create and maintain interactive applications that provide online services. According to Fuller, all of this takes dollars and people and policies and procedures which are incorporated into the notion of web management. In this connection, Moi University as an institution ought to make conscious effort to put up the right web presence and do what it takes to improve on its global ranking amongst academic institutions of higher learning.

4.1.15 Percentage of Respondents' Work Published Online

The purpose of this question was to find out the amount of work that different respondents have published in digital form and its availability online via the web or via local area networks in the university.

The results in Table 4.10 indicate that majority of the respondents 47.8% have only 1%-20% of their academic work published on the web or available via the university local area networks. In addition, a large percentage of the respondents [16 respondents (34.8%) out of the total 46 respondents] have no publications at all published on the web or available on the university LANs. Only 4 respondents (8.7%) have 30% − 50% of their work published online while a similar number has 60% − 80% of their work online. None of the respondents have 90% -100% of their work published online.

Table 4.10: Percentage of Work Published Online (N=46)

Amount of Work on the Web	Frequency	Percentage of Total
90 – 100 %	0	0.0
60 – 80 %	4	8.7
30 – 50 %	4	8.7
1 – 20 %	22	47.8
0 %	16	34.8
Total	**46**	**100**

The results above indicate that levels of digital publication are still considerably low among members of the university's academic staff. With the proliferation of ICT resources at the institution, efforts should be made at both individual and institutional levels to improve on this state of affairs. Utulu and Bolarinwa (2009) note that as experienced through the years, researches carried out in Africa and on African subjects are disseminated using only the paper media that are less effective and efficient than electronic systems and the Internet in dissemination. In addition, African academics as readers of scholarly papers have been reported to have had access to limited scholarly publication produced in Africa. They further observe that even with the proliferation of electronic scholarly information systems, the whole of Africa still lags behind and has

less than 4 percent of internet content. These views are evident from the study findings which indicate that 82.6% of academic staff have less than 20% of their academic output published electronically.

4.1.16 Challenges of Managing Digital Information and Content

The purpose of this question was to establish the problems and challenges that respondents may be having in managing the digital information they create and/or access from different sources. Out of those who had been issued with questionnaires, six respondents (13%) failed to answer this question and left the spaces blank. Forty (87%) respondents answered the question providing a wide variety of responses on the challenges they face in digital information management. Their responses are captured in the discussion below.

To begin with, 13 respondents out of the 40 who answered indicated they have no problems as they are competent in managing the information they create and/or have access to. This formed 32.5% of those who answered this question.

Out of the remaining 27 respondents, 3 respondents indicated they experience problems with retrieval of information from the Internet, and also saving and filing this information for future reference. Closely connected to this was a respondent who said they have a problem choosing what information to treat as important thus save it for future use and which one to treat as unnecessary. In addition, another respondent indicated she has a problem in adding websites to 'my favourites' folder when browsing the web so that she can later use the information offline.

One respondent indicated she has experienced loss of data because of using faulty storage media while another indicated he has trouble keeping track of digital

information in his computer system. Linked to these are the 2 respondents who said they experience problems managing their digital information as they have limited digital skills relevant for this task. 3 respondents pointed out that they have problems accessing and using e-journals and other library materials.

A major problem that was cited by 8 respondents is the loss of data due to the lack of antivirus within the university. This has made their computer systems prone to frequent virus attack and has therefore hindered information sharing amongst colleagues. The ICT Director when interviewed also acknowledged that the department has also suffered loss of data from virus attacks and once or twice has had the university website hacked. This, as he explained, "was a serious problem that put the institution out of global visibility until the problem was rectified". A closely related problem cited by 2 respondents is the low levels of technical assistance provided by the university to service and maintain the existing computers.

Lack of enough computer and related electronic equipment was another problem cited by 4 respondents. They stated that their departments do not provide adequate numbers of these resources to facilitate their use and management of digital information.

Another major problem that was mentioned by 8 respondents was the unreliable and slow Internet connectivity in their departments and/or schools. 1 of these respondents elaborated that in their department, they only have 1 computer linked to the Internet and this is meant for use by the entire department with over 30 members of staff. Another respondent also elaborated that this slow Internet connectivity hinders access to information from some sites such as Emerald Group Publishing.

When interviewed, the ICT Director acknowledged that as the department in charge of digital content on the website there have been challenges mostly as a result of lack of interest from the schools and departments of the university to avail content for uploading on the website. There is resistance to change and people are not ready to give personal information to be put on the website. He also explained that generally, the ICT Department has been castigated for not performing on top notch but he reasoned that this is because people do not understand the constraints within which the department has to work.

This question addresses the research objective number 5 which was on the challenges experienced in managing digital content in Moi University. The findings imply that most of the problems faced are to do with either access to information or management of that information once it has been accessed. This can be tied in with the findings from the question on the existing methods of content management where it was found that the university has no formal strategies or tools for content management. It was also established that individuals are left to devise their own strategies and acquire their own tools for content management as evident in responses to this question where respondents showed that they have lost data due to virus attack. The university has not invested in corporate antivirus software to protect data from loss. Responses also indicate that connectivity to the Internet is slow thus hindering efficient access to digital information on the web.

4.1.17 Solutions to the Challenges

The purpose of this question was to find out the steps that the respondents have taken to solve the problems they highlighted in the previous question. Their responses are captured in the discussion below.

As in the previous question, 6 respondents did not attempt to answer this question, naturally following the fact that they had not indicated any problems in the previous question. Thirteen respondents also indicated N/A in response to this question, also following the fact that they had indicated that they do not experience any problems therefore had no solutions to provide either. As a result, only 27 (58.7%) of all respondents provided solutions in answer to this question.

Out of the 27 who answered, 3 indicated that they frequently consult the school's ICT technicians or systems administrators whenever they experience problems with management of digital information. One of these 3 added that she also seeks assistance from friends and library staff if she has a problem with access to or management of the data she has accessed. One respondent indicated she tries to make the most of the information while she is online.

Out of the 27 respondents who answered this question, 10 pointed out that they have solved their problems by purchasing their own personal equipment comprising computers (laptops), modems, and storage devices. They then have to carry this equipment to and from the offices to ensure they can do their work and access whatever data they need at their own convenience. Closely related to this is 1 respondent who said he sets aside some of his own money for use to access information while another 1 indicated he uses facilities outside the university but did not specify which. Still another 1 respondent said he co-operates with other universities in Europe and gets to solve his information management problems.

Three out of the 27 respondents revealed that they make personal efforts at learning how to manage their information and do not rely on formal sessions that may be

organised by the university. Related to this are 5 other respondents who said they make efforts to organise their files and documents in folders and using secondary storage devices. They try to balance memory space versus relevance of the documents to avoid storage of files that may not be useful. In addition, they archive some documents away from active storage space by use of CDs and other devices.

Four respondents indicated they constantly update the antivirus software on their computers to counter virus attacks. One of these 4 respondents expressly added that he avoids careless sharing of removable data storage devices such as flash disks. This can be tied to 1 other respondent who indicated that he backs up his data to prevent loss.

Finally, 2 respondents explicitly said they are not able to overcome their information management problems.

The findings indicate that respondents are devising independent ways of solving their content management problems without relying much on the university's input into solving the problems. They are spending their own resources to acquire hardware and software to enable them access digital information and keep it safe for both current and future use.

4.1.18 Suggestions to Improve Access/Use of Digital Information

The purpose of this question was to elicit suggestions for improvement of access to and use of digital information by members of the university. Six respondents did not answer this question but the 40 respondents who answered provided a wide variety of useful suggestions.

Twenty respondents (50%) indicated that the speed of Internet connectivity should be improved and that all departments in the university should be equipped with Internet access points to enable all members access the Internet. They elaborated that the university should invest in more funds to improve Internet connectivity to student laboratories as well. Amongst these was the suggestion to invest in wireless connectivity facilities. In addition, there was the proposal to make full use of the broadband allocation to the university as currently, it is not used to its full potential. The respondents also suggested that ICT should be used in all teaching activities e.g. use of LCD projectors and also all services in the university should be digitized.

Related to the above suggestion was the proposal by 10 respondents (25%) that ICT infrastructure in all departments of the university should be improved to enable all members' equitable access to these resources for creation and management of digital information. Specifically, the numbers and quality of equipment should be improved. In the words of one respondent, 'the university should acquire state-of-the-art ICTs'. Further some of these respondents suggested that the computers should be networked in Local Area Networks to facilitate centralized access to digital information. Existing equipment should also be serviced regularly e.g. removal of viruses. A closely related suggestion was that the university should establish '24/7' walk-in, walk-out computer centres to facilitate improved access to the ICT resources.

In addition, there was a suggestion from one respondent to decentralize ICT management to the schools while another respondent suggested that ICT personnel should be more easily accessible by users.

Twelve respondents representing 30% suggested that the university should mount training programs to equip users with skills to use new modules (software) and also on the use of the web to access and use digital information. Further, some of them suggested that there should be a curriculum review to include ICT courses that will equip students on the use of ICT to create, access and use digital information. In addition to this, 1 respondent proposed that staff and students should be trained on content development and dissemination. In their work, Goodwin, *et al.* (2005) opine that not allocating adequate time and training to develop new competencies is unfair to employees and will most likely result in service degradation and dissatisfied users. Moi University should therefore strive to incorporate training programs for content creation and management.

Another proposal from 6 (15%) respondents was that staff should be given incentives to encourage them to create content (notes and assignments) for e-learning. Related to this is the suggestion from 2 respondents to encourage staff to post their lecture notes, research papers and assignments on the Internet for ordinary learning not necessarily e-learning. One other respondent suggested that abstracts of Moi University published journals should be made available on the Internet through African Journals Online (AJOL) hosted by NISC South Africa at <http://www.ajol.info.>

There was a suggestion from 3 (7.5%) respondents that the University ICT policy and other relevant policies should be implemented to deal with many of the weaknesses currently witnessed while 4 (10%) others suggested that serious content management practices and frameworks should be implemented. These respondents also suggested that Content Management Systems and databases should be created to facilitate content

management in the institution. 1 respondent further suggested that the university should establish an institutional repository for academic content in digital form.

Another suggestion was that the university should have a website hosting server where individuals (staff and students) can develop personal web pages, blogs and wikis and maintain them. This will increase visibility of the members and the university as a whole since owners of these pages will put the content they feel is necessary to be visible. Further the respondents suggested that the server should be well managed and should operate like 'Facebook' or 'myspace.com' where users are able to post and share information freely. This can be related to the proposal by Ramos and Piper (2006) that librarians and educators have much to gain from embracing and using blogs and wikis in their work and practice. These tools provide an excellent, interactive way to communicate amongst the community of users, and they provide rich content which when explored with a critical eye yields information found nowhere else.

When interviewed on suggestions for improvement of access to digital information, the Senior Principal Administrative Officer (Academic) felt that though the design of the university website has been improved, it still needs to improve further and this can be done by borrowing ideas from websites of other universities. He suggested for example that the website should be made more interactive and Internet bandwidth increased to boost accessibility of the website.

4.2 Moi University Website Content Analysis

The content on Moi University Website was analyzed according to the following Content Analysis Heuristics proposed by Leise (2007):

a) *Currency:* This was an analysis of how up to date the information on the website is. It was found that the website is not as regularly updated as should be. On various random visits to the website, it was found to frequently contain information that was outdated and had been left on display on the website long after the particular information would be considered useful, e.g. several months after an event. Refer to Appendix 5 which shows a webpage advertising the Moi University workshops and events four months after the event.

b) *Quantity of Information:* This criterion is concerned with how much information is provided on the website. It was observed that the amount varied from department to another and there was no standardized amount that would be available for an event or department.

c) *Diversity of Information***:** This examines the extent of variety of information captured/presented. It was observed that there is a wide variety of information presented about the various university programs and events, departmental information and others. This generally gives information on the university as a whole.

d) *User Friendliness*: This was concerned with ease of use of the website. It was noted that generally the website was easy to use and navigation around it generally got a user to the information they sought if it was available. However, it was noted that the site could do with some improvement e.g. the pointer to *HOME* in the various web pages does not take one to what they would expect

the homepage to be i.e. the initial organizational welcome page. This does not therefore standardize one's browsing experience of the website as happens with other organizational websites.

e) *Reliability*: This focused on how dependable the website is. It was observed that the website is not totally reliable or dependable and this is greatly compromised by the connectivity issues. It was observed that internet connectivity within the university premises fluctuates quite a lot thus denying internal users access to the website. However, outside the university, the website is available and therefore dependable much of the time.

f) *Collocation:* This criterion checks on whether items with similar content or on the same topic brought together in one area. On observation it was realized that the content is arranged in subject headings such as schools, Administration, ICT, Research and Publications among others. This means that a user can easily follow this links to find information on any topic brought together in one place.

g) *Differentiation*: In this criterion, the concern is whether dissimilar items or items about different subject areas located in different content areas. In the same vein as above, it was observed that items about different subject areas are actually located in different content areas. This is achieved through the arrangement of different items in different subject topics and accessible via individual links.

h) *Completeness*: This part confirms whether all content mentioned or linked to actually exist. It was noted that generally, most of the links do lead to existing content under each topic. There were generally no dead links.

i) *Accessibility*: This part is concerned with whether users are able to access the content they want through the browsing hierarchy or by using search. It was

observed that the website design does not employ the use of the 'search' option. Users can only access content directly by clicking on the existing links. This is a shortcoming of the website design as it implies that users have to physically search for content they need and are not assisted to access it directly using the search feature.

j) *Multiple Access Paths:* Are users able to take multiple paths to get to specific content? On examining the website, it was noted that users do not have multiple access paths they can use to get to specific content. The website design employs a linear design where links to the various web pages are collated in one common page (the home page) after which a user selects the topic they want to search under and follows it to its logical end. Thereafter, they cannot access a different subject content from wherever they find themselves, they have to click on '**back**' until they get to the homepage from which they can then search along a different subject line.

k) *Audience-Relevance*: This aspect has to do with whether different audience segments are able to easily find relevant content facilitated by content organization. On observation, it was noted that users can easily find relevant content because it is arranged under subject areas that are simple and easy to follow.

l) *Consistency*: This aspect is to do with whether the content structures in similar content areas are consistent. On this it was found that there is no uniformity from webpage to another and from departmental web pages to the next. It was noted that as the user browses the website, the design frequently changes and one gets

a feeling of visiting different websites. This somehow distorts the user's browsing experience as the organization presents different faces.

4.3 Conclusion

This chapter presented, analyzed and interpreted the findings obtained from the participants and respondents in the study who included academic and administrative staff of Moi University. The findings indicate that a wide variety of digital content is generated in the various units of the university owing to the ever increasing penetration of ICT resources. However, users of these resources are not adequately facilitated by the university to manage the content. There are no formal content management strategies and tools provided at institutional level so users have devised their own methods. Problems associated with access to and use of digital information include unreliable and slow connectivity to the Internet, inadequate numbers of hardware and software in the schools and departments, poor management of the university website as a central portal for access to university-wide information, and low levels of publication of research findings on the web.

Solutions suggested by respondents to solve the problems and improve access to digital information include implementation of the university ICT policy, implementation of content management frameworks and strategies, training users on use of the web and on creation and management of digital content, improving Internet connectivity and general ICT infrastructure in the university among others.

The next chapter discusses the analysis and design of the proposed system.

CHAPTER FIVE

SYSTEMS ANALYSIS AND DESIGN

5.1 Introduction

In Moi University, digital content exists arising from the intellectual and administrative activities of the members of this institution. This content exists as lecture notes and presentations, course syllabi, theses and dissertations, information on academic programs, advertisements and news, examination results, research papers and e-journals among others. The users of the content are both staff and students and users outside the institution. From the researcher's findings, it is evident that majority of the content arising from the activities of the personnel in Moi University is handled as personal assets rather than as institutional assets. As a result, the management of this content is left to the owners and creators to handle. From the findings, it is evident that after creating the content, there are no management strategies in place to keep the content current, accurate and accessible by others, especially at the institutional level. This has resulted in several challenges both for individual creators and the institution as a whole. Some of the challenges have been loss of data and information, poor accessibility of digital content, and little or no implementation of research findings because they are not publicized well enough. The findings also show that Moi University has no digital repository to house her locally generated material. The Moi University website is also inadequately consulted as a source of university information because of poor management. Most of the time, the content on the website is not updated in a timely fashion resulting in outdated content remaining on the website for quite a long period of time. Moi University Content Management System (MUCMS) should be implemented

to centralize and coordinate the management of intellectual assets and other forms of digital content in Moi University.

5.2 Justification of the Computerised Strategy

The system is justifiable for implementation since: the cost of implementation is low; it will make management of content easy; and content can be added, edited and updated regularly as required with a lot of ease without having to code. Content can also be uploaded and downloaded with ease without having to write a single line of code or doing any programming. All that is needed is a user's access to the Internet and user rights to the system.

5.2.1 Project Plan

The prototyping method was selected for development of the system because it was evident from the study findings that no content management system currently exists in Moi University. This means that users have no prior experience with such a system and may therefore not be able to clearly articulate their requirements. Ralhan (2000) postulates that prototyping is very suitable for gaining experience in new application areas and for supporting incremental or evolutionary software development. Purtilo, Larson, Clark in Rahlan (ibid.) propose a methodology that can be used for development of prototypes. The steps are:

a) Identify Objectives: First, a definition of the problem to be solved must be expressed, along with the criteria by which its success is to be judged.

b) Identify Risk: No realistic software effort can expect a clear and complete statement as the result of a step labeled 'define the problem', as the above item might suggest. In the gray and uncertain areas of the problem definition lurk great risks. These gray areas of risk must be identified and made explicit.

c) Formulate Prototyping Hypotheses: Once the risk areas have been expressed, the developer is in a position to design experiments to specifically address those risks. Each experiment addresses a hypothesis concerning the nature and potential remedy of the risk to a product's success. The hypothesis should include explicit linkage to the parts of the project that may be affected.

d) Construct Prototype System: A system that implements the hypothesized solution must be developed. Traditional programming practices are too expensive to make this practical in many situations. Thus there is a need to use specialized tools that facilitate inexpensive prototyping.

e) Instrument Prototype: Since the primary purpose of constructing a prototype is to answer one or more questions concerning its functional or other characteristics, it will usually be necessary to gather dynamic information regarding the operation of the software. In a large prototype, the complexity and volume of information is likely to exceed the limit of a single person's ability to comprehend it. It would be desirable to use automated tools for this purpose.

f) Experiment: The prototype system must be exercised to determine its behaviour and gather the output from the system instrumentation.

g) Evaluate Results: The results of the experiments must be evaluated to assess the efficacy of the hypothesized solution.

h) Repeat. This entire process is repeated until one of three outcomes is reached:

   i) Sufficient information has been derived from the prototyping activities to begin the development of a product

   ii) No solution to the problem can be found or, equivalently, that the solution would be too complex or costly to be of benefit

iii) The prototype system itself is of sufficient quality to serve as the production-quality system or, that it can be modified to serve as the production-quality system at less cost than a full-scale production-quality development effort.

5.2.2 Goals and Objectives of the Proposed System

The main goals for the Moi University Content Management System are:

a) To gather initial user requirements for use in developing an operational system later.

b) To present web pages using a series of templates

c) To build a search engine that indexes documents according to metadata

d) To make adding and editing of content easy

e) To centralise management of digital content

Achievement of the above goals will involve the following:

a) Analysis of the Moi University's website.

b) Incorporating the findings from user interviews and questionnaires

c) Knowledge of PHP Programming Language, Cascading Style Sheet language, Java Script and MySQL Database.

5.2.3 Functions to be Performed by the System

The functions that will be performed by various system elements in the MUCMS are as follows:

1. **Functions to be Performed by the MUCMS Software**

   a) Document creation and editing

   b) Uploading of content

   c) Downloading of content

d) Registration of MUCMS users

e) Registration of MUCMS managers

f) Management of MUCMS users

g) Document searches according to metadata

h) Management of files

i) Management of resources

j) Management of modules

k) Management of actions

l) Backup of MUCMS database

2. **Functions to be Performed by Hardware**

a) Data will be entered into the system through the keyboard

b) Processing of different MUCMS transactions will be handled by the computer

c) The Visual Display Unit (VDU) will display the information stored in the system

d) Processed data will be stored in the Hard Disk

e) Printers will produce hard copies of the generated reports

f) Other computers in the network will be used for MUCMS Database backup

3. **Functions to be Performed by Data**

Data will be input into the system by the users and then processed to output the required information. The data stored in the system will show the MUCMS registered users, MUCMS managers, documents and access permissions.

4. **Functions to be Provided by MUCMS Users**   `

      MUCMS users will view and download content. The uses can also edit and upload content according to user rights.

5.2.4 Prototype Risks

Some of the risks that would be faced in this particular prototype development are that user requirements may not be fully clarified and the end product may not fully address user requirements. However, this can be clarified as fully as possible through the numerous iterations that the prototype is expected to go through before a final product is accepted and implemented.

Another risk associated with the iterations is deciding how much iteration is enough and when to stop and implement the final product. This problem can be solved by initially defining the purpose of the particular prototype. For instance, in this study the purpose of the system was to gather initial user requirements. These can then be used as a springboard for subsequent system development. Time limits and deadlines can also be set to guide the development process and avoid spending too much time on the prototyping process.

5.2.5 Priorities for System Features

Different types of systems features were identified and are discussed below.

a) Normal System Features

Normal system features are those which satisfy the system users. The normal system features present in the MUCMS are:

   i)   Graphical User Interface (GUI)

   ii)   Database for storing information

b) Expected System Features

These are the features that are implicit to the system. The user does not have to specify

them but the software developer knows that it is important for them to be present.

Expected system features present in the MUCMS are:

    i)   Login for MUCMS System user authentication

    ii) Menus

    iii) Text boxes

    iv) Command buttons

    v)   Labels

    vi) Forms for data entry

    vii) List views

c) Exciting or Aesthetic Features

These are features that go beyond the user expectations. Aesthetic system features

present in the MUCMS are:

    i)   Tree view for fast navigation

    ii) Shortcuts

    iii) Pictures on forms and command buttons

5.2.6 Solution Strategy

MUCMS is an Internet-based system. If adopted, users will access content on the

system from any computer connected to the Internet according to their user rights. This

makes access to the content effective and convenient since the user does not have to be

within Moi University to access the site.

Data Dictionary

 1) Full Name: MUCMS member's full Name

Full Name = First Name + Middle Name

When Used: During MUCMS Member Registration

How Used: In logging into the system

2) Email address: MUCMS member's email address

When Used: In receiving mail and in getting a new password incase user

forgets current password.

