Addis Ababa University

School of Graduate Studies

School of Information Science

INVESTIGATING DATA MANAGEMENT PRACTICE IN HIGHER EDUCATION INSTITUTION: THE CASE OF MADDA WALABU UNIVERSITY

BY

TEFERA SIME LEMA

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN INFORMATION SCIENCE

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(Approval Sheet)

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Name and signature of Members of the Examining Board

Name	**Title**	**Signature**	**Date**
Ato Getachew Jemaneh	Advisor		
Tibebe Beshah (PhD)	Examiner		
Wondwossen Mulugeta (PhD)	Examiner		

DECLARATION

This thesis is my original work and has not been submitted in a partial requirements for a degree in any university. Additionally, all the references used in this thesis have been fully acknowledged.

TEFERA SIME LEMA

JUNE, 2017

This thesis has been submitted for examination with my approval as university advisor.

Ato Getachew Jemaneh

Advisor

DEDICATION

This thesis is dedicated to my loving families, my wife Asnaku Ketema, my cousin Guchi Tamiru and all my friends. Thank you all for your reliable support in every way I needed.

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Abstract

Currently Information and Communication Technology (ICT) altered our daily life in many aspects. Consequently, data management in higher education institution is increasingly gaining importance in both academic and administrative environment. So that, this study was examined the roles of data management in higher education institution and identifying types of data currently needed to manage in higher education institutions.

Activities regarding organizational data management, especially in higher education institutions is increasing in superabundance. Academic staffs and university administrators struggle to keep up data secure throughout their institution. Therefore, improving institutional data management culture of higher education is increasingly gaining importance in all sectors, such as: in libraries, registrar and curriculum, in researcher center, in human resource department, in managerial department, teaching and learning departments were a growing body of data committed to this study area.

This case study was engaged a quantitative and qualitative study method. The evidence was gained through structured questionnaires, which contains three sections (see in Appendix A). Initially, the questionnaires were distributed to 112 participants, but since the entire participants approximately 90% were returned. The best way to manage data in Madda Walabu University, enhanced to explore how institutional data management is implementing, investigating roles and responsibilities that evaluate outcomes of activities taken in the application of structural data management and finally in chapter four analyses were presented

The study also determined views and requirements of stakeholders involved in the establishment of institutional data management based on evidence that identified and discussed by different variables. Therefore, this study enhanced to improving approachable objectives such as: participants need on development of IT strategic plan and infrastructure regarding institutional data management and identified relationship between institutional data management and individual awareness, responsible stakeholders and roles, current data management issues of the organization, future improvements and resolutions.

List of Abbreviations and Acronyms

CDs,	Compact Disk
CIO	Chief Information Officer
CRM	Customer Relationship Management
DAMA	Data Management Association
DaMSSI	Data Management Skills Support Initiative
DM	Data Management
DMPs	Data Management Plans
DMP	Data Management practice
DVDs	Digital versatile Disk
EDMP	Effective Data Management plan
EMIS	Education Management Information Systems
FTP	File Transfer Protocol
HEI	Higher Education Institution
HR	Human Resource
IBM	International Business Monetary
ICT	Information and Communication Technology
JISC	Joint Information Systems Committee
KDD	Knowledge Discovery in Database
MRD	Managing Research Data
OCLC	Online Computer Library Center
SMT	Senior Management Team
SPSS	Statistical Package for Social Science

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CHAPTER ONE

1. Introduction

Under this section described background information, statement of the problem, research questions, research objectives, scope of the study, limitation of the study, and significance of the study.

1.1. Background

Study on data management in higher education institution is becoming a significant field. Currently, Information and Communication Technology (ICT) altered our daily life in many aspects. Therefore, ICT can influence and change the disseminations of data, information, knowledge and resources around the globe. Accordingly, data management is a concept in which an organization functionally and widely gather, organize, manage, manipulate, record, maintain, preserve, analyze and share its data in terms of resources, documents and human skills. The current advancement of information technology and the way we access and share data have changed. So many organizations have different kinds of data management outlines.

Institutions of higher education are operating in increasingly complex and competitive environment [10]. Therefore, they are under increasing pressure need to respond to national and global economic, political and social change, such as: the growing needs in proportion of students in certain disciplines.