3) User's role: identifies user rights

4) Date: Shows the system date. Has the format: mm/dd/yyyy

dd   = date of the month

mm   = month of the year

yyyy   = the current year

The system date must always be set correctly for right tracking of

MUCMS transactions.

Blocked until: Date up to which the user is not allowed to access a document

Blocked after: Date after which the user is allowed to access a document

5) Access permissions: used in setting user rights

5.3 Software Requirements Specification (SRS)

Also known as software functional specifications or system specifications, this is a precise description of the functions and capabilities of a software system and the constraints by which the system must abide.

5.3.1 Requirements Elicitation

As noted earlier, users within Moi University have no prior experience with content management systems and as such may not understand what the system will look like

and what it will enable them to do more effectively. For this reason, it was not possible to come up with accurate user expectations beforehand. However, it was still important to talk with the users to understand the setting within which the proposed system is expected to operate and to find out the environmental issues that are likely to impact on the system.

Elicitation of this information was carried out through several methods. In gathering the information, different people who are users were involved so as to come up with optimal requirements. These included the academic and administrative staff (who include researchers) and management staff in Moi University. Methods used in information elicitation are discussed below:

a) Interviews

Interviews were carried out with management staff of Moi University. The interview with the users primarily focused on the prevailing types of content and problems they experience in management of this content. The findings were noted down and used as the basis for deducing the requirements of the system.

b) Questionnaires

Both teaching and administrative staff were issued with questionnaires whose purpose was to elicit information on issues to do with the types of content they create or use, the strategies for management of this content, their views on the role of the university in facilitating their access to and use of digital content, and the problems and challenges with regard to personal management of digital information and knowledge. The findings from the questionnaires formed a basis for inferring the system requirements.

c) Content Analysis

The researcher carried out an analysis of content on the Moi University website. It was noted that the website did not contain all the content that was required by users and was also not updated regularly. It was deduced that lack of update could be as a result of tedious processes especially in obtaining relevant information from the schools and units. In addition, from the interview with the ICT Director, he noted lack of cooperation from the schools and departments to provide current information thereby preventing timely update of the content.

5.3.2 Requirements Analysis and Validation

In this phase, the requirements deduced were keenly analyzed and validated to ensure that:

a) They are an unambiguous, correct and consistent

b) They conform to the standards established for the proposed system.

From the interviews and questionnaire data collected, it was evident that users create a lot of digital content in varied formats but thereafter, there are no formal methods to manage this content.

From the findings, several problems to do with accessibility of local and foreign content were cited most resulting from shortcomings of the existing infrastructure, lack of policies to ensure content created is stored centrally for access by users within and outside the institution (in form of an institutional repository) and lack of accessible update procedures that can be used by ordinary users of the system.

5.3.3 Requirements Specification

From the cited problems, requirements were deduced that formed the basis for development of the system prototype. The MUCMS system was developed to manage content in a better way. It can be accessed by many users at the same time so long as their computers have access to the Internet. Features of the MUCMS include:

a) Document search according to metadata

b) Backup module for the MUCMS Database

c) Document manager module that makes creation, editing and publishing of documents easy

d) System settings module for the Administrator/ manager to define and customize system settings such as the system passwords, type of documents to be uploaded, manage system users and their access rights among other things.

5.3.3.1 System Functions

MUCMS performs the functions outlined in section 5.2.3 above. Other requirements are as follows:

5.3.3.2 User Characteristics

a) System users will require training on the usage of the system

5.3.3.3 Constraints

a) Only registered users can use the system. To do this they need a password to access the system.

b) This system can be accessed from any computer connected to the Internet

5.3.4 Security Features

As advised by the UKOLN (2003) in their Technical Guidelines for Digital Cultural Content Creation Programmes, the machines used to deliver projects must be operated

in as secure a manner as possible and should be placed behind a firewall if possible. Where sensitive information is being passed from a client to a server across the network, projects must use Secure Sockets Layer (SSL) to encrypt the data. This includes the transfer of usernames and passwords and other personal information. This also provides the end-user with an increased level of confidence in the authenticity of the service.

In addition to user login as a security requirement, MODx has other security features that can be integrated to protect the system. These include PHPIDS which is a PHP based intrusion detection plug-in which will enable the system administrator to find out at a very early stage about attacks to the website or system. The plugin does the logging of intrusions into the database, a file, or the MODx event log. It also blocks high intrusions and banns IP addresses.

5.3.5 Specific Requirements

The following are the specific requirements for the MUCMS:

5.3.5.1 Interface Requirements

a) User Interfaces

The user interface will provide interaction between the users and the system. This will be provided by the graphical interface provided by the CMS software.

b) Hardware Interfaces

A server will host the database. A user will use a client computer to access the system.

5.3.5.2 Performance Requirements

The static as well as dynamic numerical requirements placed on the software or on human interaction with the MUCMS are described below.

a) Dynamic Requirements

Keyboard entries are required to input the necessary information into the system. A mouse will also be used to input specific instructions to the system, for example making specific choices on a menu.

b) Static Requirements

For effective functioning, the system requires a memory of at least 128 MB RAM, 50 MB free space of Hard Disk but this should increase as the database becomes larger, and CPU clock speed of 1.0 GHZ minimum if it were to be installed on the local machine. However, this issue is not of much concern since the system will be uploaded onto the Internet.

5.3.5.3 *Organizing the Specific Requirements*
Each major function of the MUCMS will have Data Flow Diagrams (DFDs), scenarios and State Transition Diagrams (STDs).

5.4 Functional Requirements and Functional Requirement Models
This section outlines the behavioral requirements or functioning of the proposed system and how the different parts relate to each other.

5.4.1 Functional Modelling
In this section various models are used to model the major functions of the system. The major functions of the MUCMS system are:

a) Document creation

b) Registration and management of MUCMS users

c) Backup of MUCMS database

d) Archiving of content

To model the different aspects of the system, the following models were used:

a) *Scenarios*: These are used to model system behaviour.

b) *Data Flow Diagrams*: These are used to model each major function of the system. They indicate the inputs, processes and outputs of functions.

c) *Entity Relationship Diagrams (ERDs):* These model data. They are used to show the relationships between the entities relevant to the MUCMS system and the attributes of these entities.

d) *State Transition Diagrams (STDs):* These are used to model system behaviour.

5.4.2 Functional Modelling through Scenarios

These include:

a) Logging into the System

Scenario I

Normal Flow of Events

a) The user selects the login level

b) The user enters the login password

c) The system grants the user access

Scenario II

Incomplete Login Information

a) The user selects the login level

b) The user tries to log in without issuing password

c) The system prompts the user to enter password

Scenario III

Wrong Details

a) The users selects the login level

b) The user enters the wrong password

c) The system denies the user access and prompts him/her to enter the right password

b) Registering MUCMS Users

Scenario I

Normal Flow of Events

a) The user enters the member details

b) The system accepts the entry and alerts the user about the same

Scenario II

Entering an Existing User

a) The user enters member details with an email address already registered

b) The system detects the anomaly and alerts the user that the user already exists

c) The user registers another member

c) Creating a Document

a) The user enters document details and content

b) The system accepts and publishes the document

d) Management of MUCMS Users

a) The administrator/manager selects the user to manage

b) And enters the details

c) The system saves the details about the user

e) Backup of the MUCMS Database

    a) The administrator is given the opportunity to select the tables to be backed up

    b) The system backs up the selected tables of the database

5.4.3 Functional Modeling through Data Flow Diagrams

Context Diagram (Level -0 DFD)
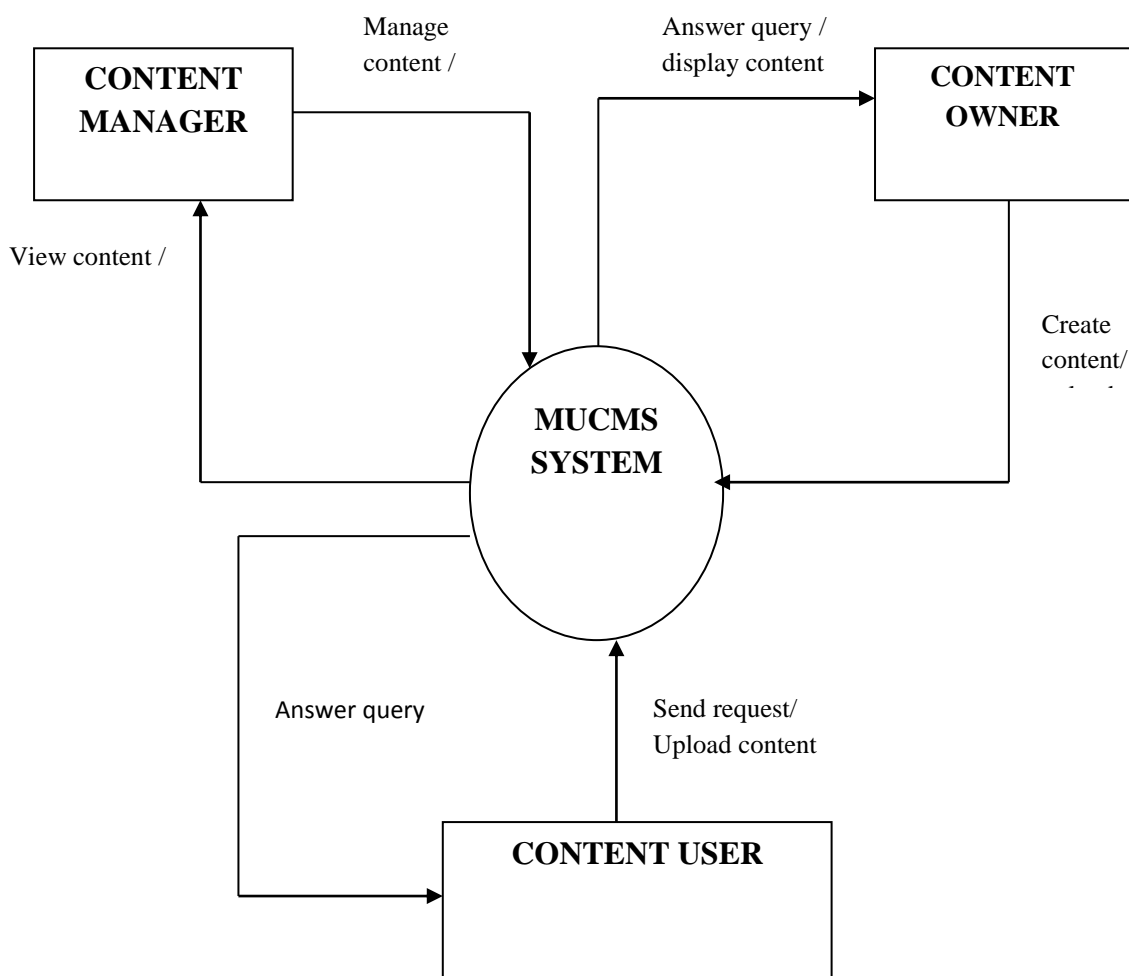
Figure 5.1: Context Diagram (Level -0 DFD) for the MUCMS

The diagram above shows the level-0 data flow diagram for the MUCMS. It models the system's boundaries by highlighting its sources and destinations. The system is

represented by a single process which supplies data to and receives data from the entities Content Manager, Content Owner and Content User.

Level -1 DFD

The level-1 data flow diagram below captures the main processes and data flows between the major entities in the CMS i.e. Content Manager, Content User and Content Owner. The data stores (Owner, User and Content) are also depicted in this level-1 DFD. Content managers can update both users and content, content owners can update content, and content users can update and display content.

`

CONTENT MANAGER

CONTENT OWNER

User & content
details

Owner

Content details

1
Update
user and
content

2
Update
content

User

Content

3
Update and
Display
content

Upload & display
details

CONTENT USER
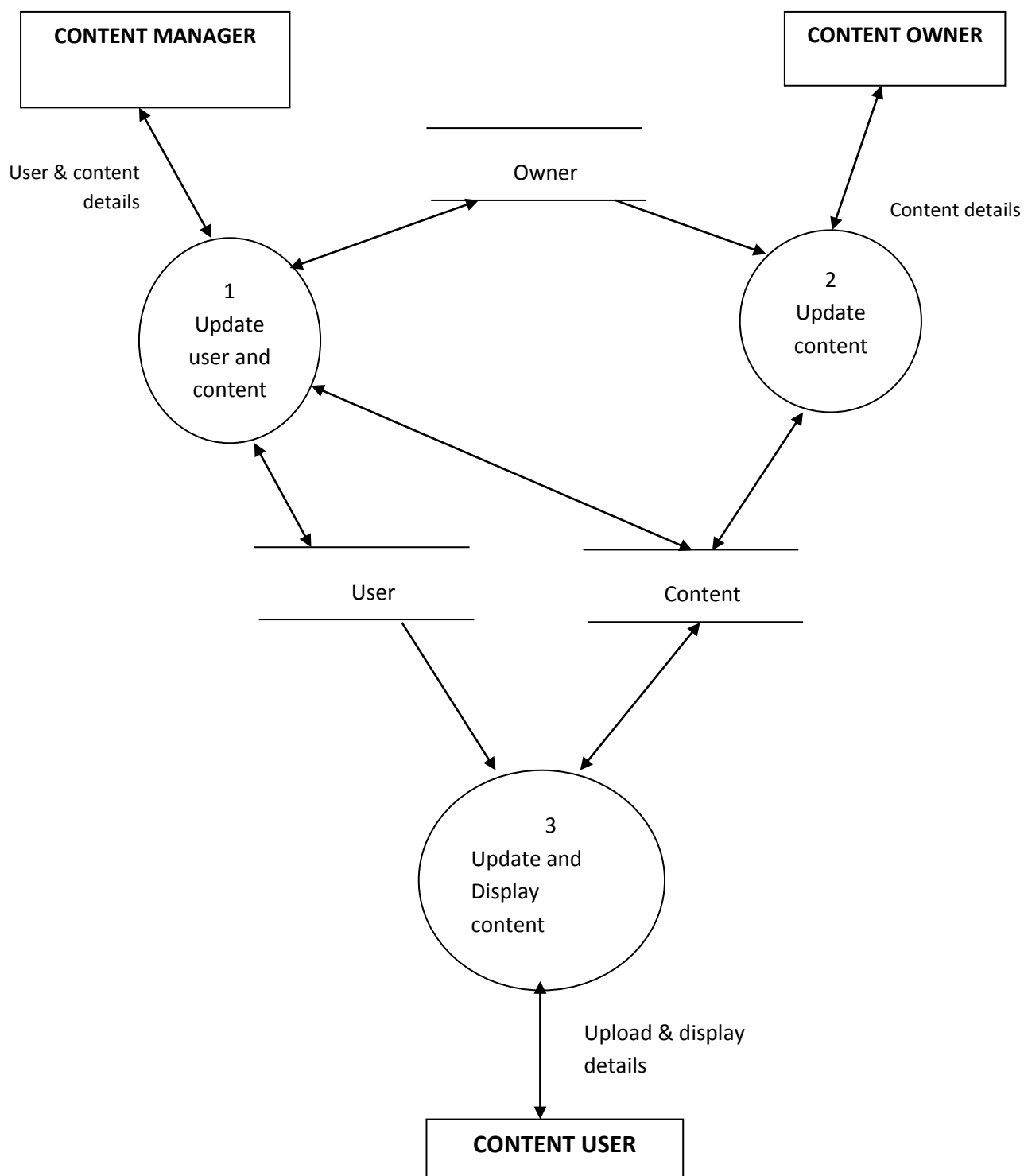
Figure 5.2: Level -1 DFD Showing the Main Processes and Data Flows in the CMS

Level -2 DFD

The Level-2 (a) data flow diagram below is derived from exploding the Process 1 above. It models the flow of data and processes between the content manager and the 'User', 'Content' and 'Owner' data stores. The Content Manager updates the user file, updates the content file and registers and validates owners of content in the owner file.
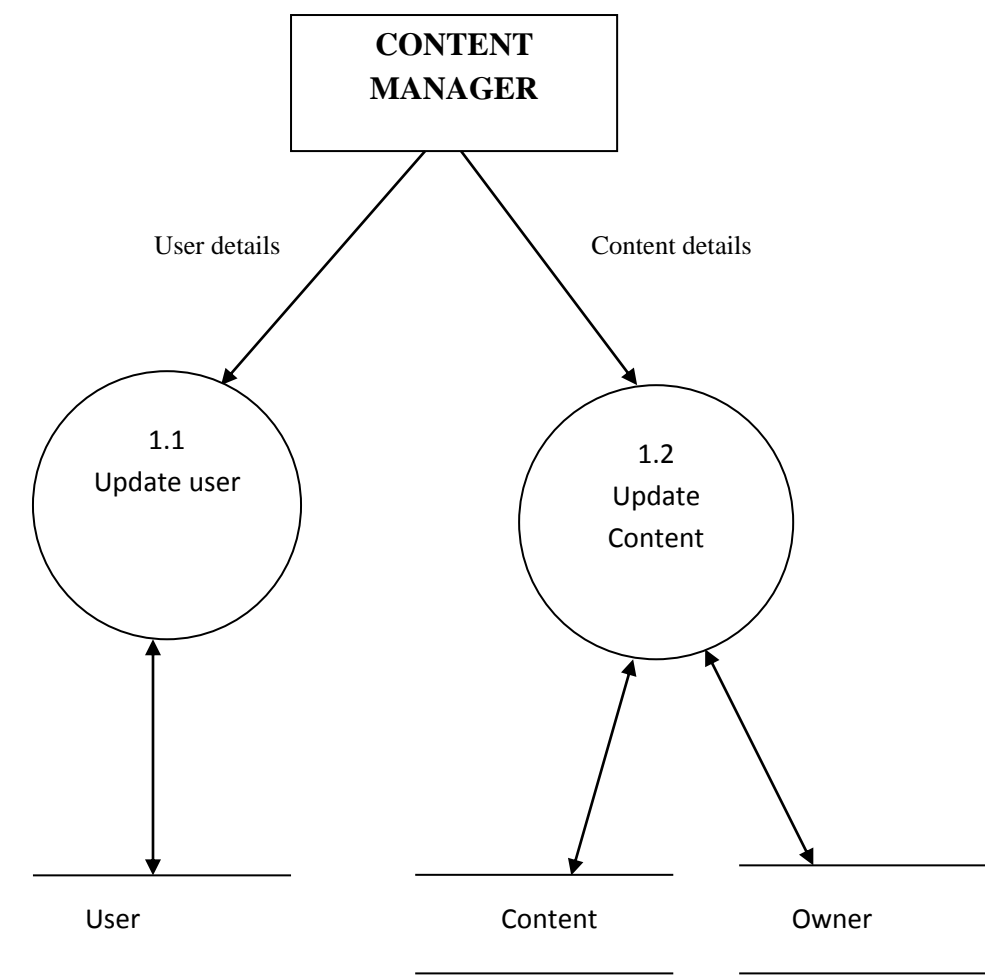
Figure 5.3: Level-2 (a) DFD Showing Data Flow and Processes between Content Manager and 'User', 'Content' and 'Owner' Data Stores

The Level-2 (b) data flow diagram below is derived from exploding the Process 2 in the Level-1 diagram. It shows the flow of data and processes between the content owner

entity and the 'Content' and 'Owner' data stores. The content owner can update content but only after registration and/or validation in the 'Owner' data store.
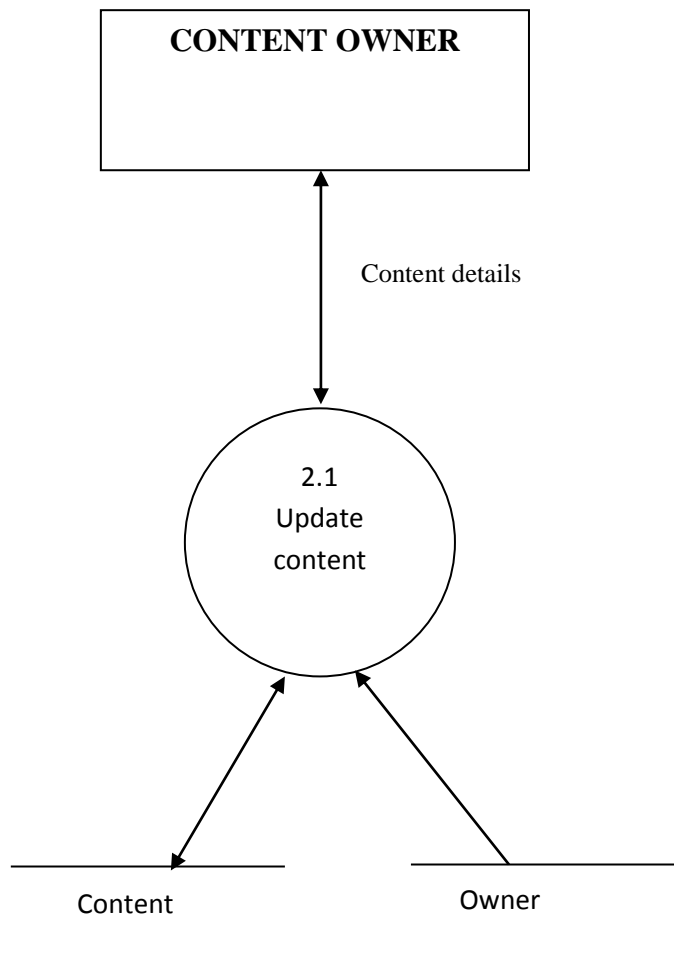
Figure 5.4: Level -2 (b) DFD Showing Data Flow and Process between Content Owner and 'Content' and 'Owner' Data Stores

The Level-2 (c) data flow diagram below is derived from exploding the Process 3 in the Level -1 DFD above. It describes the flow of data between:

i)   The content user and the 'User' data store via Process 3.1 (Update Content). Here, the user has first to be registered and/or validated in the user data store before he/she can update content in the 'Content' data store

ii)   The content user and the 'Content' data store via Process 3.2 (Display

Content). Users can also view content from the 'Content' data store.
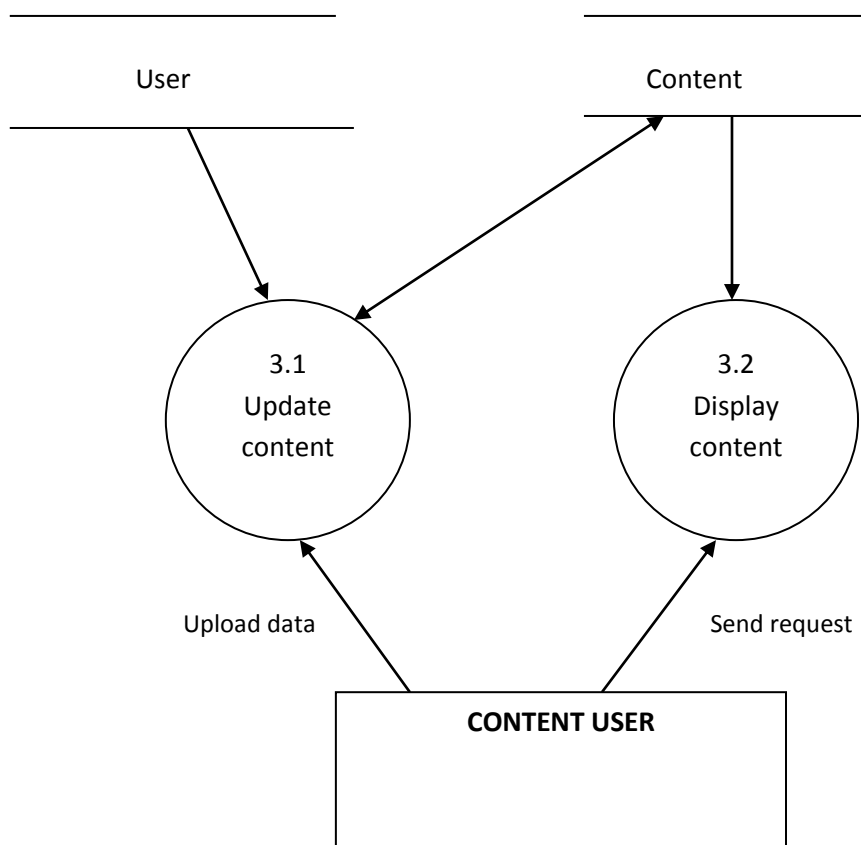
Figure 5.5: Level-2 (c) DFD Showing Data Flow and Process between Content User

and 'User' and 'Content' Data Stores

Entity Relationship Diagram

Langer (2008) defines an Entity Relational Diagram (ERD) as a model that depicts the

relationships among the stored data in an information system. He notes that the ERD is

the most widely used of all modeling tools and is really the only method to reflect the

system's stored data. The data stores depicted in the DFDs are used as the initial entities

prior to implementing logic data modeling. In the current system, the entities USER,

CONTENT and MANAGER from the DFDs are the major entities identified for the CMS.

The Schema for the entities is as follows:

    USER   (*User_ ID*, Fullname, Role, E-mail, Phone, Photo, Gender,

        Login_Count)

    CONTENT (*Content_ID*, Type, Page_title, Description, Long_title, Published,

        Pub_date, Unpub_Date, Parent, Created_by, Created_On)

    MANAGER (*ID*, Username, Password)

    CONTENT_USER (*User_ID, Content_ID*)

The entity CONTENT_USER is a junction table that results from breaking up the Many-Many relationship that exists between the USER and CONTENT entities. Its primary key is made up of the primary keys from both the User and Content tables i.e. User_ID and Content_ID.

The diagram below shows the Entity Relationship Diagram for the MUCMS.
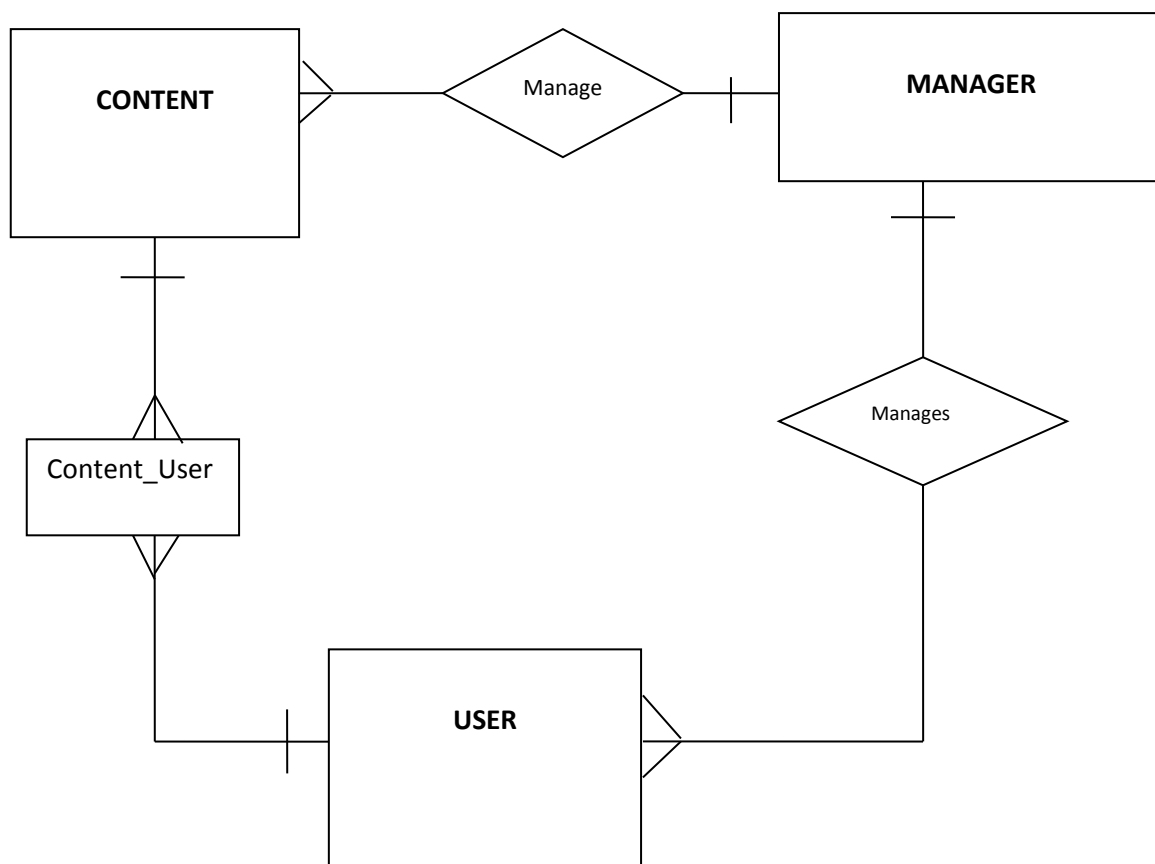
Figure 5.6: Entity Relationship Diagram for the MUCMS

5.4.4 Functional Modeling through State Transitions Diagrams (STDs)

State Transition Diagrams depict the time-dependent behavior of a system by describing the state of the system at any one time. A system's behavior can be described by more than one STD. In this section, one system state is described i.e. registering a MUCMS member. The transitions are depicted in the diagram that follows.

Registering a MUCMS Member (Narrative)

a) The administrator logs into the system

b) The system confirms that the administrator is authorized to use the system

c) User details are entered into the system

d) System checks that the user had not been previously registered to avoid double registration

e) System saves user details in the database
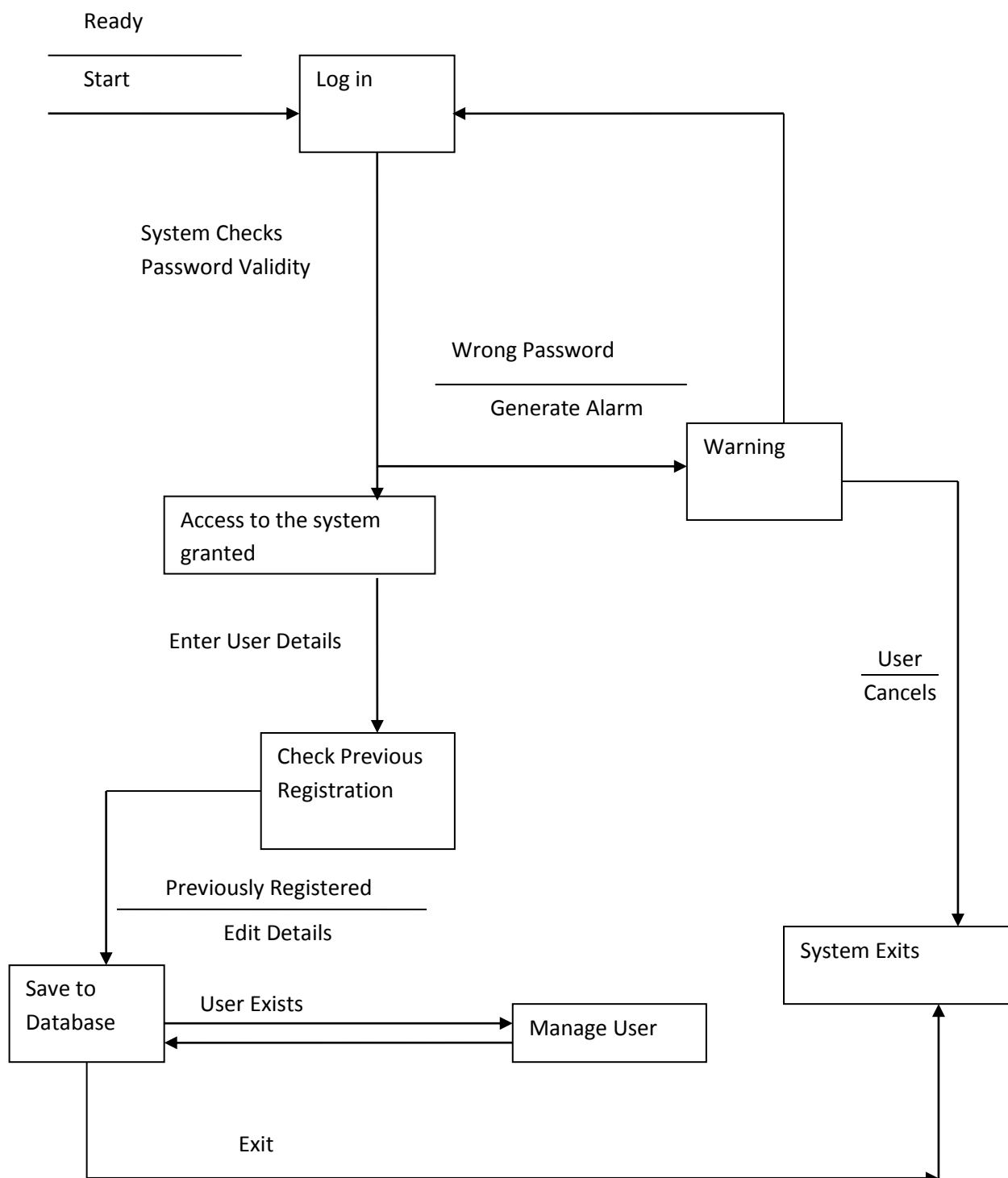
Figure 5.7: STD for User Registration

5.5 User Interface

This section outlines some of the screens and interface design that makes the software functional. Refer to Appendix 7 for the

implementation code for the prototype.

5.5.1 Interface Design

5.5.1.1 The Login Screens

Figure 5.8: User Login

5.5.1.2 The User's Main Interface
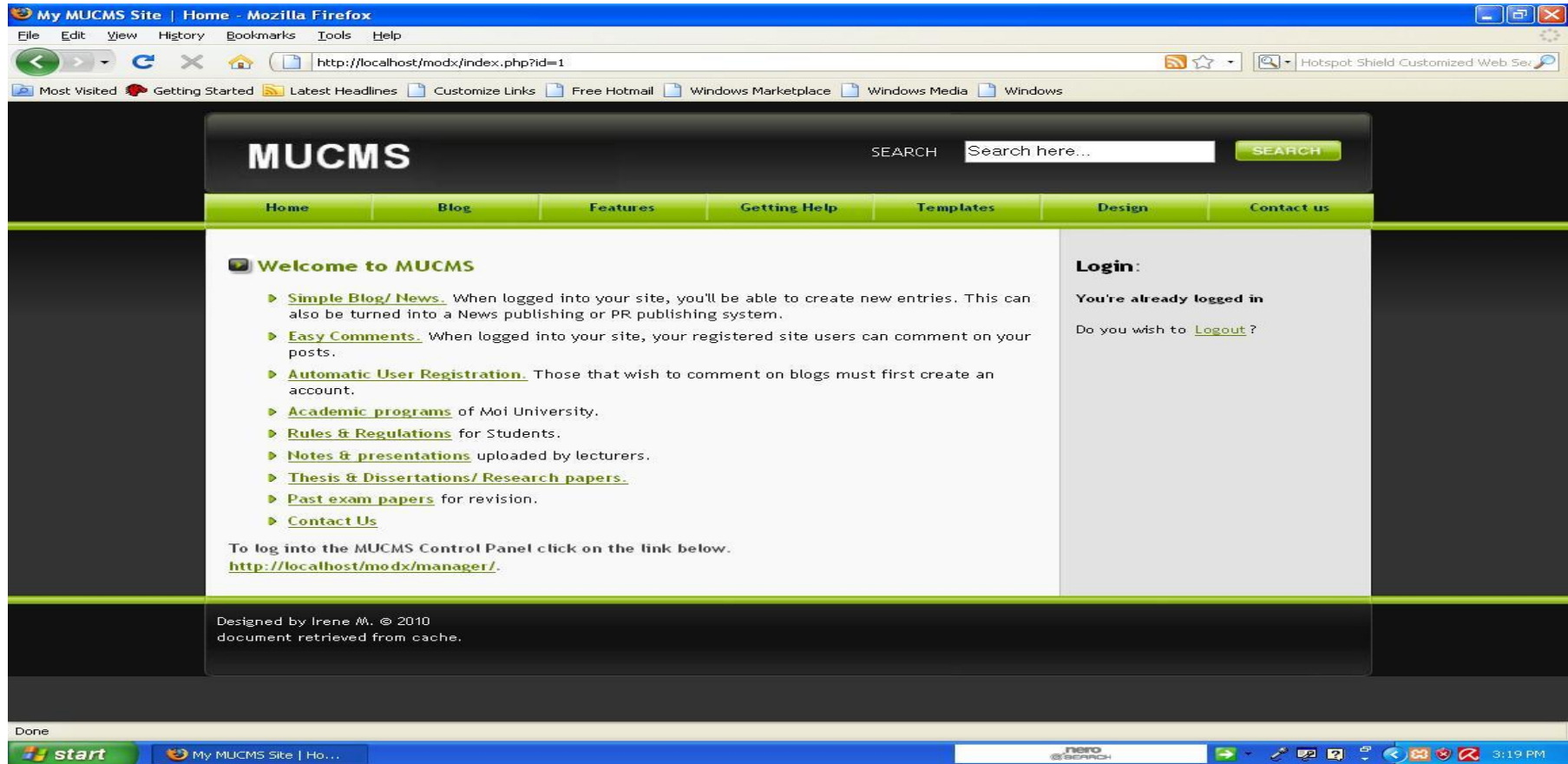
Figure 5.9: The User's Main Interface

5.5.1.3 Academic Programs Interface
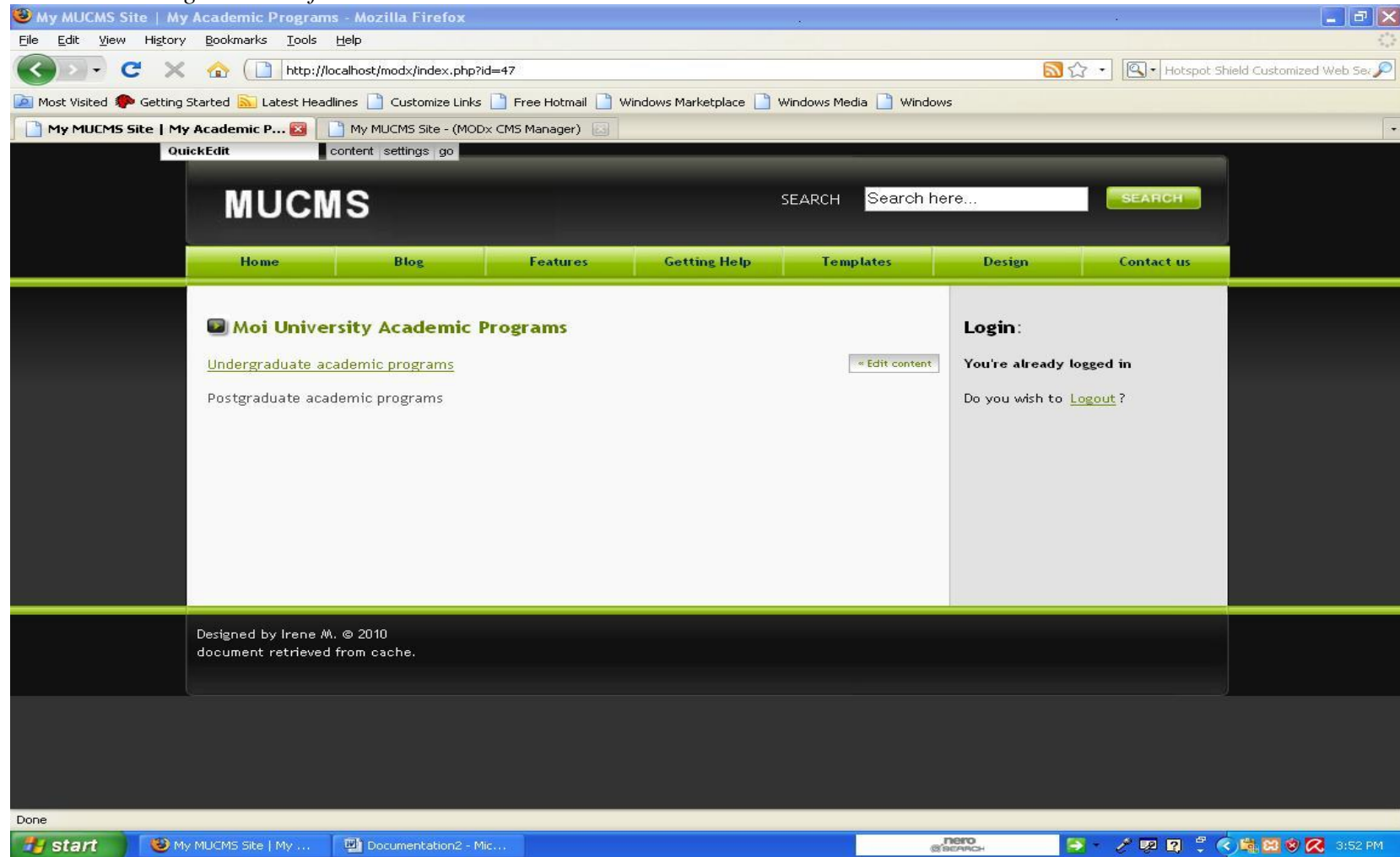
Figure 5.10: Academic Programs Interface

5.5.1.4 The Notes and Presentations Interface
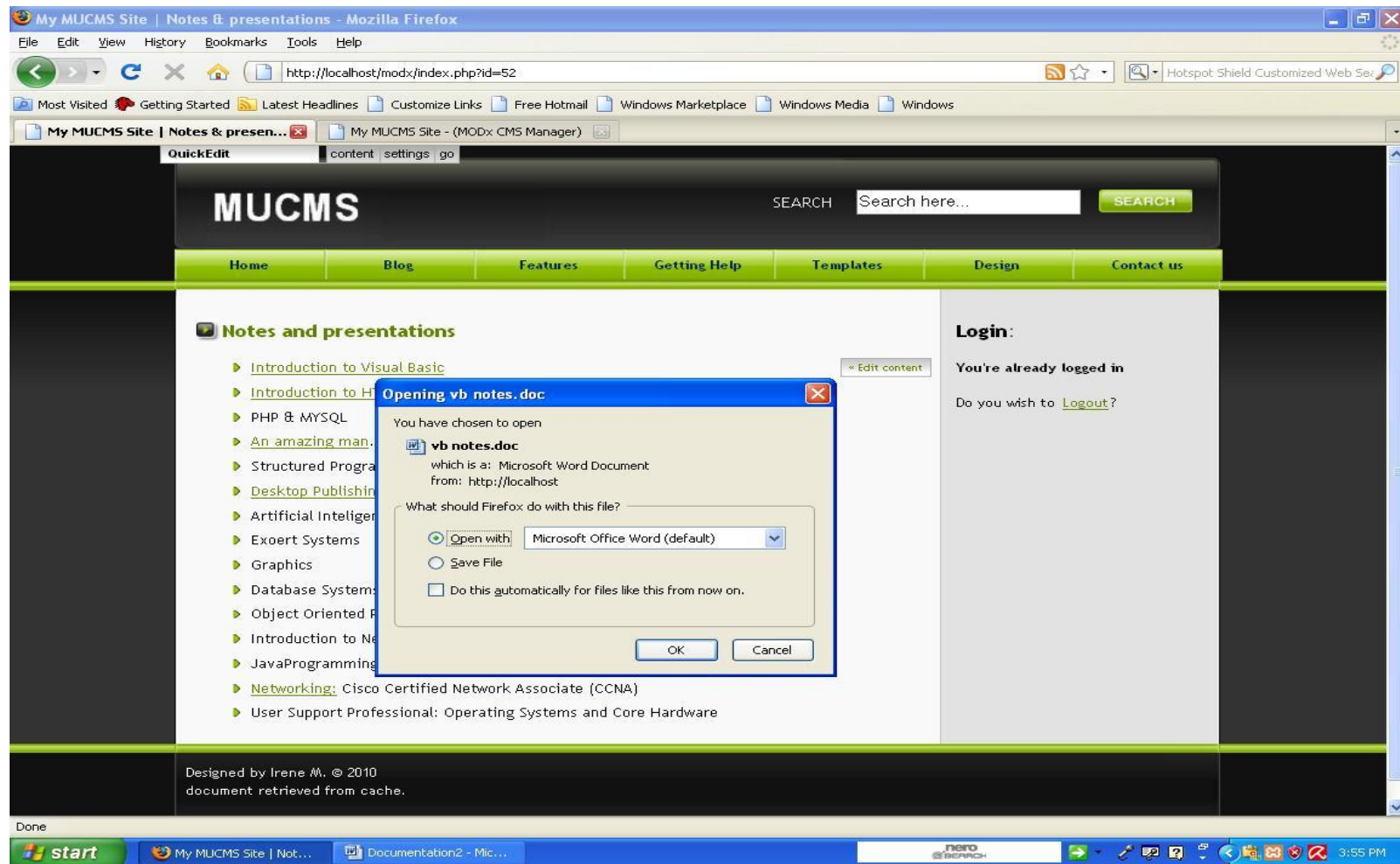
Figure 5.11: The Notes and Presentations Interface