Based on body of information technology effectiveness and practice surrounding data management issue is known as differently (i.e. information management, enterprise information management) and others defined in different concept. There are also some authors stress theoretically useful distinction between data (the representative and elementary components of information) and information which is (data that is understood, processed and put to purpose). And attempts carry hierarchy further by researcher, (Ackoff‘s), noted as Knowledge and Wisdom, have been powerful in management theory [7]. However, working on knowledge management is not the focus of most information technology atmosphere and in this research.

Commonly, the researcher approach in this study has been to believe the fluid relationship between the raw data and processed data (information), primarily engaging a data-oriented language. While

still being aware on information needs of higher education institutions and reason why information technology leaders are called chief information officers (CIO). As the guiding concept, the researcher used the term data management in higher education institution is defined as practices, policies and procedures by which higher education institutions effectively and efficiently collect, protect, secure, manage, maintain and use both digital and paper based information in order to meet academic and administrative needs of the institution.

In common sense, based on the literature reviews gaps were recognized, why this research required to study on data management practices of higher education institutions. Since, there is a research done in the developed countries on different companies especially, in Australia and United Kingdom, based on data management practice. But currently it is interesting to study in developing country, especially in Ethiopian higher education institutions, which need to have a strong data management culture. Because, institutions of higher education are working in an increasingly complex and competitive environment. Therefore, they produced increasingly huge amounts of data in daily activities. Hence, data is an encouraging asset for any organizations of the globe.

Therefore, using higher education institution as the focus of this study and narrowing down the focus to organizational data management practice, the study aim to investigate data management in higher education institution cultural perspective of Madda Walabu University. Objectives of this study were need to create an awareness or familiarity regarding institutional data management in this university especially, in main campus which is established in 2006(1999 E.c). In general, improving data management in this university plays significant role, which providing the ability to produce income, control costs and alleviate risks. Effectively, being able to share, store, protect and retrieve ever-increasing amount of data can bring the competitive advantages of the institution and need to grow in today's organizational environment.

Today majorities of higher education institutions in Ethiopia stress with data management. Because, the volume of data is increasing in each day at an alarming rate. So that, the study is vital to determine which data are relevant and essential for organizational perspective. Identification and classification of organizational attentive data should be performed by concerned level of team representatives from each line of higher education departments. Therefore, these team members should be committed to

have awareness and contribution in institutional relevant data management, processes and understand the requirements of their respective participation.

As the definition provided by Data Management Association (DAMA); data management is the development, execution and supervision of plans, policies, programs and practices which control, protect, deliver and enhance the value of data and information assets. Likewise, different researchers defined data management in different context, such as:-

The university and research sectors should have paid particular consideration regarding to data and data repositories [17]. Similarly, data management is the group of activities relating to the planning, development, implementation and administration of systems, for the acquisition, storage, security, retrieval, dissemination, archiving and disposal of data [1]. Therefore, such systems are commonly digital; but the term equally applies to paper-based systems, where the term records management is commonly used.

Data management in research sector encompasses all aspects of looking after, handling, organizing and enhancing research data [2]. Consequently, in well managing data enhance to scientific process, ensuring the highly data quality production and also increases the durability of data with opportunities to sharing and re-using. Institutional data management is the policies and practices by which higher education institution effectively collect, protect and use digital information assets to meet academic and business needs [3]. As a whole, data management is the development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets in nay organization [4].

In addition to the growing changes happening on data management environment of higher education institution, the role of data is enhance to addressing contemporary challenges often unnoticed. As information technologies continue to enter all surfaces of higher education, overabundance of useful data suggestions are generated. These data management can be utilized to inform institutions of higher education to adapt the better response to change that happening within and outside their environments.

1.2. Statement of the Problem

It is not recognized how and to what degree data management has been advanced in higher education institution effectiveness and challenges for strategic goals. However, the current competitive market between higher education institutions and the need for national and international competitiveness requests to improve data management habits of each individual and teams working together in order to achieve organizational goal and success.

Normally, the researcher motivation on studying institutional data management is nowadays; the effective development in information technology is enhance to improve data management in each organization. And it provides to dealing and controlling paper based data in order to easily search all the information and provide to minimizing cost and effort. So that, the main challenges that hinder overall educational goal attainment in higher education center is lack of proper data management in different departments. Hence, traditionally, data were present in hard copy format, so it is difficult to dealing accuracy and possible factors that hindering organizational success. Therefore, this involves most of the time customers have worried about the finding of data they need and always afraid on poor access to their own data and little ability to use it for their own purposes.