5.5.1.5 Theses and Dissertations Interface
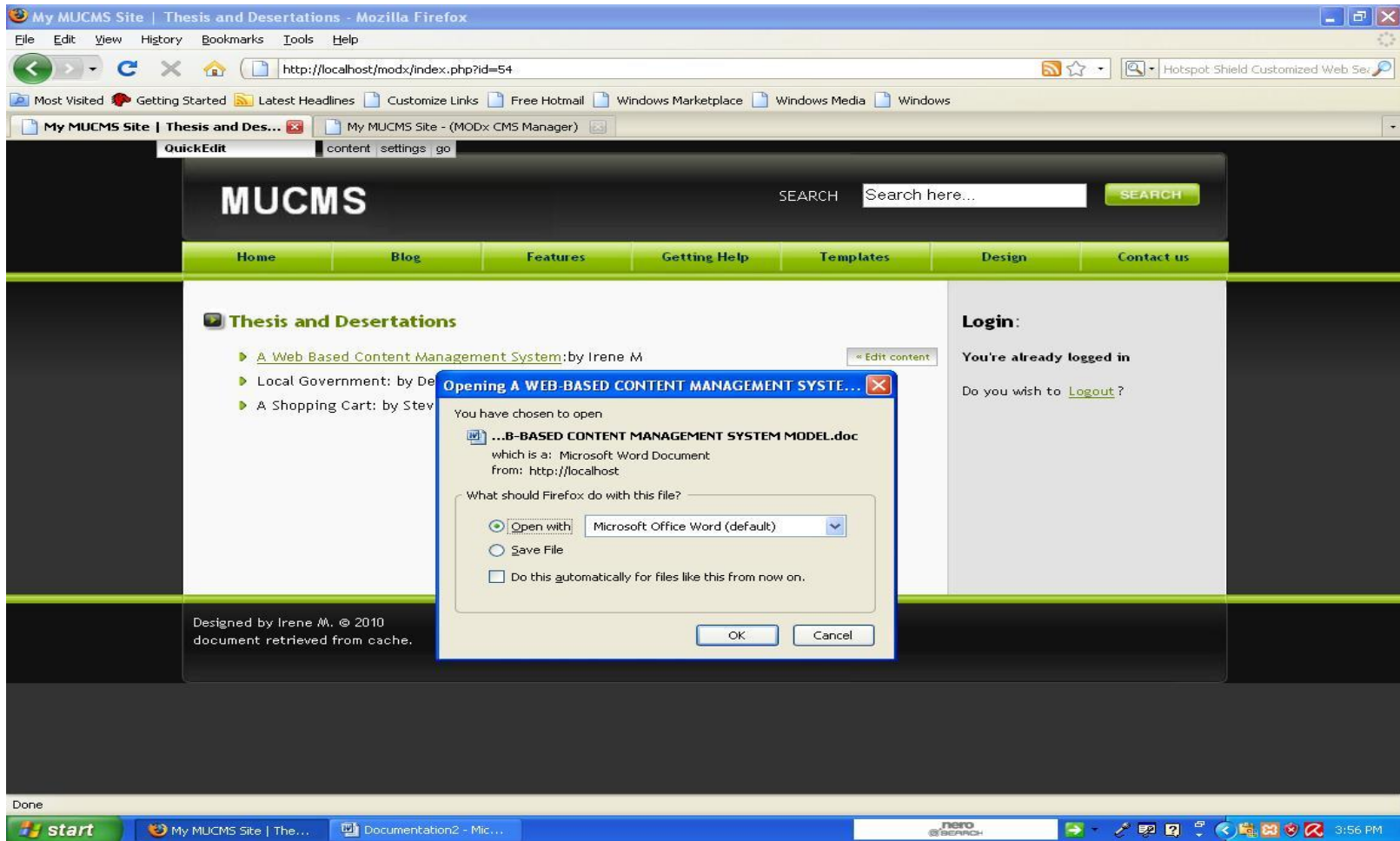
Figure 5.12: Theses and Dissertations Interface

5.5.1.6 The Past Exam Papers Interface
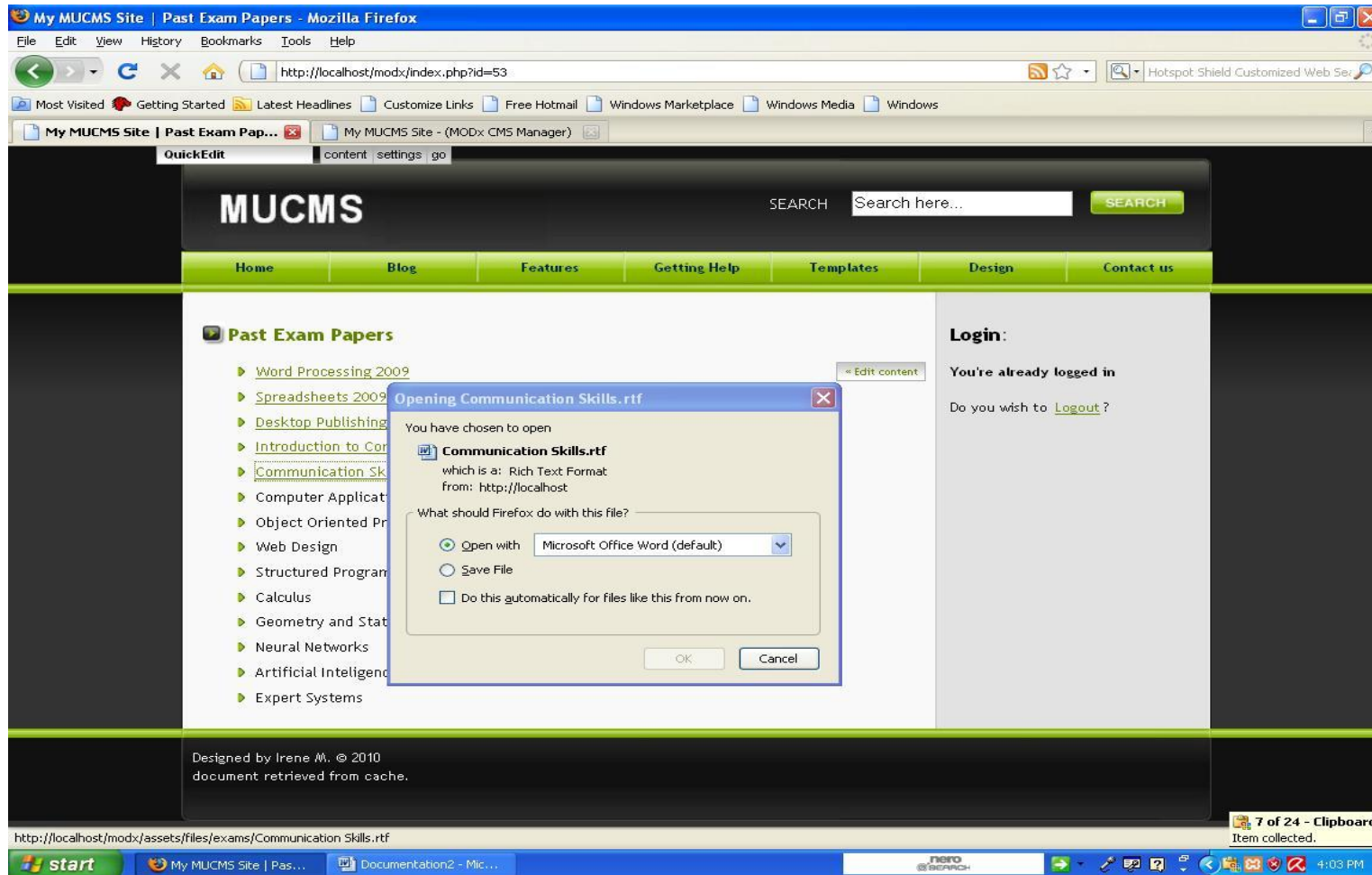
Figure 5.13: The Past Exam Papers Interface

5.5.1.7 The Managers Interface (Control Panel)
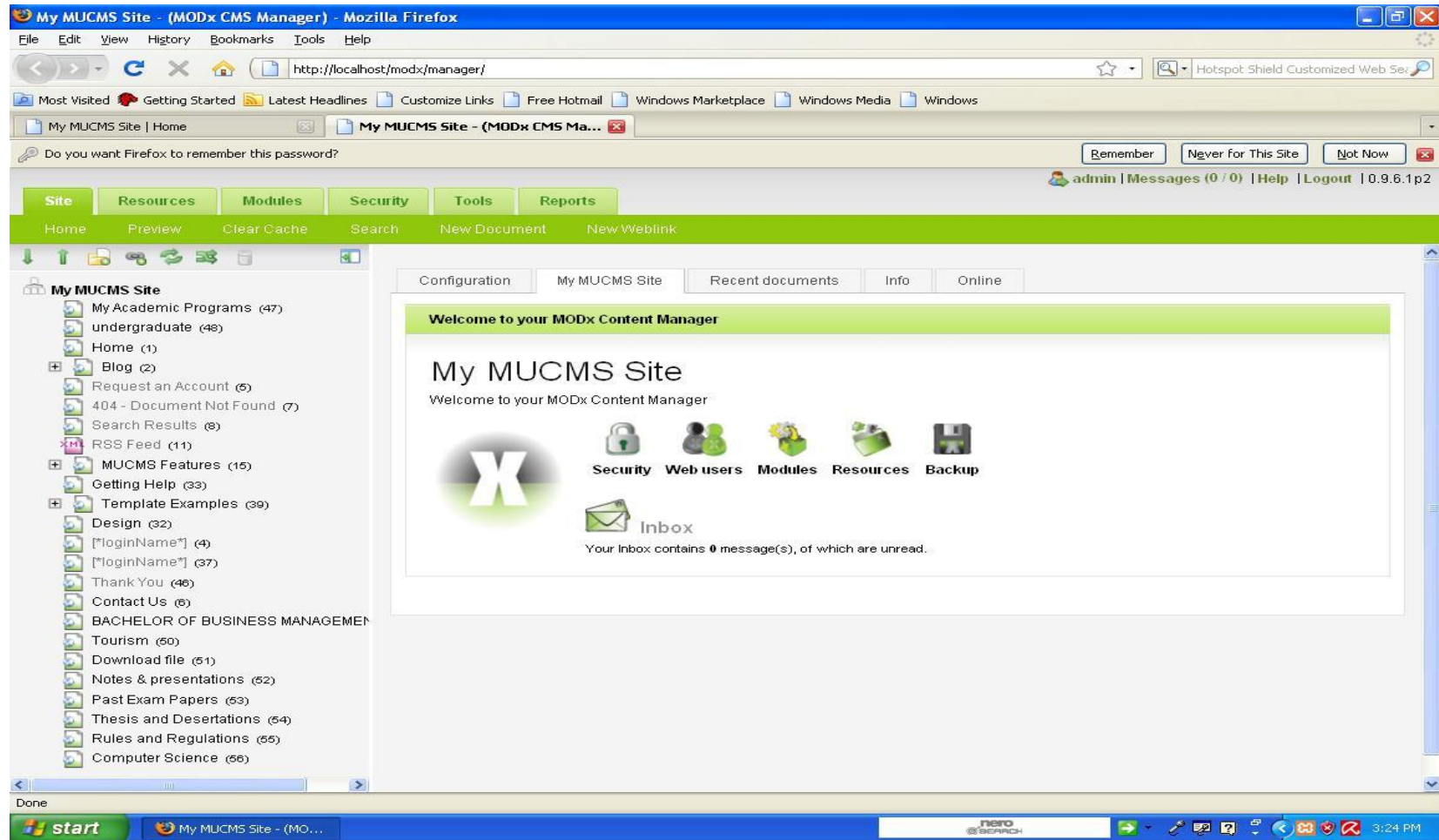
Figure 5.14: The Managers Interface (Control Panel)

5.5.1.8 The Interface for Managing Users

Figure 5.15: The Interface for Managing Users

5.5.1.9 The Interface for Creating and Editing a Document
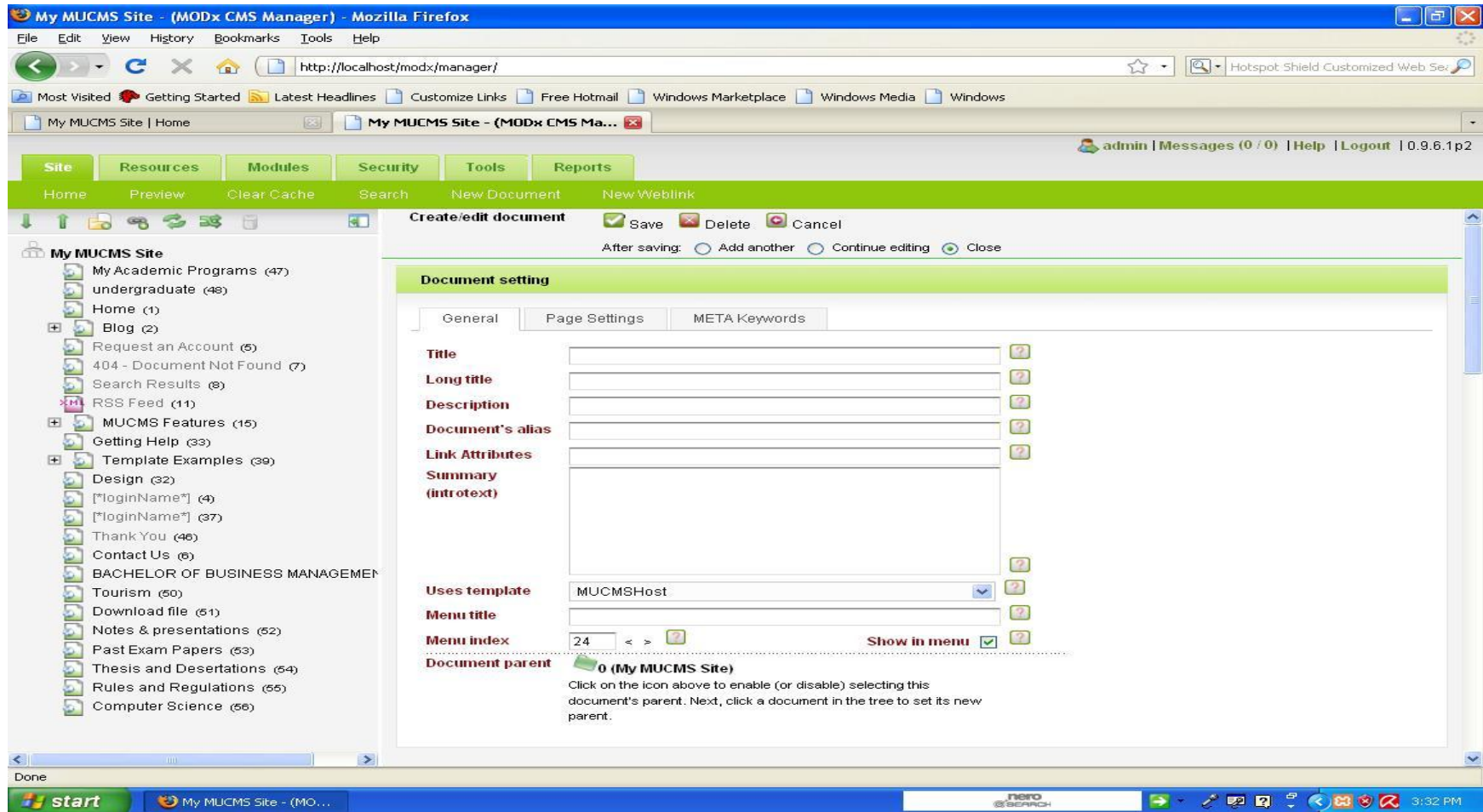
Figure 5.16: The Interface for Creating and Editing a Document

5.5.1.10 The Interface for Managing Files
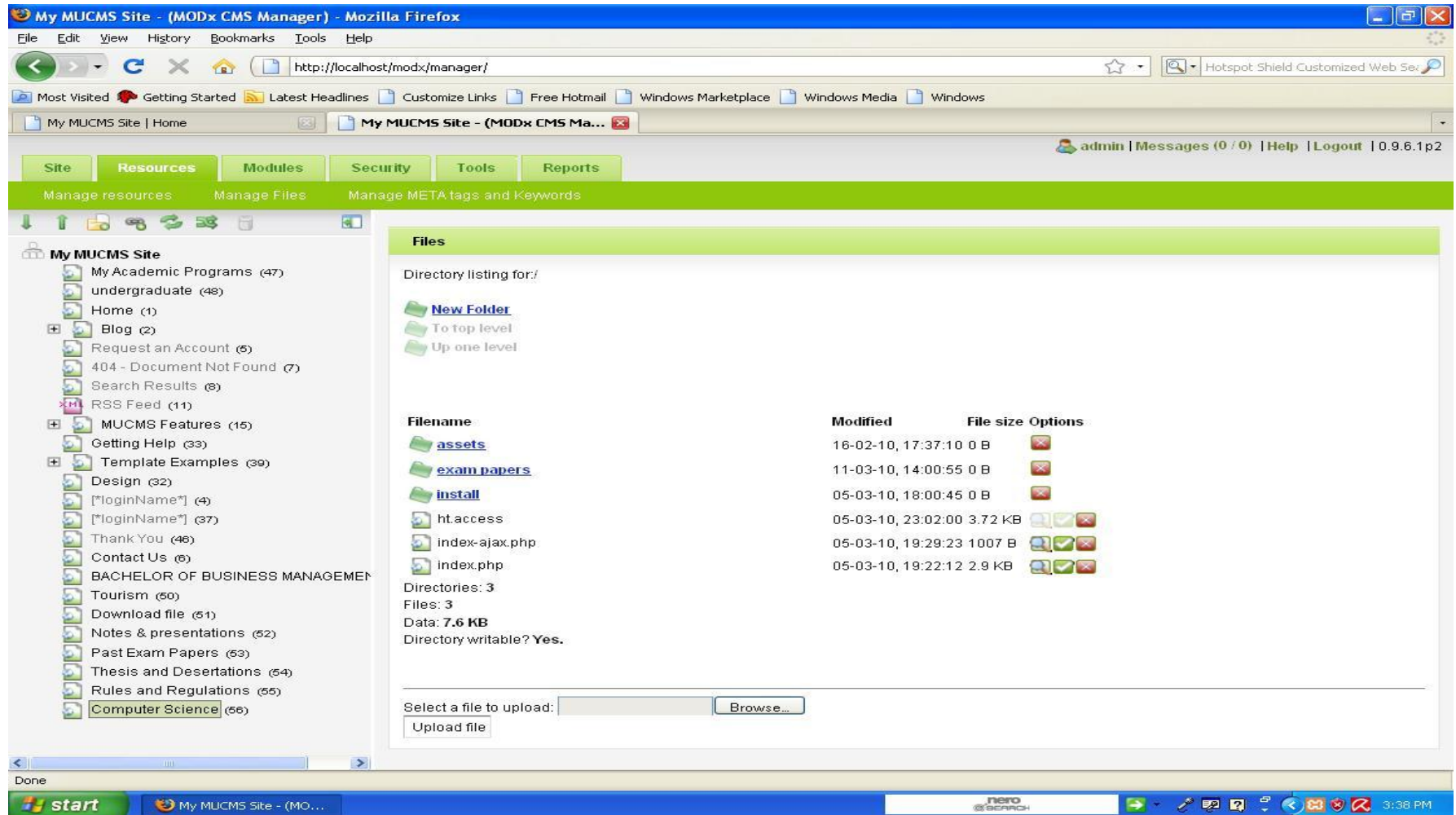
Figure 5.17: The Interface for Managing Files

5.6 Software Testing

Testing involves running new or revised programs to determine if they process all data properly. The test is done using test data that is made available by the users and developers of the system. This process helps to evaluate the software product developed. Test data is a set of data created for testing new or revised programs. It should be developed by the user as well as the programmer and must contain a sample of every category of valid data as well as many invalid conditions. Validation and verification are important elements of this process. The system was tested with some sample data which was then stored in a database. The system was seen to work well for the given data although later increments will still be welcomed for integration. Further tests will be carried out after visiting the customer and delivering the product.

5.6.1 Types of Testing

The types of testing included:

a) **Functional or Black Box Tests**

Functional tests on the system were implemented by providing the stimulated nominal inputs to the system and observing the actual output versus the expected output and results noted down. Various test cases were chosen for both boundary and non boundary values.

b) **Structural or White Box Tests**

This test involved checking the internal logic of the program modules. Stimulated data was availed and this test data was input into the system to check the validity of the algorithms and functions that performed the tasks at hand. The major things that were tested during this kind of testing were conditional statements, use of Boolean variables, loops and iterations.

c) Acceptance Tests

These include Beta Testing and Alpha testing and should be done before the system is implemented. This was not done for this system.

Beta Testing - Testing by the customer at the customer's site. This exposes the software to the real environment and any errors are reported to the developers.

Alpha Testing - This is the final stage in the testing process before the system is accepted for operational use. It is done by the customer at the Developers site.

d) Stress Tests

This was done by testing the software with abnormal or extreme data usually with an intention to break down the system. It attempted to find the limits with which the system will fail through abnormal quantities of inputs.

5.6.2 Testing Process

The computerized system automatically makes checks on data type entered and the length of the data entered. The system also checks whether the system inputs lie within accepted domains. This ensures that the data entered is correct and is designated to the correct place. It should also display error messages whenever an error is detected. The following data tests were performed on the various forms in the system. The expected results and the actual results obtained are tabulated below.

5.6.3 Test Data

In this section is a brief description of the types of data used in testing the system for errors.

File Upload

Text Field	Data Input	Expected Results	Actual Results
File type	File type whose extension is not in the configuration settings	Error Message	Error Message
	Applicationform.doc (.doc extension included in configuration settings)	OK	OK
	Applicationforms.zip (.zip extension not included in configuration settings)	Error Message	Error Message
	No Input (blank)	Error Message	Error Message

5.7 Recommendations

a) Once the system is uploaded it can be accessed from any computer connected to the Internet.

b) Training of users and walkthroughs for the developed system is necessary, however basic the system may seem.

c) The developers of systems should adhere to engineering and software laws. Use of open-source software is recommended so as to minimize costs on development but the maintenance costs increase and users need some level of expertise to use the system.

d) The Moi University Administration should adopt the idea implemented in this system to make the management of content easy and efficient.