Therefore, there are challenges on getting information technology and data management in Ethiopian higher education working together. Information technology and data management often operating in separate domains, sometimes using the same words to express very diverse thoughts. So that, in order to improve institutional success information technology and data management activities should be work together.

According to Oracle, defined by oracle data sheet [20], higher education institutions face on critical data quality and duplicate management issues. Therefore, the problem is compounded as the volumes of data continually grow and the number of disparate systems where tracked and monitored increases. So the institutions need a way to maintain an accurate and single source of constituent data across systems and repositories.

Different researchers agreed universities around the world are undergoing an increasingly emphasis on needs of effective data management and stewardship underpin the changing research environment. So that, research becomes more dependent on data in digital format [5].Though, data is valuable from

the moment of creation, not to mention expensive to collect, so there is no point in duplicating its collection. And it should be unique, represent a snapshot in time and space, so that, it is impossible to replicate. However, there is the increasing pressure to ensure that data should not go to waste and universities should develop infrastructure that need to care for this invaluable resources.

Likewise, data has been always a significant asset for institutions and has been used to inform their day-to-day operational decisions, as well as longer-term business and enhance the strategic decisions [6]. However, the data revolution, or 'big data' is commonly referred to us the massive increases in the amount of data exists and ability to perform increasingly sophisticated analytics using this data. Therefore, data has being considered an economic and policy asset for decision-making and enhance to anticipate it will be crucial in all policy-making to the future.

The reason why institutions might invest in data management is to keep data secure, get more value out of it and deliver new services or to make IT systems more integrated and efficient [7]. However, unfortunately, in many of the organizations there are some major data management problems and misunderstood about data they have in their institution [18]. Therefore, these problems may occurred by a combination of duplicated data with inconsistent occurrences and caused by lack of a cohesive, enterprise-wide data definition regime.
Institutions differ widely in their capacity to use data owing to their culture, available personnel and financial resources. However, there are factors that can be used to assess any institution's capacity to fully engage in using data [21]. Consequently, the resource-poor institutions have begun to deal using data at one extreme, while institutions with sufficient resources to gather, use and employ data at another extreme. Therefore, regardless of institutional circumstances there are a range of barriers and challenges likely to exist that can explain the inconsistency of effective use of data.

Effectively managing the institutional data is no mean feat, rather dozens of factors come into play, from the choice of reporting tools to makeup of the institution's strategic plan [22]. Therefore, with all those moving parts enhance to mastering regarding institutional data management can be desirable. So that, unfortunately even if an institution accepts data management is a people problem, often the assumption is a problem specific to information technology people. Though, lack of communities understanding and trust on data management is a functional side that can kill any reporting mission and no matter how perfectly it's executed on the IT side. The only way to ensure that functional staffs

should understand and trust on data they are seeing from the technical staffs is need to get both sides talking, early on the process. Hence, functional and technical communicates will be easier to build up transparent on institutional wide data management processes and it is necessary to improve competitive advantages between higher education institutions.

As the advancement on information technology changes rapidly, often we embrace and understand new technology is already evolving or obsolete. Therefore, this creates challenges concerning records management, archives and information technology, which enhancing to address ongoing issues, such as: what constitutes an electronic record, how long it needs to be kept and how it can be preserved or accessed to the future [23].

The ability to access, analyze and manage vast volumes of data rapidly evolving, that information architecture has long been a goal at many higher education institutions [24]. Though, big data based architecture enables the inclusion of a greater variety of data sources, so many different types of data can be difficult to analyze. A digital revolution associated with developments in new technologies, such as universal computing devices, flexible class room design and massive open online courses is radically reshaping the mode and accessibility of learning and teaching. Therefore, in spite of the growing changes happening in environment of higher education, the roles of data for addressing the contemporary challenges is often overlooked [10]. So that, as learning technologies continue to enter all facets of higher education, overabundance of useful data traces are generated. These data can be utilized to inform institutions of higher education to adapt better response to changes happening within and outside their environments. As indicated by IBM, 80% of organizational data generated are unstructured and come in a variety of formats such as text, video, audio, diagrams, images and combinations of any two or more formats.

Likewise, institutional data management challenges can be understood through reflection of three broad domains of data impact [34]: such as (a) the difficulties in higher education institutions that face on attempting to retrieve, manipulate and analyze aggregate data for metrics and planning; (b) the enormous body of content, primarily unstructured data. Therefore, unstructured data refers free format information outside the contents restrictive modeled field of data. So, technologies to compile, manipulate, and analyze unstructured data is considerably less mature than what is available for structured data; and (c) the last domain that represents a data challenge for college and universities

is research data which exists in massive quantities. So in digital world data is highly portable, sharable and searchable; qualities that some believe are leading us into an open access environment.
Normally, when data is no properly managed, it is difficult to the researcher, who want to do research based on data and it makes confusion for the decision makers or mangers that want to managing and controlling the organizational data handling habits.

1.3. Research Questions

In order to achieve the above mentioned objectives, some basic questions are raised as follow:

- What are the benefits of data management in Madda Walabu University?
- What are the communities' awareness's towards data management?
- What kinds of data is required to managing in higher education institution?
- Who are beneficiaries from developing proper data management practice in this university?
- Who is responsible for managing the data? & who have the responsibility regarding data management plan is carried out?
- What factors affect in developing data management culture in this university?

1.4. Objectives of the Study

The general and specific objectives of the research are described as follow.

1.4.1. General Objective

The general objective of this research is to investigate data management habits of higher education institution: The Case of Madda Walabu University.

1.4.2. Specific Objectives

While conducting the study, the researcher believes the study have the following specific objectives:-

- To identify data management practices of Madda Walabu University
- To identify kinds of data need to be manage
- To identify relationship between individual awareness and data management
- To identify types of storage device participants used for data handling purpose
- To investigate the individual awareness towards data management
- To report the finding results
- To draw recommendations for future practice

1.5. Scope of the Study

This study was focused in higher education institution data management practice at Madda Walabu University. More specifically, this investigation was included the main campus stakeholders, namely: academic, library, secretarial, research office, IT services providers and other concerned stakeholders. Because, data management in higher education institution is not administrated by single controlled terminology and well-established or complete agendas and standards. However, it needs to the clear consideration for the strategic and regulatory issues that are likely to be concern in information technology leaders and other communities in any private or governmental organization. In general, the scope of this research implications are concentrated on data management in higher education institution, which spread in only Madda Walabu University, located in Bale Zone. This university is found 430 km away from the capital city of Ethiopia and study focused only in main branch, which is located in Bale Robe City.

1.6. Limitation of the Study

Resources and time were the main constraints of this research. There were also additional limitations related the choice of research methods and data collection techniques employed. Certainly, the study would have gained complete understanding if both quantitative and qualitative methods had been employed fully parallel. But the researcher used the qualitative method as the supplementary component for the quantitative procedures. Furthermore, data sources covering observation from a range of different department's data handling habit that support services in main campus. Also in Ethiopia there is no previous study on this topic, so this is another limitation of the study that limited the study literature only outside to the country.

The final remark regarding the researcher was involved in a small scale study on institutional data management carried out in main campus of Madda Walabu University. Therefore, some observation and questionnaires were excluded in branch colleges, due to the fact that, this branch colleges are far away from the main campus, consequently it is difficult to include all branches within this limited time and resource.

1.7. Significance of the Study

In addition to being an academic exercise to fulfill the obligation of (master program of science in Information Science). This research is supposed to produce results that can indicated the purpose of improving data management culture within the higher education institution. Therefore, this research is significant for the preserving or managing all primary, secondary and tertiary materials. Such as: research data, library resources and students' academic record, that should be stored in institutional repository and archive for the long term storage. As a whole, this investigation provide to the purposes of validating institutional data, furthering knowledge preservation and access.

Likewise, this study is compulsory to all higher education institutions for adapting data management in modern ways, (i.e. electronic record management) or more accessible format over time. Therefore, considerable body and organizational administrators should be ensure that data is appropriately stored to the future. Accordingly, this research is being range to all employees and other communities of the university. Such communities are: recorders, managers, librarians, department heads, college managers or directorates, university administrators, human resource managers, facility managers and policy makers, these providing to develop the culture of data management, in order to reduced time, cost and effort appropriately. The research also opens up new research areas, which can be explored and enrich understanding of institutional data management in higher education institutions and other organizations.