5.8 Summary

The designing of this software was a success due to the cooperation given to the researcher by those interviewed namely the academic staff and members of management of Moi University. If Moi University adopted this content management system (MUCMS), convenience among the users (students, academic staff and members of management) would be greatly increased. Pages can be created and edited easily, users can be managed well and documents can be uploaded easily. This allows everyone to concentrate on what they are best at and bring their output together to provide fast access to regularly updated information on the MUCMS. In this case the designer ensures that the Website content looks great and is usable, which is what he/she does best. Writers, on the other hand, write excellent articles/ documents, but cannot draw well or build Web sites.

The system has maximized the use of the database to maintain data integrity and consistency. Reliable and accurate data can therefore be guaranteed by the system.

The next chapter summarises the findings of the study and presents the conclusions and recommendations.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The purpose of the study was to examine the types of content generated at Moi University and the strategies for their management to pave way for designing a framework to effectively manage digital content in the institution.

This chapter summarizes the study findings drawn from the discussion in Chapter Four, draws relevant conclusions from the study findings, suggests recommendations and proposes a framework which will guide implementation of content management at Moi University. The chapter also presents suggested items for further research.

6.2 Summary of the Findings

The findings of the study are summarized according to the specific objectives that guided the study.

6.2.1 The Nature of Digital Content Generated at Moi University

The study established that approximately 98% of the respondents who participated in the study have access to computers to facilitate their work activities. This in turn creates a large variety of digital content. Moi University is a teaching institution and most of the respondents involved in the study were teaching staff. They are involved in preparing teaching material and documents in digital formats. Other digital content created is used for administrative purposes. Generally, the digital content includes:

a) Lecture notes and presentations

b) Course syllabi

c) Theses and dissertations

d) Information on academic programs

e) Advertisements and news

f) Electronic communication

g) Examination results

h) Software

i) Research papers and e-journals

j) Multimedia (Images, video, sound)

Some of the content (e.g. lecture notes, theses and dissertations, software and multimedia) belongs to individuals while some belongs to the institution (e.g. course syllabi, theses and dissertations, advertisements and news, and examination results).

From the study it was noted that this content is intended for use by both students and staff and also by users outside the institution who include researchers, industry professionals, quality assurance units, and former students.

6.2.2 Analysis of the Existing Methods and Strategies for Creation, Update, Publishing, Translating, Archiving and Retrieving Digital Content at Moi University

The study established that there is some awareness on the concept of content management amongst some of the members of staff at Moi University. In addition, there are some strategies for the management of digital content including creation, secure storage and retrieval but these are largely personal efforts made by the creators of the content. In spite of provision of tools for creating digital content (by the university), the study found that content management strategies at institutional level are still at minimal levels.

The university website is an important tool for provision of university related information and can be an important avenue for management of digital content. However, the study established that while respondents regularly access the website, majority (52.2%) are dissatisfied with the information services it offers. Access to the website is often compromised by poor Internet connectivity in the university, information on the website is outdated due to irregular updating by the concerned personnel, and it is too general in approach so that users do not get adequate information specific to their departments. Finally, there is no research output published on the website. This is in spite of the numerous research activities and resultant output that has been published via other avenues such as international and local journals.

Coupled with these are strategies to ensure that content created is accessible by the targeted users in the intended format. The study established that creators of content especially the teaching staff make commendable effort to ensure that intended users can actually access and use the content in digital form. Some of these strategies include training the users, availing the content in soft copy, distributing the content in hard copy, publishing in online scientific journals and using the Chisimba e-learning portal to disseminate digital learning materials.

6.2.3 Assessment of User Satisfaction with the Existing Content Management Strategies in Facilitating Access and Retrieval of Digital Content

The study established that more respondents (47.8%) are satisfied with the ICT infrastructure provided in their respective departments and feel that they adequately support them in creation, dissemination, storage and use of digital content. This is as opposed to 34.5% who feel otherwise. On the other hand, majority of the respondents feel that the university does not support them in publication of their research work on

the Internet. This is in contrast to the response about the effectiveness of Internet connectivity in the university in enabling users to access digital content on the web. On this, 47.8% of the respondents feel that they are well enabled to access digital content while 37% feel otherwise. When combined with the findings that address the objective on content management strategies, these particular findings show that in spite of provision of tools to access digital content, other content management tools, activities and strategies are not catered for especially at institutional level. This has negatively impacted on users' satisfaction with existing content management strategies.

6.2.4 Global Best Practices in Content Management

From the literature review, several aspects on global best practices were identified. These include recommendations for involvement of upper level management in content management projects and initiatives to ensure decisions are made, implemented and communicated (Goodwin, *et al*, 2005); and involvement of subject specialists for content, collection managers for organization, in addition to people who understand content management software and its capabilities. Williamson (2005), on digital preservation, advises that consideration must be given at an early stage to ensuring the longevity of digital resources, in order to protect and maximize the return on the investment in content creation. The choice of file and media formats used to create, store, and deliver digital content, and the strategies that are employed to manage these in the long-term are crucial.

The National Information Standards Organisation (NISO) suggests 9 principles that should apply to good digital collections namely: creating digital collections according to collection development policies, describing collections to facilitate their use, actively managing collections during their lifecycle, enabling availability and accessibility of the

collections to users as needed, provision of user statistics, respect for intellectual property rights, enabling interoperability of collections, integrating a collection into users' workflow, and long-term sustainability of a collection.

6.2.5 The Challenges Experienced in Managing Digital Content at Moi University

The study established that there are various challenges experienced by the respondents in managing digital content and these include:

a) Limited ICT skills in retrieval and management of digital content.

b) Loss of data due to virus attacks (no licensed antivirus in the university)

c) Inadequate numbers of computers and related electronic equipment

d) Unreliable and slow Internet connectivity in departments of the university

e) Lack of interest and/or commitment by schools and individuals to provide digital content for publication on the website

f) Lack of policy to guide content management activities

Some of the suggestions given by respondents for addressing these challenges at both individual and institutional levels include:

a) Purchase more ICT resources (computers and related resources) for individuals and departments

b) Create LANs in all schools and departments

c) Improve Internet connectivity at departmental level

d) Train staff (and students) in creation, access and use of digital information

e) Motivate staff to create digital content

f) Review curricula to include ICT courses to equip students in use of ICT to access digital information

g) Purchase corporate antivirus software

h) Implement an institutional repository to house local content

i) Implement content management practices and frameworks and content management systems

j) Implement university ICT policy and other relevant policies to govern content management

The study established that there are currently no policies and neither any framework in place to guide content management in the university. There is currently no recognition of the categorization and management of content as proposed by the theoretical models that informed this study.

6.2.6 A Framework for Moi University to Plan for the Implementation of Content Management Systems

A Content Management Framework was developed and its main purpose is to outline the main activities and components undertaken in content management. According to CMS Magazine (2005), the development of a robust framework is one of the keys to creating a successful CMS. While most of the content management tasks aim to eliminate coding by web administrators, the framework guarantees the flexibility and the continuation of the project. The author elaborates that the framework is the core of the CMS itself. It provides the main functionalities for developers for the different features. He emphasizes that with an excellent framework, very well documented, implementing new features becomes easy. It is possible to add components or add-ons thus creating new features with the very minimum coding required. A comprehensive presentation of the framework is given in Section 6.4.

6.2.7 A Prototype to Demonstrate the Use of CMS to Manage Digital Content at Moi University

A prototype Content Management System was developed to demonstrate automated content management. Its key features are enabling document creation and editing, uploading and downloading of content, registration and management of system users, management of files and resources, and backup of the database among others. The system is fully discussed in Chapter 5.

In summary, the study established that ICT facilities are already in active use at the institution thus generating a large variety of digital content namely lecture notes and presentations, theses and dissertations, information on academic programs, electronic communication, research papers and e-journals among others. The study also revealed that strategies for content management are largely personal initiatives that individual creators of content implement to ensure the content they create is accessible to themselves and to their intended users and that they can access it in the long term. The university, in spite of having provided ICT resources to its staff for use in day to day work activities, has not put in place relevant strategies and framework for management of the digital content that result from the various information systems in place. For example, the institution does not have an institutional repository that would be useful in centralizing access to and management of locally generated digital content. This lack of formalized strategy has led users of the system to experience serious problems with accessibility and use of information.

The study showed that users are hindered from accessing content due to poor Internet connectivity at the university, insufficient numbers of ICT resources to effectively create, access and use digital content, limited ICT skills in creating, retrieval and

management of digital content and lack of commitment by schools and individuals to provide context-specific content for publication on the university website.

6.3 Conclusion

This study investigated the content management practices at Moi University. It was intended to examine the types of content generated at the university and the strategies for their management to pave way for designing a framework for effective management of digital content in the institution. This was in relation to the fact that content management poses challenges to institutions and organizations and Moi University has been no exception. Moi University as an academic institution has implemented several information systems whose information products are not yet effectively managed. The institution lacks formal coherent strategies and frameworks to identify the digital content generated from its departments, and thereafter guide its management.

The study specifically sought to examine the nature of digital content generated at Moi University, analyze the existing methods and strategies for creation, update, publishing, translating, archiving and retrieving digital content at the institution, assess user satisfaction with the existing content management strategies in facilitating access and retrieval of digital content, examine global best practices in content management, establish the challenges experienced in managing digital content in Moi University, develop a Content Management Framework and that will assist Moi University to plan for the implementation of Content Management Systems and finally to develop a prototype to demonstrate the use of CMS to manage digital content at Moi University.

In view of the study's findings, the study concurs with Mutula & Wamukoya (2007) in their observations that content management poses serious problems to institutions due to

inadequate infrastructure, weaknesses in content organisation, consistency and management, lack of institutional framework for managing content, accessibility issues, underutilisation of content, lack of preservation plans for content, lack of cultural policies, lack of capacity building plans and poor e-content security.

The study revealed that inadequate infrastructure has compromised the effective creation and management of digital content and lack of strategy while absence of a content organisation approach has had a negative impact on accessibility and use of content in the institution. Further, there is evidence of lack of preservation plans, both long and short term, for the content created in the university. This implies that content may have to be recreated severally or duplicated in various locations because no content is preserved for future use or for use by other departments or individuals.

The study therefore concludes that despite the presence of extensive digital content in the university, lack of formalized strategy and policy guidelines has greatly compromised its management and contributed to the problems experienced by users of the content. The study also concludes that best practices in digital content management as upheld by institutions of excellence such as National Information Standards Organisation (NISO), Washington State University and Digital Preservation Coalition have not been explored at Moi University and this needs to be addressed. In this connection, the study concludes that a framework is vital to lay the necessary groundwork and provide guidelines for content management at Moi University.

6.4 Recommendations

In order for the university and its members to benefit more from the ICT presence and the digital content generated, it is important that the following issues be addressed as a

matter of urgency. This is because digital content generation and use are some of the fastest growing activities in the university and on the globe as a whole. The institution has invested a great deal of resources in terms of finances, personnel and time to implement ICT facilities that create and are used to access digital content.

6.4.1 ICT Resources and Internet Connectivity

In Chapter Four, it was reported that respondents lack adequate numbers of computers and related electronic equipment to facilitate their access to and use of digital content. Slow and unreliable internet connectivity was another problem that was cited. It is therefore recommended that due to the ever increasing demand for ICT facilities, it is important that the university makes effort to increase the numbers of computers, printers, LCD projectors, Internet access points and other facilities in schools and departments. This would enable users to effectively and efficiently create and access digital content such as lecture materials, presentations, communication, research output and others on a day-to-day basis. This would also include improvement on Internet/intranet connectivity by setting up LANs in departments and setting up wireless connectivity zones whereby individuals can access information on the Internet more easily. This can be facilitated by the ICT department in liaison with systems administrators in the various schools and units.

6.4.2 Training and Curriculum Development

Following a suggestion in Chapter Four that the university mounts training programs to equip users with skills to use the emerging technologies both hardware and software, and also review curricula to include ICT courses for training of students, it is recommended that the university should raise awareness of the importance of digital content in the information age and generally build institutional capacity to create,

collect, organize, store and share digital information. Hindrances to accessibility of information should be significantly reduced amongst the members of the university community. To do this, the university should mount training programs to educate members on the use of ICT to create their own documents, to communicate amongst themselves and their peers, to access local and global information on subjects of interest, to communicate with their students and other users of content they create. The importance of a institutional repository should be well articulated and implementation of this should be a key item in content management. Additionally, it is vital that awareness levels on the concepts of content management are raised amongst creators and users of digital content at the university. This can be done by the ICT department in liaison with the ICT personnel in the various schools and units of the university.

For a long time, the university has planned to implement a mandatory campus-wide ICT curriculum that will give all students basic skills in use of ICT and further enable them to access and use digital information. It is high time this curriculum was completed and implemented. This will raise the general standards in use of ICT to deliver course content.

In addition, there is a policy requirement that all new academic programs must include an ICT component for them to be approved.

6.4.3 Involvement and Support of Upper Level Management in Content Management Initiatives

The findings in Chapter Four generally indicate that most respondents feel that the university is not doing enough to support their efforts in content management. Other than providing the infrastructure, other activities to support access to and use of digital

content are not adequately facilitated, e.g. access to the Internet, and publication of local content.

Goodwin, *et al* (2005) recommend that for a big and far-reaching project such as the implementation of a Content Management System, upper level management involvement and support are needed to insure that decisions are made, implemented and communicated. They opine that a project this significant needs direct participation of upper management for authority, subject specialists for content, collection managers for organization, in addition to people who understand the software and its capabilities.

In light of this, the study recommends that the university management (such as the deans and departmental heads) take a more proactive role in spearheading initiatives for content management right from creation of the content, storage, dissemination, update and long term access. The university management through appropriate departments/units should be at the forefront to identify and provide relevant policies, financial resources, staffing, motivation and other requirements in order to ensure that content management is a reality. For example, setting up an institutional repository should be spearheaded by the university library with strong backing from the top management.

Policies such as the university ICT policy should be taken a step higher and should now be implemented.

In addition to this, the university must correctly understand the role of the university website and give it its due position in communicating university information to the local and global audience. More effort should be made by the ICT Department in design of the website, correct analysis and understanding of the characteristics and needs of the

target audience, update of content and availability, reliability and usability of the website among other issues.

6.4.4 Digital Publishing and User Generated Content

According to the findings in Chapter Four, it was noted that strategies for publication or distribution of content created are limited to manual methods such as hard copy print outs or basic techniques such as use of CDs, flash disks, power point presentations, or on the university website. Respondents are not yet using advanced and current digital publishing techniques such as those advocated by Crisp (2009) which include print pdf, screen pdf, SCORM, eBooks and Web 2.0.

In light of the foregoing, therefore, it is recommended that the university increases on training and exposure programs to enable its staff and students to participate more fully in these current avenues of digital publication. Students and staff would also be encouraged to build individual websites where they can freely create, share and generally manage their own content especially in line with the recommendations by Chin (2003) who advises that the content's owner is best placed to ensure it is accurate and kept up-to-date. This will greatly increase the amount of content generated by allowing individuals to create and publish their own content without passing through the more rigorous traditional avenues. A wider audience will also be served by these techniques. This initiative can be spearheaded by the ICT department in liaison with unit or departmental heads and ICT staff.

6.4.5 The Proposed Framework for Content Management at Moi University

Based on the research findings that content management systems have not been implemented at Moi University and that there exist no formalized strategies for content

management, the study proposes a framework that can be used as a basis for formalization of content management at the institution. The main purpose of the framework is to outline the main activities and components that the institution should undertake in content management and especially before an automated CMS can be implemented.

The framework is based on recommendations from various organizations and bodies, who have undertaken content management such as the National Information Standards Organisation (NISO), Washington State University, Digital Preservation Coalition, and Digital Library for Earth Systems Education (DLESE) among others.

The proposed framework is illustrated in Figure 6.1 and its components are:

    a) Content creation

    b) Selection

    c) Description (metadata)

    d) Management

    e) Usage

    f) Evaluation

    g) Archiving
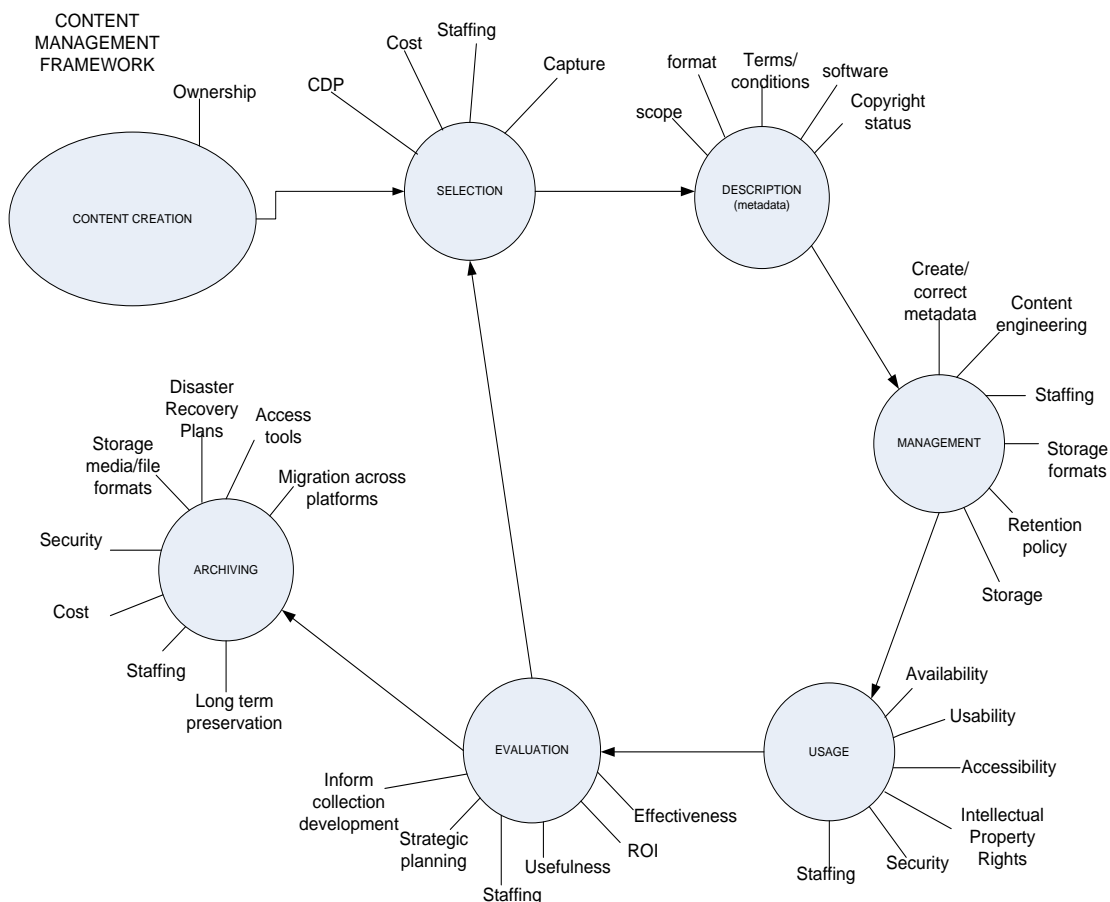
Figure 6.1: Proposed Content Management Framework for Moi University

a) Content Creation

This is the primary activity in this framework and involves the actual creation of content that will thereafter require management. Information objects in digital form, like those in other forms, move through life cycles. They are created, edited, described and indexed, disseminated, acquired, used, recreated, modified and retained for future use or destroyed by a complex, interwoven community of creators and other owners, value added services and institutional and individual users (Waters and Garrett, 1996). They suggest that the creators, providers and owners of digital information have the initial responsibility for ensuring long-term accessibility to the information.

With availability of technology, content can now be created using computers (text and graphics), digital cameras (digital images), scanners (digital images), and microphones (digital audio). Digital content can be created from scratch ('born digital') or by digitizing analogue information materials. Creators/owners of content should ensure that the content they create can be used as much as possible in different environments and for different users and purposes over time even if these uses/users cannot be immediately identified.

However, individual creators/owners of content would be overwhelmed by the expectation to undertake long term preservation for their content. At Moi University, the ICT department as the umbrella unit in charge of ICT issues, should therefore, educate and facilitate creators/owners/providers of digital content on standards and practices that will make their content available and usable in the long term. This would include creating documents in PDF (Portable Data Format) for long term preservation and accessibility on different platforms; and use of open standards (e.g. HTTP, HTML, URL, JPEG) which can operate across multiple hardware and software environments.

When creating digital content for use in the university setting, appropriate planning should be undertaken to consider and define the purpose and usage of the intended content and the appropriate and acceptable formats for content creation. This will provide advance guidance to avoid wasting resources on content that will not be widely used.

b) Selection
Once digital content has been created, it must be brought together in a storage area from which it will be accessible to potential users. This collection can be hosted on a website,

on a LAN server, or in a database. The NISO in its *Collections Principle 1* recommends that a good digital collection is created according to an explicit collection development policy that has been agreed upon and documented before building the collection begins.

In selecting digital content for inclusion in a collection, the collectors should refer to the mission statement of the university and articulate how the proposed collection will support this mission. Moi University also collects other non-digital materials and this digital collection should fit in with its wider collection policy. The university should identify the target audience for this collection and also think about unexpected uses and users.

It is further recommended that the university articulates selection criteria that will guide creators and builders of digital collections on suitability of content for inclusion in the collections, e.g. whether the resource enhances educational activities in a specific discipline and whether the resource functions well enough to be accessible by users. Such resources could include assessment resources such as Continuous Assessment Tests (CATs), examinations, quizzes; lesson plans, curricula, tutorials and lecture notes, interactive learning activities such as lab sessions, modules, case studies among others. Some selection principles could include:

a) Clearly show the information needs that the resource addresses (its overall value)

b) Economies of scale offered by way of benefiting the most faculty and students (patron demand)

c) A balance must be achieved among disciplines and specific information materials e.g. reference materials, full-text, digital images.

Additionally, the selection component should factor in cost of digitization, storage and access. For example, text documents can be offered as images, but costs rise with use of OCR or other interpretive tools and color images cost more and require higher rates of storage and access than black and white images.