Indirectly, this enquiry is significant to the total stakeholders and communities of Ethiopia, especially, personnel such as: recorders, managers and administrators, ministry of education and all societies that living with different companies. In general, developing effective data management is interesting to all organizations which supported to the accessibility, reliability, consistency and relevance for the strategic decision making of their administrators.

CHAPTER TWO

2. Review of Related Literature

This chapter offers a review of literature on the key themes of data management a crosses various disciplinary fields. In general, the literature review supports three main purpose: First, it enhance to satisfy the readers in which it displays whether the researcher is familiar to the literature and capable to conducting investigations. Second, this provides to the researcher to identifying statements of the problem. Thirdly, it satisfies the reader about the proposed study fits into existing body of knowledge and explains how the proposed study is needed to fill a gap in the literature.

Normally, the functional necessity of literature review is providing to the description of data and contextual information that future researchers need to understand and use the data. So that, during this study researcher referred particular materials; such as: books, journal articles, thesis, conference proceedings and internet resources were reviewed in detail, in order to get better understanding about the technical domain and have detail knowledge on various techniques of data management in any organization. In addition, the literature review provide to the descriptions of detail research problem correctly and also enhanced to review other related literatures to have a deep knowledge on domain area and problem solving procedures.

Commonly, under this chapter, the researcher tried to reviews related literature and instructions from different materials, such as: thesis, journal articles, books and book sections, which talks about related to data management in higher education and other organizations. In order to more specific this study is focused on data management framework, definitions, responsible bodies of data management in higher education institution, processes, purpose, principles and best practice of data management and researchers perspective were described. Such as, data management in business, in higher education institution, in government, in research and others perception have been described by different authors as briefly.

2.1. Definition of Institutional Data Management

2.1.1. What is Data?

To understand the phrase data management, one must first understand the word data. On the simplest level data in higher education institution is the organizational area that collects, generates, uses and reports an enormous range of resources in each year and a big data world, in which it is increasingly

doing so in larger volumes and with higher velocity [6]. Therefore, there are two types of data, such as, static and fluid data. The concept of static data is the information which segments has been collecting since its beginning and comprises basic student records (names, addresses and grades), staff details, course information and financial records. On other hand fluid data is what is now being generated by the increasingly digital nature of the university in day to day activities.

2.1.1.1. Static Data

As Lord Norton and Sarah Porter described [6], the first types of data is called static data. Which suggested as the higher education institutions have always worked in an information rich landscape, generating and collecting huge amounts of data in each daily activities. Therefore, such types of data are listed below which is generated each day in higher education institutions such as:-

Student record data→ this is the representatives of students record may include the details of the students name, age, address, ethnicity, socioeconomic status, school, course undertaken, and modules studied, examination outcomes, degree awarded and degree classification.

Staff data → Organizations hold data on their staff, containing the number of people employed full-time and part-time, the number at each level and within each faculty, and staff equal opportunity data.

Admissions and applications data→ these records contain details of the number of students who applied to the institution, the acceptance rate and any broadening participation data such as: ethnicity and socioeconomic status.

Financial data→ Universities hold data on their finances, including income streams, spending and predicted profits and losses, held at all levels such as an institutional level and by college and school.

Alumni data→ The University is also hold data on its alumni which containing graduate destinations (i.e. employment or further study), current address and contact details and details of any previous contributions made to the institution. Which is increasingly important as institutions look to diversify their income streams.

Course data→ which is including data on students enrolled in each course and per module in each semester.

Facilities data → Includes data on the number and type of rooms across the campus (lecture halls, classrooms, computer labs, science laboratories), room capacity, equipment, housing, facilities and retail.

In summary, in this modern era, regularly called the information technology age. Which is attractive, computing and storage device were highly available. Though, higher education institutions need to play the big role on making this big data explosion and daily generate of students' academic records. The purpose of this study is to examine its effects in higher education institution, and the ways of their information technology with organizational transaction. Since, higher education institutions consumes and generate a huge amount of operational data or information. Particularly, when we compared with the digital use of this kind of information or data goes back to the days when the punched card symbolized as "data processing," many of that era's typical problems remain with us today in some organization.

Therefore, making sure data is accurately recorded, managed, kept up to date and available for use elsewhere is effective. Although, in the modern age relational databases and institutional applications need operational use of organization data quickly and more flexible. So that, currently the relational database is enhance to place the right student in the right course to the right institutions and used to aggregate information about students and courses to do enrollment and curriculum planning.

2.1.1.2. Fluid Data

In addition to static data, the second types of data which is found in higher education institution is called fluid data [6]. Consequently, it is the novel kind of data generated by a student as the way they interact with their university converts increasingly digital. This is what they call 'digital footprint', which is the data left behind as a student interaction with their university through online systems and on-campus technology.

Such kinds of data in university requires swipe card (which enhance to online) access to its buildings and have a data set on how often each student is visiting campus, and enhance to identifying which buildings they are most frequently visiting, and which days and times of day they are most often in campus. Therefore, it providing in each time students log into their institutions and they create a set of data including login times, page clicks, downloads, length of time visited and comments made. In addition video and audio lectures (if available) also generate data, such as: how long a student spends

listening/watching to a single file, how often they rewind/fast-forward, and any points at which they close the file and stop listening. Also it provides to check in library how many books each student is borrowing and libraries which deliver e-textbooks may also be able to collect data about how students are using these.

In addition these fluid and static data has always a significant asset for higher education institutions, and has been used to advise their day-to-day operational decisions as well as longer-term occupational and strategic decisions. Therefore, to take the common instance, creating the timetable for each semester requires drawing on a range of different types of data across the institution [6]. Though, to effort out how many lectures, tutorials and labs to schedule per module the timetable need to bring together information about student enrolments in the module, staff numbers in each faculty (including staff with the relevant capability/qualifications to lecture or lead labs) and decide data on rooms available with the necessary capacity and any materials required.

2.2. Concepts and Definitions of Data Management Practice

The term data management has much wider concepts having more to do with an institutional culture and defined as differently. So that, good data management is all about making sure people understand the data trust, the accuracy and use it in their decision-making environment appropriately.

In order to effectively manage data holding and fully realize their potential an organization should be first aware of the location, condition and value of its assets [8]. So that, conducting a review regarding institutional data management provide information about; raising awareness of collection strengths and issues to improve overall strategy. Therefore, an audit in any organization is highlight duplication of effort on areas that require additional investment and allowing an organization to put its resources to the best use. It also highlight inadequacies in data creation and sharing practices, suggesting policy change to reduce the risks faced in any organizations. An organization, which is well-informed about its data should be puts itself in a position to maximize the value of its collections through continued use and management.

Institutional data management means the policies and practices by which higher education institutions effectively collect, protect and use digital information assets to meet academic and business needs [3],[9]. Therefore, data management topics are examined about size and scale of institutional data

environment, data integrity, data quality, data analysis and decision support, stewardship and security polices, content and record management and the management of institutional research data in all staffs.

Though, a successful data quality management program has both proactive and reactive components [27]. Therefore, proactive component consists of establishing the overall governance, defining the roles and responsibilities, establishing the quality expectations with supporting business practices and deploying technical environment which supporting business performs. While, the reactive component consists of dealing with problems that are inherent in the data in the existing databases. So that, in any institution there is a need to improve data quality management. Because, quality of data in legacy systems were developed without data quality management program in place, as shown by the different representations of the same data may be inadequate for meeting new business needs.

2.2.1. Concepts and Definition from Research Data Management Perspectives

Rather research data are valuable products of the scientific creativity, which conventionally have not been well preserved or archived. Though, currently most scientific journals should be encouraging and requiring to complete the improvement of data management and data sharing habits. Therefore, effective data management are critical to the scientific process in higher education institutions.

In addition, concepts of data management from research data management perspective is defined in different researchers such as: "Big Data is a knowledge system that is already changing the objects of knowledge and social theory in a numerous fields, while also having the potential to transform management decision-making theory Boyd & Crawford 2012. Likewise, big data incorporates the emergent research field of learning analytics Long & Siemen, 2011, which is already a growing area in education"[10].

The research data management (RDM) has emerged as an area of keen interest in higher education institution, which leading the considerable investment in services, resources and infrastructure to support researchers' data management needs [41]. Therefore, this is the first in a series of reports by Online Computer Library Center (OCLC), which examines context, influences and choices higher education institutions should face in building or acquiring research data management capacity. In other words the infrastructure, services and resources needed to support emerging data management practices in higher education institution is vital to institutional competitiveness.