Another issue to consider is staffing. Usually, technology is not the highest cost factor as most people think. Staffing may consume two-thirds of the budget for provision of digital content. The Digital Preservation Coalition (DPC) (2008) points out that the staff necessary will be from structurally separate parts of the organization, with a wide range of knowledge of digital preservation (from novice to sophisticated), with both technical and non-technical skills. Moi University at the moment does not have these staff on the ground and it must, therefore, invest in recruitment and re-training programs to equip the units and departments so they can all participate in content management.

c) Description (Metadata)

Once the collection items have been created and/or identified for inclusion in the collection, they have to be described, that is, have their metadata articulated. TASI (2008) defines metadata as structured data about resources that can be used to help support a wide range of operations on these resources. NISO collections Principle 2 states that collections should be described so that a user can discover characteristics of the collection, including scope, format, restrictions on access, ownership and any other information significant for determining the collection's authenticity, integrity, and interpretation. NISO Metadata Principle 1 states 'Good metadata conforms to community standards in a way that is appropriate to the materials in the collection, users of the collection, and current and potential future uses of the collection', and Metadata Principle 5 states 'Good metadata supports the long-term management, curation, and

preservation of objects in collections'. Other issues related to metadata include details of the software and hardware needed to access the digital object. These are also important as a guide to help future users or managers of the collection understand how the object was intended to be used when it was created.

Several metadata schemes exist which can be used for describing digital objects. When describing the digital collection at Moi University, it is important that the established standards for metadata are researched and analyzed to select the most applicable and appropriate ones. Such metadata include: Administrative metadata to facilitate the management of resources (includes information e.g. when and how an object was created, person responsible for controlling access to or archiving the content, restrictions on access or use); and technical metadata (capture information, format, file size, checksum, sampling frequencies). ANSI/NISO Z39.87-2006 and JHOVE-JSTOR/Harvard Object Validation Environment are examples of technical standards that can be used to extract metadata for digital formats; structural metadata relates the pieces of a compound object together. An example of structural metadata is the IMS Content Packaging Information Model, version 1.1.2 used primarily in the education community.

d) Management

After describing the collection adequately, the resources therein may be managed to achieve the purposes for which it was built in the first place. NISO Collections Principle 3 states: "a good collection is curated," i.e. its resources are actively managed during their entire lifecycle, i.e. from creation to disposal. Curation encompasses data management, archiving, and digital preservation. NISO emphasizes that active data

management is required to ensure that objects in the collection can be used and re-used over time.

Some of the important management activities include: creating, correcting and enhancing metadata, correcting or recreating the data itself, content engineering to filter content leaving only usable and value-added information, adding linkages to other items and preservation. It can also involve liaising with the creators of the digital objects to ensure they are appropriately transferred to the custody of the curator, and appropriately described and documented. Digital preservation is an important management activity at this stage. It involves implementation of preservation strategy that would ensure an object remains usable despite hardware and software obsolescence, which is a serious challenge in the digital environment.

NISO acknowledges that many academic institutions have established institutional repositories to capture content generated by students, faculty and staff, but it is difficult to convince authors to deposit their own materials. Moi University should actively engage content creators by launching programs to educate them on the possibilities and benefits presented by institutional repositories and digital collections to which they can contribute.

In data management, staffing issues are an important matter the university should carefully consider. Qualified staff is required to manage the digital collection to ensure it is kept secure, accessible and usable and kept up to date. Personnel at this level are mostly technical staff and the correct job descriptions and task requirements need to be determined beforehand to ensure that only individuals with the right skills and capabilities are engaged. In addition, data center and IT staff at Moi University should

be conversant with industry standard practices applicable to management of data. For example, they could make use of resources from the Web Application Consortium (available at: www.webappsec.org), and the ISO/IEC 17799:2005 Information technology - Security techniques - Code of practice for information security management professionals (available at: http://www.iso.org/iso/catalogue_...39612). These documents will equip them with guidelines on best practices in varying areas of information security management.

A critical issue for collection management is the retention policy that governs the storage periods that an item can be retained in active circulation and use. The institution should formulate specific guidelines on how digital content may be handled so as to ensure important documents are retained for reference and for future use, how and when content no longer necessary/useful for functioning of institutional activity shall be deleted or disposed of and where the useful but inactive content shall be kept for future reference. The policy should also ensure that all employees know which content should be retained, how long it will be retained, and how and where it shall be stored. Generally, content should only be retained for as long as the event utilizing that content has not taken place or as long as it is ongoing. For example, on the Moi University website, announcements for events should only remain visible on the website as long as the event is still ongoing or has not occurred. Thereafter, it should only be retained for at most one more week and then deleted. This is a decision that should be made by the website administrators in consultation with the owners of the content and imply that regular scrutiny of digital content is mandatory.

e) Usage

The next stage in the framework is the active use of the digital collection. NISO Collections Principle 4 states: "A good collection is broadly available and avoids unnecessary impediments to use." This principle encompasses three attributes namely: *availability, usability* and *accessibility*. Availability means the collection is accessible and usable upon demand by an authorized person. This implies that the collection should be accessible through the web, using technologies that are well known among the target user community. The collection should be 'up' as close to 24/7 as possible with implications for system security and maintenance.

The American Library Association (2007) principles for digital content indicate that digital collections must be built on standards and best practices that maximize their usefulness and accessibility. Such standards must serve the broadest community of users including those with disabilities. They propose that preference should be given to open standards and non-proprietary technologies that support long-term sustainability.

According to NISO, usability refers to ease of use. In this case, how usable the technology will be by potential users on different types of infrastructure, e.g. those on low bandwidth connections and the different browser versions. Technology requirements for accessing the content should be documented as part of the collection description. Based on the above recommendations, Moi University should strive to ensure that its digital content is usable by as many of the university community members as need the information. They should be facilitated to use the collection from environments with which they are familiar. One recommendation to achieve this is to have a web portal that users can manage and run just like Face book where they can

freely contribute personal digital resources or preprints and postprints to an academic institutional repository with minimal significant additional effort.

Another issue that should be considered when providing access to the digital collection is the intellectual property rights of the owners or creators of the content. According to the NISO Collection Principle 5, "a good collection respects intellectual property rights". These should be considered from several viewpoints namely: what rights the owners of the original source materials retain in their materials, what rights or permissions the collection developers have to digitize content and/or make it available, what rights or permissions the users of the digital collection are given to make subsequent use of the materials. At Moi University, the content whose copyright may be protected may include software, lecture notes, multimedia files and theses or research articles. However, with open access catching on, some of this content may be availed with no restrictions as to access or re-use. However, policies must be developed to guide this. There must be a risk management strategy that balances the educational value of the collections against principles of fair use (NISO, 2007).

Further areas to consider are the staffing and security issues concerning use of the digital collection. The collection must be manned by qualified personnel who will facilitate issues of accessibility, availability and usability of the collection. The collection must also be secured against unauthorized access and the content therein must be protected to maintain its integrity as much as possible. It is advisable to maintain backups especially of the more rare and special collections such as rare books, photographs, theses and dissertations, training manuals and research data among others.

In the event of corruption of the main database containing this content, the institution can easily retrieve the data from the backup site.

f) Evaluation

NISO Collections Principle 6 states that "a good collection has mechanisms for collecting data that measure use and usefulness." Digital collections should be evaluated periodically to monitor usage, assess service effectiveness, demonstrate return on investment, inform collection development, inform strategic planning and support funding requests. The criteria, methods and metrics for evaluating collections will vary by the objectives of the collections and the purpose of the evaluation. For example, the collections of the National Science Digital Library are designed to support teaching and learning, so it is appropriate that evaluation measures focus on the educational impact of these collections (NISO, 2007).

In evaluating the collection's use and usefulness over time, various methods can be used to obtain data from the users and managers of the digital content. Interviews, observation, surveys, case studies and transaction log analysis can be used to gain insights into the usefulness and extent of current usage of the collection. Answers should be obtained as to 'who is using what, where, why and how'.

To achieve effective evaluation of the collection, staff with appropriate expertise and knowledge of such evaluation should be used, measurement techniques and evaluation metrics must be employed and data (statistics) on users, uses and usability must be captured and maintained over time for comparison purposes. This will ensure evaluation efforts are actually undertaken.

g) Archiving

Conway (2000) asserts that in the digital world, preservation is the creation of digital products worth maintaining over time. He adds that the time to be concerned about the long-term persistence of digital products is when a system is designed and before digital conversion has begun.

American Library Association (2007) in their principles for digital content emphasize that digital resources must receive appropriate preservation and that preservation activities require the development of standards, best practices, and sustainable funding models to support long-term commitment to digital resources.

Digital collections containing resources of long-term value should be sustained and archived permanently and ensure access to them. Sustainability needs to be addressed from organizational, financial and technical perspectives. There must be a clear understanding of the long-term obligations necessary to ensure a sustained digital collection (NISO, 2007).

Once content has been created and used over time, some of it will have to be discarded from current circulation but some may need to be preserved for long term accessibility. A digital archive has to be set up to house the content earmarked for permanent storage. DPC (2009) defines digital preservation to include all the activities employed to ensure continued access to digital resources which have retained properties of authenticity, integrity and functionality. Several issues need to be considered to ensure that content in an archive is maintained and can be accessed by authorized users. Policies need to be defined to guide the decisions on which content goes to the archive and possibly for how long it can be held therein.

It is important to consider the storage media and file formats which will be used to store digital content for long periods, bearing in mind issues of software and hardware obsolescence. Coupled with this should be the possibility of migration across software or hardware platforms to ensure long term accessibility of content.

Disaster recovery planning is another very important aspect of long term preservation and accessibility of digital content. The development and use of a disaster recovery plan based on sound principles, endorsed by senior management, and able to be activated by trained staff will greatly reduce the severity of the impact of disasters and incidents (DPC, 2009).

Security of the content in the archive is a very significant aspect to consider. Content managers should consider logical and physical security of the archive to guard against attacks by malicious individuals and also to protect the content against loss by natural disasters. Data backups are a key issue here to maintain multiple copies of the archived content.

Other issues to consider are the cost and staffing issues regarding the long term maintenance of the digital archive.

In conclusion, the aim of the study which was to examine the types of content generated at Moi University and the strategies for their management to pave way for designing a framework to effectively manage digital content in the institution, has been achieved. In the discussions above, the types of content at the institution have been adequately described and a framework has been designed for effective management of digital content.

6.5 Suggestions for Further Research

The study endeavored to establish content management practices at Moi University. It revealed gaps in the effective management of digital content by both creators and users of digital content. In this light, suggested areas for further research would be to assess the readiness for digital scholarship and administration at Moi University with an aim of implementing the proposed framework.

The study can also be carried out in similar institutions of higher learning in Kenya, both public and private, to find out the state of content management practices. In this way comparative data can be collected and analyzed to establish best practices, lessons the other institutions have learnt and their success stories. These could be incorporated into content management strategies for Moi University.

Another area for further research would be the extent of use of Web 2.0 technologies among students and staff. This will unearth the types of web 2.0 technologies already in use and those that are yet to be explored and also to specify the uses of these technologies.

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APPENDICES

APPENDIX 1: ICT NETWORK DIAGRAM

ANNEX 1

WAN/LAN STATUS AT MOI UNIVERSITY
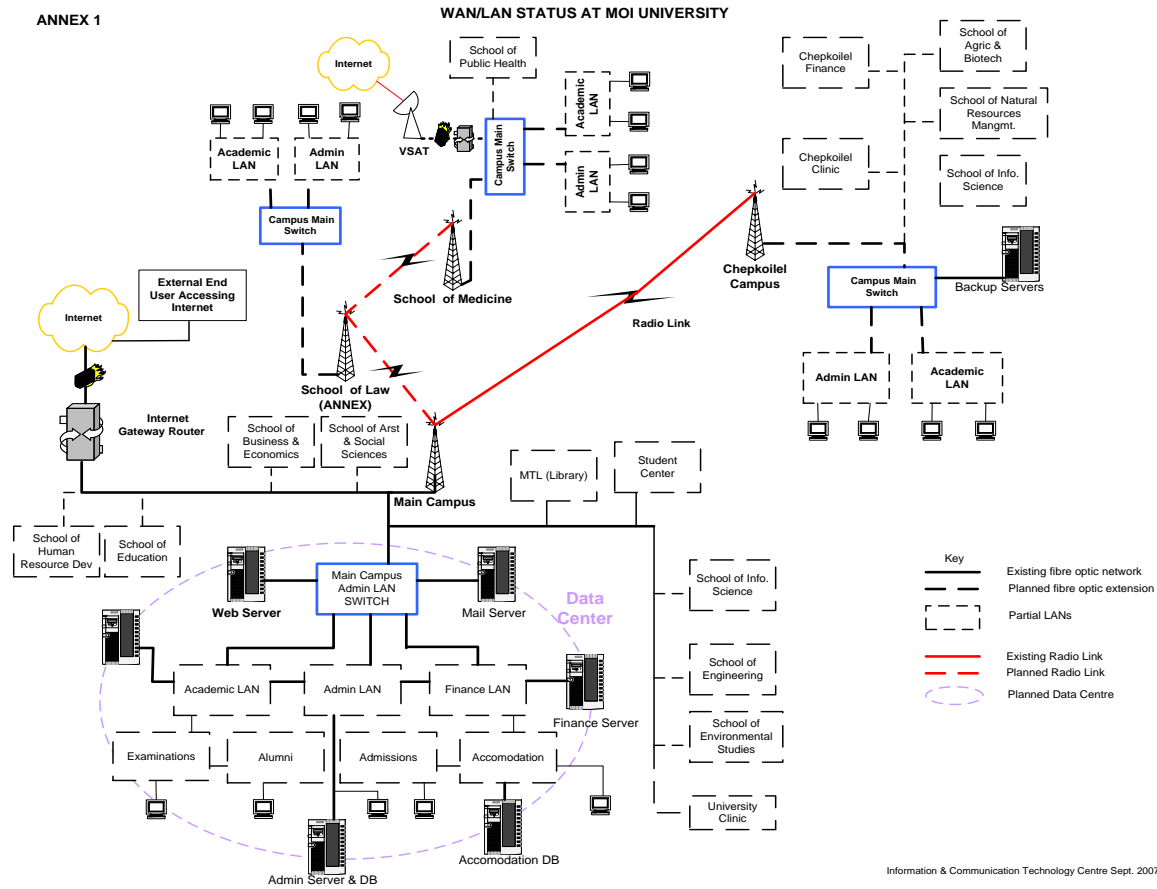
Source: Moi University ICT Centre. Valid 2007-2010

APPENDIX 2: INTERVIEW SCHEDULES

Interview Schedule for ICT Directorate Staff - Moi University

Dear Respondent,

I am a Postgraduate student pursuing a Master of Philosophy degree in Information Technology at the School of Information Sciences, Moi University. I am conducting a research study on "Digital Content Management and Use at Moi University". Content management is the set of processes and technologies that support the generation, dissemination and use of content in digital form and may comprise text, multimedia, websites and online databases. Content management systems (CMS) are computer software that assist users in managing digital content by facilitating organisation, control and publication of the digital content. The purpose of this study is to review the existing content management techniques and strategies used in Moi University, establish their strengths and weaknesses to pave way for designing and developing a web-based CMS to manage digital content in Moi University. Please be assured that your responses and the information you provide will be kept confidential and will be used for research purposes only. If the spaces provided are not sufficient to include all the information you may want to avail, please feel free to attach extra sheets of paper as necessary.

Your kind assistance in providing information to assist me in the research will be highly appreciated. For any queries/clarifications, do not hesitate to contact me on 0721 735456 or email: irenemorara@yahoo.com.

Yours Sincerely,

Irene M. Moseti

M.Phil. Student

Department of Information Technology, School of Information Sciences, Moi University

1. What is your position in Moi University and what is the role of your

   department?

   ....

2. Are you aware of content management? ....

   ....

3. What are some of the current practices, policies and strategies for content

   management in the institution? i.e. existing methods and strategies for creation,

   update, publishing, translating, archiving and retrieving digital content in Moi

   University. (You may answer this on a separate page.)

   ……………………………………………………………………………………

   ……………………………………………………………………………………

4. What are the specific roles and responsibilities of staff members in content

   management?

   ……………………………………………………………………………………

   ……………………………………………………………………………………

5. a) What is your experience in managing Internet content?

   ....

   ....

   b) What are the challenges and how do you overcome them?

   ....

   ....

   ....

   c) What are the risks (if any) associated with managing information on

   individual (departmental)/ corporate Website?

....

....

6. What are the unique qualities of publishing to the web compared to traditional print or broadcast media? How does the management of web activities compare to the others?

....

....

7. What management framework do you have in place to help the university and its departments to integrate its Web posting and management functions within its overall record-keeping and publication management?

....

....

8. Who are the people likely to need and/use the information you are providing on-line?

....

....

....

9. Do you have any preset standards regarding creation, update, publishing, translating, archiving and retrieving digital content? If yes, what are they and how do they apply?

....

....

10. What are the retention policies governing records, data and information on the Website?

....

....

11.   Do you have strategies in place for providing long-term access to information that remains valuable long after it is removed from an active Website?

....

12.   What suggestions can you give for improvement of the MU Website?

....

....

13.   Please comment on some of the future considerations e.g. future technological trends and on-line possibilities for the institution as pertains the use of Internet and Websites

....

....

....

Interview Schedule for Members of Management - Moi University

1. What is your position in Moi University and what is the role of your

   department?

   ....

   ....

2. What technological tools do you use for the processing of information?

   ....

   ....

3. Are you aware of content management?..

4. Describe the types of digital content you create and/or use.

5. Do you have a formal system or strategy to facilitate your efforts at

   managing the content you create and/or use? i.e. to keep it available,

   valid, accurate, current and complete.

   ....

6. How often do you access the Moi University Website?

   ....

   ....

7. How useful do you find it? Are your needs and expectations met?

   ....

   ....

8. As compared to other sites that you may have visited, give your

   comments about the MU Website in terms of attractiveness, appropriate

   design, stability and reliability.

....

....

9. How easy is it to navigate around it?

....

....

10. What suggestions can you give for improvement of the MU Website?

.,..

11. What tools do you use for creation, update, publishing, translating,

archiving and retrieving digital content? (i.e. text, e-journals, images,

graphics, video, websites, online databases, software)

....

....

APPENDIX 3: QUESTIONNAIRE

Content Management Questionnaire for Moi University Staff

Dear Respondent,

I am a Postgraduate student pursuing a Master of Philosophy degree in Information Technology at the School of Information Sciences, Moi University. I am conducting a research study on "**Content Management Practices at Moi University**". Content management is the set of processes and technologies that support the generation, dissemination and use of content in digital form and may comprise text, multimedia, websites and online databases. Content management systems (CMS) are computer software that assist users in managing digital content by facilitating organisation, control and publication of the digital content.

The purpose of this study is to review the existing content management techniques and strategies used in Moi University, establish their strengths and weaknesses to pave way for designing and developing a Framework to facilitate management of digital content in Moi University.

You are requested to kindly provide information that will address the issues outlined below. Please be assured that your responses and the information you provide will be kept confidential and will be used for research purposes only. The following instructions will guide you as you provide the required responses:

- Give your opinion based on a 5 point scale where 1(one) means you strongly disagree and 5(five) means you strongly agree.

- For questions with no numbers to be circled, please provide the answer in your own words.

- There is no right or wrong answer. Feel free to express your opinion as closely to your experience as possible.

- Do not write your name anywhere on the questionnaire.

- Kindly attempt to answer all questions.

Your kind assistance in providing information to assist me in the research will be highly appreciated. For any queries/clarifications, do not hesitate to contact me on 0721 735456 or email: irenemorara@yahoo.com.

Yours Sincerely,

Irene M. Moseti

M.Phil. Student

School of Information Sciences, Moi University

Please tick (√) or check (x) on only one answer

i) Age: 25 - 35 ☐   35 – 45   ☐

45 – 55 ☐   55 and above   ☐

ii) Gender   Male   ☐

Female   ☐

iii) Category   Teaching Staff   ☐

ICT Staff   ☐

Administrative staff   ☐

iv) Designation …………………………………………………………………………

v) Campus………………………………………………………….............................

vi) School/Department………………………………………………………………….

vii) What are your main tasks at your workplace? (Tick all that apply)

Administrative ☐

Teaching ☐

Research ☐

Technical ☐

viii) Which of the following facilities are available to facilitate your work and help you achieve

your objectives? (tick all that apply)

Computers and associated tools e.g. printers ☐

Computer Networks ☐

Communication facilities e.g. Telephones, email, ☐

Well defined work processes and procedures ☐

Filing cabinets ☐

Other (please specify) ☐

ix) Are you aware of content management?   Yes ☐   No ☐

xi) Which of the following digital content do you directly create or use? (Tick all that apply)

a) Lecture notes and presentations ☐

b) Course syllabi ☐

c) Theses and dissertations ☐

d) Information on academic programs ☐

e) Advertisements and news ☐

f) Electronic communication ☐

g) Examination results ☐

h) Software ☐

i) Research papers and e-journals ☐

j) Images, video, sound (multimedia) ☐

k) Any other? (Please Specify)……………………………………

xii) Who are the users of the content you generate? Staff ☐ students ☐

Other……………………

xiii) What strategies do you have to ensure that the content you create is accessible to your users in the intended format? E.g. to equip users with ICT skills, web searching skills

………………………………………………………………………………………………………

………………………………………………………………………………………………………

xiv) Do you have a formal system or strategy to facilitate your efforts at managing the content you create and/or use? i.e. to keep it valid, accurate, current and complete. e.g. databases, Chisimba

Yes ☐ No ☐

xv) Are these efforts personal, departmental, or done at higher levels of the university?

....

xvi) To what extent do you agree with the following statements? (Please circle one only.)

1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 =Agree; 5 = Strongly Agree

a) Considering the ICT infrastructure available in my department, the facilities adequately support me in my creation, dissemination, storage and use of digital content.

1 2 3 4 5

b) There is adequate support of the university to equip me to publish my research work on the Internet.

1 2 3 4 5

c) The Internet connectivity enables me to easily access digital content on the Web

1 2 3 4 5

d) The university website enables me to access university information in a satisfactory manner

1 2 3 4 5

xvii) How often do you access the Moi University Website?

Daily ☐

Weekly ☐

Monthly ☐

Never ☐

xviii) How useful do you find it as an information source? Briefly comment on your answer

………………………………………………………………………

xix) Comment on the MU Website in terms of attractiveness, appropriate design, stability and reliability.

....

…………………………………………………………………………………………………

xx) How would you rate your Web literacy?

1	**2**	**3**	**4**	**5**
Very Poor	Poor	Average	Good	Excellent

xxi) As you may be aware, ranking of universities globally is done based on Website content, currency, quantity, types of content, relevance and generally, their presence on the web. What can you (as the academic or administrative staff) do to improve the university's rank? **(currently MU is ranked No. 86 in Africa and 7,965 globally)**. (This may be in terms of web policy, promoting substantial increases of the volume and quality of electronic publications.)

…………………………………………………………………………………………………

….………………………………………………………………………………………………

xxii) What percentage of your work is published on the Web and/or University Local Area Networks?

90 – 100% ☐   60 – 80 % ☐   30 – 50 % ☐   1 – 20% ☐   0% ☐

xxiii) Do you experience any problems/ challenges with regard to your personal management of digital information and knowledge? Please explain

………………………………………………………….

How do you overcome these problems/difficulties?

....

xxiv) What suggestions would you give to improve access/ use of digital information?

....

APPENDIX 4: CONTENT ANALYSIS SCHEDULE

Analysis of the Moi University Web site was guided in part by criteria derived by the researcher.

- **Currency:** How up to date the information on the website is

- **Quantity of information:** How much information is provided on the website

- **Diversity of information:** The extent of variety of information captured/presented

- **User friendliness:** Ease of use of the website

- **Reliability:** How dependable the website is

- **Collocation**: Are items with similar content or on the same topic brought together in one area?

- **Differentiation**: Are dissimilar items or items about different subject areas located in different content areas?

- **Completeness:** Does all content mentioned or linked to exist?

- **Accessibility:** Are users able to access the content they want through the browsing hierarchy or by using search?

- **Multiple Access Paths:** Are users able to take multiple paths to get to specific content?

- **Audience-Relevance:** Are different audience segments able to easily find relevant content facilitated by content organization?

- **Consistency:** Are content structures in similar content areas consistent?

APPENDIX 5: WEBPAGE SHOWING MOI UNIVERSITY WORKSHOPS AND CONFERENCES
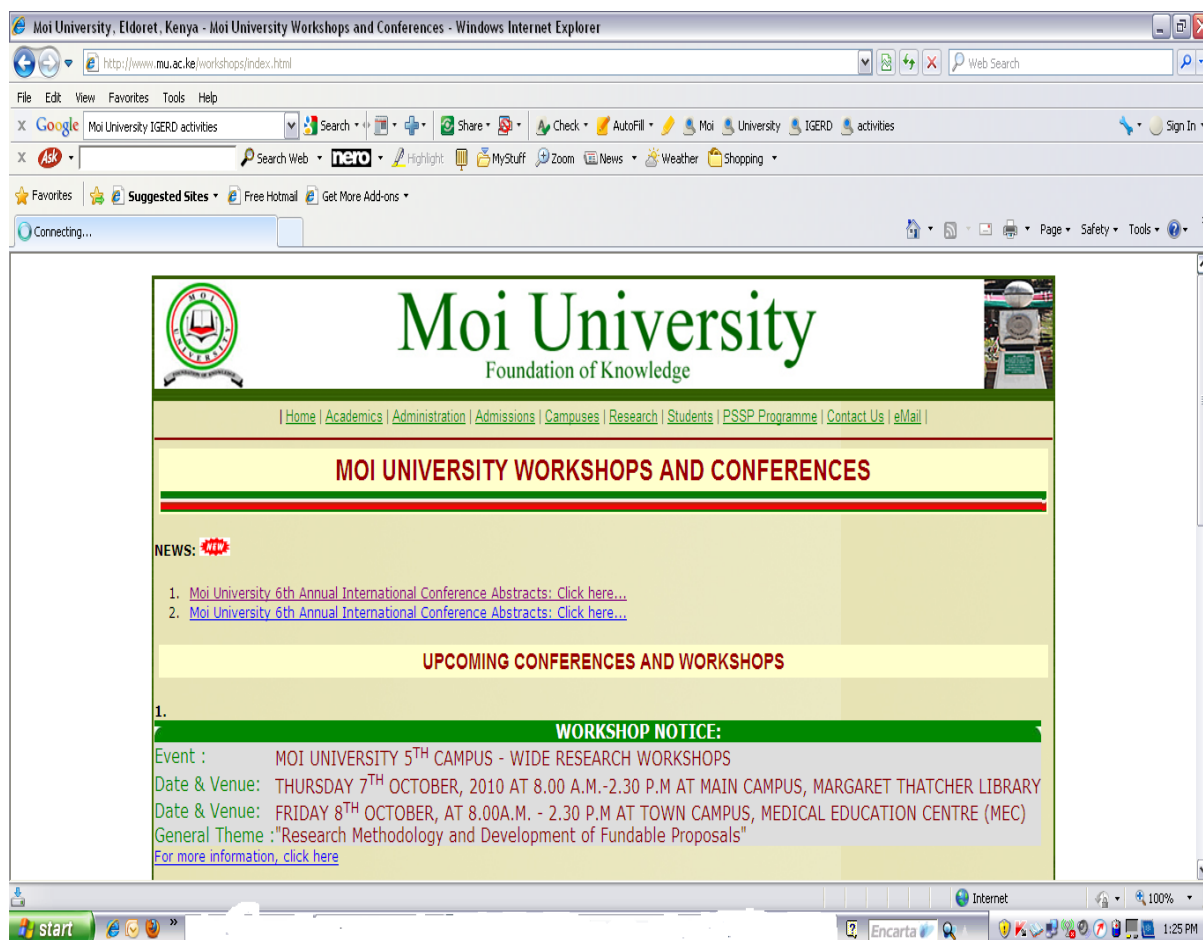
APPENDIX 6: MOI UNIVERSITY LIBRARY POLICY ON USE OF ELECTRONIC INFORMATION RESOURCES

1. Purpose

University library information systems consist of the computer devices, data, applications, and the supporting networking infrastructure. These technologies are critical to the multifaceted mission of the University, a mission that includes teaching, research, and public service. Information technology offers increased opportunities for communication and collaboration and has changed the way we conduct business as a University.

The Moi University Libraries makes computers and network resources available to students, lecturers, staff and authorized visitors to provide access to library collections and other information resources to support learning, teaching and research. The intent of this policy is to ensure that facilities and resources are used most effectively to benefit the greatest number of library users in pursuit of achieving intended goals and objectives.

Users who are in violation of these policies may be subject to penalties for infractions, including but not limited to verbal warnings and the loss of the use of library computers and network resources.

2. The Underlying Principle

This policy establishes guidelines for acceptable use of digital and electronic information resources. It includes examples of what users can do and cannot do, and what rights they have. All of these guidelines are based on the following underlying principles:

a) Information resources are provided to support the essential mission of Moi University.

b) Moi University policies, Moi University library rules and regulations, and state laws govern users' utilization of information resources.

c) Users are expected to use information resources with courtesy, respect, honesty and integrity.

d) The information resources infrastructure is provided for the entire university campus. This infrastructure is finite and requires millions of shillings to maintain, and all users are expected to use it responsibly.

NOTE: Simply because an action is easy to do technically does not mean it is legal or even appropriate. So be careful.

3. Academics First!!

- Non-academic activities including, but not limited to, game playing, e-mail and internet telephony, chat, financial transactions or other recreational use are prohibited on library computers and networks.

- Transmission of indecent materials to unwilling recipients is considered harassment and thus may lead to legal action of university disciplinary.

4. User Authentication

User authentication is required to access all Moi University Libraries computer and network resources. Current Moi University students, lecturers, staff, official visitors, and courtesy and special borrowers may use their individually-assigned usernames and passwords to access computers and network resources. Other users may request temporary authenticated access to the same from Library Systems Staff, on behalf of the University Librarian.

All users are required to produce a valid University Identification Card any time upon request by library staff.

5. Priority Users

a) Moi University students, lecturers and staff are priority users of library computers and networks.

b) Computers and networks shall be restricted to priority users.

c) Other users may be asked to relinquish computers and/or discontinue network access at the discretion of library staff.

6. Time Limits

a) Users must observe posted time limits.

b) Users with special needs shall contact library staff.

7. User-Owned Equipment

Authorized uses, including Moi University students, lecturers and staff, may connect personal equipment only through network ports designated for such use. Users may not unplug library equipment or cables for any reason. Use of personal equipment such as extension, adaptor or power cords must not pose a safety hazard for others. This must be done only after approval by the library's technical staff.

8. Requirements

i. Authorized users may use an information resource (such as an electronic identifier or an electronic mail account) that the University has provided for exclusive use.

ii. Users are responsible for all charges accrued using the computing account or computing resources assigned to you:

iii. Users will be held responsible for destructive or illegal activity done by proxy user.

iv. Users shall not provide others access to university information resources unless they are authorized and authenticated to do so. Users may not extend access to university information resources to others without permission (e.g., proxy services, accounts for non-university personnel, etc).

v. Users shall not be paid, or otherwise profit, from the use of any university-provided information resource or from any output produced using it. Users shall not promote any commercial activity using university information resources.

vi. Users shall not use any university-provided information resource to do illegal, threatening, deliberately destructive activities and jokes. Violations shall result in disciplinary action, criminal charges, or both.

vii. Users shall not deliberately install any unauthorized or malicious software on any system.

viii. Users shall not interfere with the activities of others or use a disproportionate share of information resources. Users shall not:-

  a. Send an unsolicited message to a large number of recipients (known as "spamming the network").

  b. Consume an unauthorized disproportionate share of networking resources (e.g., misuse of peer-to peer | client/server applications).

  c. Deliberately cause any denial of service, including flooding, IP attacks, or the unauthorized automated use of a service intended solely for human interaction.

ix.   Users shall not falsify identify or enable others to falsify identify using university information resources. This type of forgery shall result in serious criminal penalties and disciplinary action.

x.   Users shall not infringe upon someone else's copyright. It is a violation of university policy and the country's law to participate in copyright infringement. The university complies with all legal requests for information and will not hesitate to report your use in response to a lawful request. Copyrighted materials include, but are not limited to, computer software, audio and video recordings, photographs, electronic books and written material. If you share movies or music that you did not create, that may be infringing on another's copyright. Consequences of copyright infringement shall include, but not limited to, disciplinary actions by the university.

xi.   Users shall not circumvent login procedures on any computer system or otherwise attempt to gain access where they are not allowed. Deliberately scanning or probing information resource without prior authorization is prohibited.

xii.   Users shall not move, remove any parts of (vandalize) computers or network equipment.

xiii.   Users shall report violations of university library policies regarding use and/or disclosure of confidential or restricted information to the University Librarian.

9. Disciplinary Actions

Disciplinary action for infractions includes, but not limited to:

i.   Verbal warnings;

ii.   Revocation of access privileges;

iii.   Disciplinary action in accordance with the University's rules and regulations and/or terms of service;

iv.   Criminal prosecution.

APPENDIX 7: CODE FOR IMPLEMENTATION OF THE PROTOTYPE

The following is the code implementing various modules of the Moi University Content Management System (MUCMS). This CMS was developed by customizing MODx which is an open source content management system.

a) Code for Implementing the User's Main Interface

```
<?php die('Unauthorized access.');

?>a:41:{s:2:"id";s:1:"1";s:4:"type";s:8:"document";s:11:"contentType";s:9:"text/html";s:9:"pagetitle";s:4:"Home";s:9:"longtitle";s:16:"Welcome to MUCMS";s:11:"description";s:21:"Introduction to MUCMS";s:5:"alias";s:5:"index";s:15:"link_attributes";s:0:"";s:9:"published";s:1:"1";s:8:"pub_date";s:1:"0";s:10:"unpub_date";s:1:"0";s:6:"parent";s:1:"0";s:8:"isfolder";s:1:"0";s:9:"introtext";s:39:"Create and do amazing things with MUCMS";s:7:"content";s:1137:"<ul>
        <li><strong><a href="[~2~]">Simple Blog/ News.</a></strong> When logged into your site, you'll be able to create new entries. This can also be turned into a News publishing or PR publishing system.</li>
        <li><strong><a href="[~9~]">Easy Comments.</a></strong> When logged into your site, your registered site users can comment on your posts.</li>
        <li><strong><a href="[~5~]">Automatic User Registration.</a></strong> Those that wish to comment on blogs must first create an account.</li>
        <li><strong><a href="[~47~]">Academic programs</a></strong> of Moi University.</li>
```

Rules &amp; Regulations for Students.

Notes &amp; presentations uploaded by lecturers.

Theses &amp; Dissertations/ Research papers.

Past exam papers for revision.

Contact Us

<p>

To log into the MUCMS Control Panel click on the link below.

[(site_url)]manager/.

</p>

";s:8:"richtext";s:1:"1";s:8:"template";s:1:"4";s:9:"menuindex";s:1:"1";s:10:"searchable";s:1:"1";s:9:"cacheable";s:1:"1";s:9:"createdby";s:1:"1";s:9:"createdon";s:10:"1144904400";s:8:"editedby";s:1:"1";s:8:"editedon";s:10:"1271088782";s:7:"deleted";s:1:"0";s:9:"deletedon";s:1:"0";s:9:"deletedby";s:1:"0";s:11:"publishedon";s:1:"0";s:11:"publishedby";s:1:"0";s:9:"menutitle";s:4:"Home";s:7:"donthit";s:1:"0";s:11:"haskeywords";s:1:"0";s:11:"hasmetatags";s:1:"0";s:10:"privateweb";s:1:"0";s:10:"privatemgr";s:1:"0";s:13:"content_dispo";s:1:"0";s:8:"hidemenu";s:1:"0";s:11:"blogContent";a:5:{i:0;s:11:"blogContent";i:1;s:0:"";i:2;s:8:"richtext";i:3;s:28:"&w=383px&h=450px&edt=TinyMCE";i:4;s:8:"richtext";}s:9:"loginName";a:5:{i:0;s:9:"loginName";i:1;s:72:"@EVAL if ($modx->getLoginUserID()) return 'Logout'; else return

'Login';";i:2;s:0:"";i:3;s:0:"";i:4;s:4:"text";}s:12:"documentTags";a:5:{i:0;s:12:"docume

ntTags";i:1;s:0:"";i:2;s:0:"";i:3;s:0:"";i:4;s:4:"text";}s:17:"__MODxDocGroups__";s:0:"

";}<!--__MODxCacheSpliter__--><!DOCTYPE html PUBLIC "-//W3C//DTD

XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-

transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml">

<head>

 <title>My MUCMS Site | Home</title>

 <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />

 <base href="http://localhost/modx/"></base>

 <link rel="stylesheet" href="assets/templates/modxhost/layout.css" type="text/css"

media="screen" />

 <link rel="stylesheet" href="assets/templates/modxhost/modxmenu.css"

type="text/css" media="screen" />

 <link rel="stylesheet" href="assets/templates/modxhost/form.css" type="text/css"

media="screen" />

 <link rel="stylesheet" href="assets/templates/modxhost/modx.css" type="text/css"

media="screen" />

 <link rel="stylesheet" href="assets/templates/modxhost/print.css" type="text/css"

media="print" />

 <link rel="alternate" type="application/rss+xml" title="RSS 2.0"

href="http://localhost/modx/[~11~]" />

```
  <script src="manager/media/script/mootools/mootools.js"

type="text/javascript"></script>

  <script src="assets/templates/modxhost/drop_down_menu.js"

type="text/javascript"></script>

<script type="text/javascript">

function setActiveStyleSheet() {

var el= $('modxhost');

el.style.background = '#ffd700';

el.style.padding = '10px';

el.style.display='block';

var bgEffect = new Fx.Styles('modxhost', {duration: 1000,transition:

Fx.Transitions.linear});

bgEffect.start( {'background-color': '#f9f9f9'});

return false;

}


function highlight(el,endcolor,duration) {

$(el).style.background = '#ffd700';

var fx = $(el).effects({duration: 1000, transition: Fx.Transitions.linear});

fx.start.delay(duration/2,fx,{

'background-color': endcolor

});

return false;

}
```

```
</script>

</head>

<body>

<div id="wrapper">

  <div id="minHeight"></div>

  <div id="outer">

    <div id="inner">

      <div id="right">

        <div id="right-inner">

          <h1 style="text-indent: -5000px;padding: 0px; margin:0px; font-size: 1px;">My MUCMS Site</h1>

              <div id="sidebar">
```

```
        <h2>Login:</h2>

          <div id="sidebarlogin">[!WebLogin? &tpl=`FormLogin` &loginhomeid=`1`!]</div>
```

```
<br><br><br><br><br><br><br><br><br><br><br>
```

```
        </div>

        <!-- close #sidebar -->

        </div>

        <!-- end right inner-->
```

```
        </div>

        <!-- end right -->

        <div id="left">

          <div id="left-inner">

            <div id="content">

              <div class="post">

                <h2>Welcome to MUCMS</h2>

                <quickedit:content /><ul>

                <li><strong><a href="[~2~]">Simple Blog/ News.</a></strong> When
logged into your site, you'll be able to create new entries. This can also be turned into a
News publishing or PR publishing system.</li>

                <li><strong><a href="[~9~]">Easy Comments.</a></strong> When logged
into your site, your registered site users can comment on your posts.</li>

                <li><strong><a href="[~5~]">Automatic User Registration.</a></strong>
Those that wish to comment on blogs must first create an account.</li>

                <li><strong><a href="[~47~]">Academic programs</a></strong> of Moi
University.</li>

                <li><strong><a href="[~55~]">Rules &amp; Regulations</a></strong> for
Students.</li>

                <li><strong><a href="[~52~]">Notes &amp; presentations</a></strong>
uploaded by lecturers.</li>

                <li><strong><a href="[~54~]">Theses &amp; Dissertations/ Research
papers.</a></strong></li>
```

```
        <li><strong><a href="[~53~]">Past exam papers</a></strong> for
revision.</li>
        <li><strong><a href="[~6~]">Contact Us</a></strong></li>
</ul>
<p>
<strong>To log into the MUCMS Control Panel click on the link below. <br />
<a href="manager">http://localhost/modx/manager/</a>.</strong>
</p>
 </div>
     <!-- close .post (main column content) -->
      </div>
      <!-- close #content -->
     </div>
     <!-- end left-inner -->
    </div>
    <!-- end left -->
   </div>
   <!-- end inner -->
   <div id="clearfooter"></div>
   <div id="header">
    <h1><a id="logo" href="[~1~]" title="My MUCMS Site">My MUCMS
Site</a></h1>
    <div id="search"><!--search_terms--><span id="search-txt">SEARCH</span><a
name="search"></a>[!AjaxSearch? ajaxSearch=`1` &AS_landing=`8`
```

&moreResultsPage=`8` &showMoreResults=`1` &addJscript=`0` &extract=`0`

&AS_showResults=`0`!]</div>

<div id="ajaxmenu">   <ul id="myajaxmenu">

  <li class="category first"><a href="http://localhost/modx/"

title="Home">Home

<li class="category ">Blog

<li class="category "><a href="/modx/index.php?id=15" title="MUCMS

Features">Features<ul style="display:none">

  <li class="first">Ajax

Menus and

Lists

Manage

Content

<li class="last"><a href="/modx/index.php?id=24" title="Extendable by

design">Extendability

<li class="category ">Getting

Help

<li class="category "><a href="/modx/index.php?id=39" title="Template

Examples">Templates<ul style="display:none">

  <li class="first">MODxHost

```
<li><a href="/modx/index.php?id=42" title="MODxCSS Wide">MODxCSS

Wide</a></li>

<li class="last"><a href="/modx/index.php?id=43"

title="MODxCSS">MODxCSS</a></li>


</ul></li>

<li class="category "><a href="/modx/index.php?id=32"

title="Design">Design</a></li>

<li class="category last"><a href="/modx/index.php?id=6" title="Contact Us">Contact

us</a></li>


  </ul> </div>

    <!-- end topmenu -->

</div>

  <!-- end header -->

  <br style="clear:both;height:0;font-size: 1px" />

  <div id="footer">

   <p>  Designed by Irene M. &copy; 2010

     <br />

    document retrieved

    from [^s^]. </p>

  </div>

  <!-- end footer -->

 </div>
```

```
  <!-- end outer div -->

</div>

<!-- end wrapper -->

</body>

</html>
```

b) Code for Implementing the Managers Main Interface

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"

"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">

<html xmlns="http://www.w3.org/1999/xhtml"  lang="en" xml:lang="en">

<head>

  <title>MUCMS</title>

  <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />

  <link rel="stylesheet" type="text/css" href="media/style/MODxLight/style.css" />


  <script type="text/javascript">var MODX_MEDIA_PATH = "media";</script>

  <script src="media/script/mootools/mootools.js" type="text/javascript"></script>

  <script src="media/script/mootools/moodx.js" type="text/javascript"></script>

  <script language="JavaScript" type="text/javascript">

    window.addEvent('load', document_onload);

    window.addEvent('unload', document_onunload);


    var MODX_MEDIA_PATH = "media"; // set media path


    function document_onload() {
```

```
      stopWorker();

      hideLoader();

      ;

    };


    var dontShowWorker = false;

    function document_onunload() {

      if(!dontShowWorker) {

        top.mainMenu.work();

      }

    };


    // set tree to default action.

    parent.tree.ca = "open";


              // call the updateMail function, updates mail notification in top
navigation

              top.mainMenu.updateMail(true);


    function stopWorker() {

      try {

        parent.mainMenu.stopWork();

      } catch(oException) {

        ww = window.setTimeout('stopWorker()',500);
```

```
        }

    }


    function doRefresh(r) {

        try {

            rr = r;

            top.mainMenu.startrefresh(rr);

        } catch(oException) {

            vv = window.setTimeout('doRefresh()',1000);

        }

    }

    var documentDirty=false;


    function checkDirt(evt) {

        if(documentDirty==true) {

                            var message = "The changes you have made have
not been saved yet. You can choose to stay on the current page in order to save the
changes ('Cancel'), or you can leave this page, losing any changes you have made
('OK').";

                                if (typeof evt == 'undefined') {

                                    evt = window.event;

                }

                                if (evt) {

                                    evt.returnValue = message;
```

```
            }

                            return message;

                }

        }


    function saveWait(fName) {

        document.getElementById("savingMessage").innerHTML = "Saving, please
wait...";

        for(i = 0; i < document.forms[fName].elements.length; i++) {

            document.forms[fName].elements[i].disabled='disabled';

        }

    }


    var managerPath = "";


    function hideLoader() {

        document.getElementById('preLoader').style.display = "none";

    }


    hideL = window.setTimeout("hideLoader()", 1500);


    // add the 'unsaved changes' warning event handler

    if( window.addEventListener ) {

                        window.addEventListener('beforeunload',checkDirt,false);
```

```
                } else if ( window.attachEvent ) {

                        window.attachEvent('onbeforeunload',checkDirt);

                } else {

                        window.onbeforeunload = checkDirt;

                }


    </script>

</head>

<body ondragstart="return false">


<div id="preLoader"><table width="100%" border="0" cellpadding="0"><tr><td
align="center"><div class="preLoaderText">Please wait while MODx loads the
page...</div></td></tr></table></div>
<!-- welcome -->
<div class="sectionBody" style="display:none !important;">
    <table border="0" cellpadding="5">
     <tr>
      <td colspan="2">
         <h1 style="margin:0">My MUCMS Site</h1>
         Welcome to your MODx Content Manager
       </td>
     </tr>
     <tr>
      <td width="100" align="right">
```

```
        <img src='media/style/MODxLight/images/misc/logo.png' alt='MODx Content

Manager - \nCreate and do more with less' />

        <br /><br />

    </td>

    <td valign="top">

        <span class="wm_button" style="border:0"><a class="hometblink"

href="index.php?a=75"><img src="media/style/MODxLight/images/icons/security.gif"

width="32" height="32" alt="Manager Users" /><br />Security</a></span>

        <span class="wm_button" style="border:0"><a class="hometblink"

href="index.php?a=99"><img

src="media/style/MODxLight/images/icons/web_users.gif" width="32" height="32"

alt="Web Users" /><br />Web users</a></span>

        <span class="wm_button" style="border:0"><a class="hometblink"

href="index.php?a=106"><img

src="media/style/MODxLight/images/icons/modules.gif" width="32" height="32"

alt="Manage Modules" /><br />Modules</a></span>

        <span class="wm_button" style="border:0"><a class="hometblink"

href="index.php?a=76"><img

src="media/style/MODxLight/images/icons/resources.gif" width="32" height="32"

alt="Manage resources" /><br />Resources</a></span>

        <span class="wm_button" style="border:0"><a class="hometblink"

href="index.php?a=93"><img src="media/style/MODxLight/images/icons/backup.gif"

width="32" height="32" alt="Backup" /><br />Backup</a></span>

        <br style="clear:both" /><br />
```

```
      <a href="index.php?a=10"><img
src="media/style/MODxLight/images/icons/mail_generic.gif" /></a>
   <span style="color:#909090;font-size:15px;font-
weight:bold"> Inbox</span><br />
   <span class="comment">Your Inbox contains <strong>0</strong> message(s), of
which <strong><span style='color:red;'></span></strong> are unread.</span>
     </td>
    </tr>
   </table>
</div>


<div style="margin: 20px 12px;">
        <script type="text/javascript" src="media/script/tabpane.js"></script>
        <div class="tab-pane" id="welcomePane" style="border:0">
   <script type="text/javascript">
     tpPane = new WebFXTabPane(document.getElementById( "welcomePane"
),false);
   </script>


                <!-- system check -->
                <div class="tab-page" id="tabcheck" style="display:block; padding-
left:0px; padding-right:0px;">
                        <h2 class="tab" style="display:block">Configuration</h2>
```

<script type="text/javascript"> if('block'=='block')
tpPane.addTabPage(document.getElementById("tabcheck"));</script>

<div class="sectionHeader">Configuration check</div><div class="sectionBody">

<h4>One or more configuration details didn't check out OK: </h4>

<div class='fakefieldset'>

<p>Configuration warning: 'Config file still writable'</p>

<p style="padding-left:1em">What does this mean?

Very naughty people could potentially wreak some havoc on your site and everything associated with it. Really. Please make your config file (/manager/includes/config.inc.php) read only! </p>

</div>

<div class='fakefieldset'>

<p>Configuration warning: 'Installer still present'</p>

<p style="padding-left:1em">What does this mean?

The install/ directory contains the installer for MODx. Just imagine what might happen if an evil person finds this folder and runs the installer! He'd probably not get too far, because he'll need to enter some user information for the database, but it's still best to remove this folder from your server. </p>

</div>

<div class='fakefieldset'>

<p>Configuration warning: 'register_globals is set to ON in your php.ini configuration file'</p>

<p style="padding-left:1em">What does this mean?

This configuration makes your site much more susceptible to Cross Site Scripting (XSS) attacks. You should speak to your host about what you can do to disable this setting. </p>

</div>

</div>

</div>

<!-- home tab -->

<div class="tab-page" id="tabhome" style="padding-left:0px; padding-right:0px;">

<h2 class="tab">My MUCMS Site</h2>

<script type="text/javascript">tpPane.addTabPage(document.getElementById("tabhome"));</script>

<div class="sectionHeader">Welcome to your MODx Content Manager</div>

<div class="sectionBody">

<table border="0" cellpadding="5">

<tr>

```
        <td colspan="2">

          <h1 style="margin:0">My MUCMS Site</h1>

          Welcome to your MODx Content Manager

        </td>

      </tr>

      <tr>

       <td width="100" align="right">

         <img src='media/style/MODxLight/images/misc/logo.png' alt='MODx
Content Manager - \nCreate and do more with less' />

           <br /><br />

         </td>

         <td valign="top">

           <span class="wm_button" style="border:0"><a class="hometblink"
href="index.php?a=75"><img src="media/style/MODxLight/images/icons/security.gif"
width="32" height="32" alt="Manager Users" /><br />Security</a></span>

              <span class="wm_button" style="border:0"><a class="hometblink"
href="index.php?a=99"><img
src="media/style/MODxLight/images/icons/web_users.gif" width="32" height="32"
alt="Web Users" /><br />Web users</a></span>

              <span class="wm_button" style="border:0"><a class="hometblink"
href="index.php?a=106"><img
src="media/style/MODxLight/images/icons/modules.gif" width="32" height="32"
alt="Manage Modules" /><br />Modules</a></span>
```

```
<span class="wm_button" style="border:0"><a class="hometblink"
href="index.php?a=76"><img
src="media/style/MODxLight/images/icons/resources.gif" width="32" height="32"
alt="Manage resources" /><br />Resources</a></span>

<span class="wm_button" style="border:0"><a class="hometblink"
href="index.php?a=93"><img src="media/style/MODxLight/images/icons/backup.gif"
width="32" height="32" alt="Backup" /><br />Backup</a></span>

<br style="clear:both" /><br />

<a href="index.php?a=10"><img
src="media/style/MODxLight/images/icons/mail_generic.gif" /></a>
<span style="color:#909090;font-size:15px;font-
weight:bold"> Inbox</span><br />
<span class="comment">Your Inbox contains <strong>0</strong> message(s), of
which <strong><span style='color:red;'></span></strong> are unread.</span>
            </td>
          </tr>
        </table>
                        </div>
                </div>


                <!-- recent activities -->
                <div class="tab-page" id="tabAct" style="padding-left:0px; padding-
right:0px">
                                <h2 class="tab">Recent documents</h2>
```

```
<script type="text/javascript">tpPane.addTabPage(
document.getElementById( "tabAct" ) );</script>
<div class="sectionHeader">Recently edited/created
documents</div><div class="sectionBody">
This list shows the last documents you created or
edited:<br /><br /><ul><li><span style="width: 40px; text-align:right;">1</span> -
<span style="width: 200px;"><a href="index.php?a=3&amp;id=1">Home</a></span>
- Introduction to MUCMS</li><li><span style="width: 40px; text-
align:right;">46</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=46">Thank You</a></span></li><li><span
style="width: 40px; text-align:right;">4</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=4">[*loginName*]</a></span></li><li><span
style="width: 40px; text-align:right;">53</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=53">Past Exam Papers</a></span> - Past Exam
Papers</li><li><span style="width: 40px; text-align:right;">56</span> - <span
style="width: 200px;"><a href="index.php?a=3&amp;id=56">Computer
Science</a></span> - Computer Science</li><li><span style="width: 40px; text-
align:right;">48</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=48">undergraduate</a></span></li><li><span
style="width: 40px; text-align:right;">32</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=32">Design</a></span></li><li><span style="width:
40px; text-align:right;">52</span> - <span style="width: 200px;"><a
href="index.php?a=3&amp;id=52">Notes & presentations</a></span> - Notes &
presentations uploaded by lecturers</li><li><span style="width: 40px; text-
```

align:right;">55 - <a

href="index.php?a=3&id=55">Rules and Regulations - Rules and

Regulations
47 - <span

style="width: 200px;">My Academic

Programs

                        </div>

                </div>

                <!-- user info -->

                <div class="tab-page" id="tabYour" style="padding-left:0px;

padding-right:0px">

                        <h2 class="tab">Info</h2>

                        <script type="text/javascript">tpPane.addTabPage(

document.getElementById("tabYour"));</script>

                        <div class="sectionHeader">Your info</div><div

class="sectionBody">

  This section shows some information about you:

  <table border="0" cellspacing="0" cellpadding="0">

   <tr>

    <td width="150">You are logged in as:</td>

    <td width="20"> </td>

    <td>admin</td>

   </tr>

```
<tr>

 <td>Your role is:</td>

 <td> </td>

 <td><b>Administrator</b></td>

</tr>

<tr>

 <td>Your last login:</td>

 <td> </td>

 <td><b>11-04-10 15:23:08</b></td>

</tr>

<tr>

 <td>Total number of logins:</td>

 <td> </td>

 <td><b>49</b></td>

</tr>

</table>



                    </div>

               </div>


               <!-- online info -->

               <div class="tab-page" id="tabOnline" style="padding-left:0px;

padding-right:0px">

                         <h2 class="tab">Online</h2>
```

<script type="text/javascript">tpPane.addTabPage(document.getElementById("tabOnline"));</script>

<div class="sectionHeader">Online users</div><div class="sectionBody">

This list shows all users active within the last 20 minutes (current time is 21:15:11):

<table border="0" cellpadding="1" cellspacing="1" width="100%" bgcolor="#707070">

<thead>

<tr>

<td>User</td>

<td>User's ID</td>

<td>User's IP address</td>

<td>Last hit</td>

<td>Action</td>

</tr>

</thead>

<tbody>

<tr bgcolor='#FFFFFF'><td>admin</td><td> 1</td><td>127.0.0.1</td><td>21:15:11</td><td>Viewing home page/ online users</td></tr>

</tbody>

</table>

```
                    </div>

                </div>


        </div>

</div></body>

</html>

<!-- end footer -->
```

c) Code for Implementing the Document Manager

```
/**

 * Document Manager Module

 *

 * Purpose: Allows for the bulk management of key document settings.

 */


global $theme;

global $table;

global $_lang;

global $siteURL;


$basePath = $modx->config['base_path'];

$siteURL = $modx->config['site_url'];


/** CONFIGURATION SETTINGS **/

//-- set to false to hide the 'Select Tree' option
```

```php
$showTree = false;


/** END CONFIGURATION SETTINGS **/


//-- include language file

$manager_language = $modx->config['manager_language'];

$sql = "SELECT setting_name, setting_value FROM ".$modx->getFullTableName('user_settings')." WHERE setting_name='manager_language' AND user=" . $modx->getLoginUserID();

$rs = $modx->db->query($sql);

if ($modx->db->getRecordCount($rs) > 0) {

    $row = $modx->db->getRow($rs);

    $manager_language = $row['setting_value'];

}

include_once $basePath.'assets/modules/docmanager/lang/english.inc.php';

if($manager_language!="english") {

if

(file_exists($basePath.'assets/modules/docmanager/lang/'.$manager_language.'.inc.php')

) {

    include_once

$basePath.'assets/modules/docmanager/lang/'.$manager_language.'.inc.php';

}

}
```

//-- get theme

$tb_prefix = $modx->db->config['table_prefix'];

$theme = $modx->db->select('setting_value', '`' . $tb_prefix . 'system_settings`',

'setting_name=\'manager_theme\'', '');

$theme = $modx->db->getRow($theme);

$theme = ($theme['setting_value'] <> '') ? '/' . $theme['setting_value'] : '';

//-- setup initial vars

$table = $modx->getFullTableName('site_content');

$output = '';

$error = '';

//-- include php files

include_once $basePath.'manager/includes/controls/datagrid.class.php';

include_once $basePath.'assets/modules/docmanager/includes/interaction.inc.php';

include_once $basePath.'assets/modules/docmanager/includes/process.inc.php';

//-- get POST vars

$tabAction = (isset ($_POST['tabAction'])) ? $_POST['tabAction'] : ''; // get action for

active tab

$intType = (isset($_POST['opcode']) && $_POST['opcode'] == 'range') ? 'range' : 'tree';

// get interaction type

//-- Menu Index

```php
if ($tabAction == 'sortMenu' || isset($_POST['sortableListsSubmitted'])) {

$id= isset($_POST['new_parent'])? $_POST['new_parent']: 0;

$actionkey = isset($_POST['actionkey'])? $_POST['actionkey']: 0;

if(isset($_POST['sortableListsSubmitted'])) {$actionkey =1;}


include_once $basePath.'assets/modules/docmanager/includes/SLLists.class.php';


}


//-- process POST actions if required
if ($tabAction == 'change_template') {

        $output .= changeTemplate($intType, $_POST['pids'], $_POST['newvalue']);

        return $output;

} elseif($tabAction == 'change_tv') {

    $output .= changeTemplateVariables($intType, $_POST['pids']);

    return $output;

} elseif ($tabAction == 'pushDocGroup' || $tabAction == 'pullDocGroup' ) {

        $output.=changeDocGroups($intType,

$_POST['pids'],$_POST['newvalue'],$tabAction);

        return $output;

} elseif ((isset($_POST['actionkey'])) && $tabAction == 'sortMenu' ||

isset($_POST['sortableListsSubmitted']) ) {

                $output .= ' <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0

Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
```

```
<html'.($modx->config['manager_direction'] == 'rtl' ? 'dir="rtl"' : '').' lang="'.$modx-
>config['manager_lang_attribute'].'" xml:lang="'.$modx-
>config['manager_lang_attribute'].'">
<head>

<script type="text/javascript">

        function save()

        {

        populateHiddenVars();
if (document.getElementById("updated")) {new Effect.Fade(\'updated\', {duration:0});}
new Effect.Appear(\'updating\',{duration:0.5});

        setTimeout("document.sortableListForm.submit()",1000);

        }

        </script>

<style type="text/css">
  input {display:none;}

</style>
';
```

```
                $output.= sortMenu($id);

                return $output;

} elseif ($tabAction == 'changeOther') {

                $output.= changeOther($intType, $_POST['pids']);

                return $output;

}
```

//-- render tabbed output

//--- HEAD

$output .= ' <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"

"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html '.($modx->config['manager_direction'] == 'rtl' ? 'dir="rtl"' : '').' lang="'.$modx-

>config['manager_lang_attribute'].'" xml:lang="'.$modx-

>config['manager_lang_attribute'].'">

                        <head>

                <title>'.$_lang['DM_module_title'].'</title>

<script type="text/javascript">var MODX_MEDIA_PATH = "media";</script>

                        <link rel="stylesheet" type="text/css" href="media/style' . $theme .

'/style.css" />

                        <link rel="stylesheet" type="text/css" href="media/style' . $theme .

'/coolButtons2.css" />

                        <link rel="stylesheet" type="text/css" href="media/style' . $theme .

'/tabs.css"/>

```
                    <script type="text/javascript"

src="media/script/scriptaculous/prototype.js"></script>

                    <script type="text/javascript"

src="media/script/scriptaculous/scriptaculous.js"></script>

            <script type="text/javascript" src="media/script/modx.js"></script>

                <script type="text/javascript" src="media/script/cb2.js"></script>

                <script type="text/javascript"

src="media/script/tabpane.js"></script>

    <script type="text/javascript"

src="../assets/modules/docmanager/js/functions.js"></script>

    <script type="text/javascript" src="media/script/datefunctions.js"></script>

    <script type="text/javascript">

    function save()

                {

                        document.newdocumentparent.submit();

                }


function setMoveValue(pId, pName) {

        if (pId==0 || checkParentChildRelation(pId, pName)) {

                document.newdocumentparent.new_parent.value=pId;

                document.getElementById(\'parentName\').innerHTML = "Parent:

<strong>" + pId + "<\/strong> '.($modx->config['manager_direction']=='rtl' ? '&rlm;' :

'') .'(" + pName + ")";

        }
```

```
}


// check if the selected parent is a child of this document

function checkParentChildRelation(pId, pName) {

        var sp;

        var id = document.newdocumentparent.id.value;

        var tdoc = parent.tree.document;

        var pn = (tdoc.getElementById) ? tdoc.getElementById("node"+pId) :
tdoc.all["node"+pId];

        if (!pn) return;

                while (pn.p>0) {

                        pn = (tdoc.getElementById) ?
tdoc.getElementById("node"+pn.p) : tdoc.all["node"+pn.p];

                        if (pn.id.substr(4)==id) {

                                alert("Illegal Parent");

                                return;

                        }

                }


        return true;

}
';


if (isset($_POST['selectedTV']) && $_POST['selectedTV'] <> '') {
```

```
 $output.= 'new Ajax.Updater(\'results\',\''.$modx-
>getConfig('site_url').'assets/modules/docmanager/includes/tv.ajax.php\',
{method:\'post\',evalScripts:true,
postBody:\'theme='.$theme.'&langIgnoreTV='.addslashes($_lang['DM_tv_ignore_tv']).'
&langNoTV='.addslashes($_lang['DM_tv_no_tv']).'&tplID='.$_POST['selectedTV'].'&l
angInsert='.$_lang['DM_tv_ajax_insertbutton'].'\',onSuccess: function(t) {
$(\'results\').innerHTML = t.responseText;
$(\'selectedTV\').value=\''.$_POST['selectedTV'].'\';}});';
}


$output.='</script>';
$output.= buttonCSS();
$output.='
    </head>
    <body>
    <div class="subTitle" id="bttn">
                                    <span class="right"><img src="media/style' .
$theme . '/images/_tx_.gif" width="1" height="5" alt="" /><br />' .
$_lang['DM_module_title'] . '</span>
                                    <div class="bttnheight"><a id="Button5"
onclick="document.location.href=\'index.php?a=106\';">
                                        <img src="media/style' . $theme .
'/images/icons/close.gif" alt="" /> '.$_lang['DM_close'].'</a>
                                    </div>
```

```
                                    <div class="stay"></div>

                    </div>

                ';




//--- TABS

$output.= '<div class="sectionHeader"> ' . $_lang['DM_action_title'] . '</div>

                    <div class="sectionBody">

            <div class="tab-pane" id="docManagerPane">

            <script type="text/javascript">

                                    tpResources = new WebFXTabPane(

document.getElementById( "docManagerPane" ) );

            </script>';




//--- template

$output.= '<div class="tab-page" id="tabTemplates">

        <h2 class="tab">' . $_lang['DM_change_template'] . '</h2>

        <script type="text/javascript">tpResources.addTabPage(

document.getElementById( "tabTemplates" ) );</script>

                    ';
$output.=showTemplate();

$output.='</div>';




//--- template variables

$output.= '<div class="tab-page" id="tabTemplateVariables">
```

```
            <h2 class="tab">' . $_lang['DM_template_variables']. '</h2>

            <script type="text/javascript">tpResources.addTabPage(

document.getElementById( "tabTemplateVariables" ) );</script>

                ';

$output.=showTemplateVariables();

$output.='</div>';


//--- document permissions

$output.= '<div class="tab-page" id="tabDocPermissions">

            <h2 class="tab">' . $_lang['DM_doc_permissions']. '</h2>

            <script type="text/javascript">tpResources.addTabPage(

document.getElementById( "tabDocPermissions" ) );</script>

                ';

$output.=showDocGroups();

$output.='</div>';


//--- sort menu

$output.= '<div class="tab-page" id="tabSortMenu">

            <h2 class="tab">' . $_lang['DM_sort_menu'] . '</h2>

            <script type="text/javascript">tpResources.addTabPage(

document.getElementById( "tabSortMenu" ) );</script>

                ';

$output.= showSortMenu();

$output.='</div>';
```

//--- show Other

$output.= '<div class="tab-page" id="tabOther">

        <h2 class="tab">' . $_lang['DM_other'] . '</h2>

        <script type="text/javascript">tpResources.addTabPage(

document.getElementById("tabOther"));</script>

            ';

$output.= showOther();

$output.= showAdjustDates();

$output.= showAdjustAuthors();

$output.='</div></div></div>';

$output.= showInteraction($showTree);

//-- send output

$output.='</body></html>';

return $output;

d) Code Implementing the QuickEdit Module (it renders QuickEdit links in the
frontend)
// Set configuration variables if not already set

if(!isset($mod_path)) { $mod_path = 'assets/modules/quick_edit'; }

if(!isset($show_manager_link)) { $show_manager_link = 1; }

if(!isset($show_help_link)) { $show_help_link = 1; }

```
if(!isset($editable)) { $editable =

'pagetitle,longtitle,description,content,alias,introtext,menutitle,published,hidemenu,men

uindex,searchable,cacheable,template'; }


$basePath = $modx->config['base_path'];


// If we cant't find the module files...

if(!file_exists($basePath.$mod_path)) {


 // Log an error

 $error_message = '<strong>QuickEdit module not found!</strong></p><p>Edit the

QuickEdit module, click the Configuration tab and change the Module Path to point to

the module.</p>';

 $modx->Event->alert($error_message);

 $modx->logEvent(0, 3, $error_message, 'QuickEditor');


} else {


$GLOBALS['qe_editable'] = $editable;

$GLOBALS['quick_edit_path'] = $mod_path;

include($basePath.$mod_path.'/editor.class.inc.php');


 $qe = new QuickEditor;

 $html = '';
```

```php
$doc_id = 0;

$var_id = 0;

$mod_id = 0;

$save = 0;

$ajax = 0;

$apply = 0;


if(isset($_REQUEST['doc'])) $doc_id = $_REQUEST['doc'];

if(isset($_REQUEST['var'])) $var_id = $_REQUEST['var'];

if(isset($_REQUEST['id'])) $mod_id = $_REQUEST['id'];

if(isset($_REQUEST['save'])) $save = $_REQUEST['save'];

if(isset($_REQUEST['ajax'])) $ajax = $_REQUEST['ajax'];


if($doc_id && $var_id && $save && $ajax) {

 $qe->save($doc_id, $var_id);

} elseif($doc_id && $var_id && $save) {

$qe->save($doc_id, $var_id);

 $qe->renderSaveAndCloseHTML();

} elseif($doc_id && $var_id) {

$qe->renderEditorHTML($doc_id, $var_id, $mod_id);

} else {

include($basePath.$mod_path.'/documentation.php');
```