In other impression, data management plan is a formal document that outlines what you will do with your data during and after completing your research work [14]. Though, a data management plan is described us data will be created and used to describe the standards of metadata, who owns the data, who can access the data, how long data will be preserved and what facilities and equipment necessary to disseminate, share, and/or preserve. Therefore, several funding agencies and institutions should be encourage the development of data management plan in research atmosphere.

As suggested by Borgman, 2012, unique challenge in managing research data is the complexity and diverse nature of data that coupled with diverse data management practices across disciplines [15]. Therefore, the types of data produced within disciplinary communities can vary greatly, from static numeric and text based data to dynamic multimedia data. Consequently, even the concept of data is difficult to define in any organization.

Though, the term data are primarily determined by the communities' interest and may include, but are not limited to, datasets, publications, samples, physical collections, software, and models [15]. It is also recommended that data management plans (DMPs), include a description of data types and how data will be created or captured. Therefore, data management plans should specify any data standards that need to be applied for formats, categories and metadata. In addition, metadata should be identify the file formats used for the data in question and describe any contextual details dictating metadata to be associated with that data. The ultimate goal of data formats is to be interoperable and mobile across systems (i.e., between institutional and domain repositories) to optimize discoverability and accessibility.

Likewise, the term data cu ration (sharing) and data management services is defined as any facilities related to organization, management and long term preservation of data developed through scholarly research [16]. Therefore, these services encompass a range of activities, including consultations on creating the data management plans and strategies, physical/electronic archiving of datasets and workshops.

Managing Research Data (MRD), defined by the program of Joint Information Systems Committee (JISC), which considered as a priority to support researchers in responding to the requirements and to promote good data management and sharing for the benefits of higher education institution and research [31]. Therefore, designated funds on digital updating Centre, which provides internationally

recognized expertise in this area, as well as support and guidance for UK higher education institutions. Which facilitated to the higher education institutions, plan their data management habits, test the improvements of the essential data management infrastructure, improve methods for citing data and linking to publications and funded plans which are developing training materials in research data management for postgraduate students.

In general, the above Joint Information Systems Committee (JISC), explained good data management is a fundamental component for high quality research data and exploration of excellence is crucial for facilitating data sharing and ensuring the sustainability and accessibility of data in long-term and re-using to the future science. Therefore, according to their impression research data are well organized, documented, preserved and accessible with correctness and validity is controlled at all times, the result is high quality data, efficient research with saving time and resources in any organization.

2.2.2. Concepts and Definitions from Higher Education Institution Data Management Perspectives

On the other hand, the concept of data management in higher education institution perspective, which described by different researchers such as: In the context of higher education, "big data" means the interpretation of a wide range of administrative and operational data gathered through the processes, aimed to assessing institutional performance and progress in order to predict future performance and identify potential issues related to academic program, research, teaching and learning [10]. Therefore, as data becoming an emerging field within higher education institution, a number of scholars have been contended big data framework is well positioned to address some of the key challenges currently facing in higher education, by Siemens, in 2011.

So in order to understand data management, one must first understand data. As defined above, on the simplest level, data can be defined as "facts and figures collected together for reference and analysis" [11]. However, from an information science perspective, data can be defined more contextually in scope of research to mean; it is collected, observed, created for the purposes of analysis to produce original research results. Therefore, it is important to recognize that data goes beyond spreadsheets of numbers and it can be many formats: bio specimens, video recordings, images, software programs, algorithms, paper lab notebooks. Also most useful to think of data as everything that would be needed to reproduce a given scientific output of higher education institutions.

In order to address the high-level benefits of accepting a university-wide policy regarding research data management, identifying various university stakeholders' awareness and suggesting the library initiatives [13]. There are actions need to enhance the development of a conversation among them in order to get buy-in for a proactive, rather than reactive, high-level policy for responsible data planning and management is supported and sustainable. In general, the word data is defined here to mean units of information observed, collected, or created during the course of research. This is not limited to scientific data; it also includes social science, statistical and ethnographic data, humanities texts, or any other data used or produced in the course of academic research, whether it takes the form of text, numbers, image, audio, video, models, analytic code or some yet-to-be-identified data type. However, responsible data policy and planning doesn't just mean managing data while the research project is active and storing the data afterwards; it's about the institutional rationale for managing research data and the ensuing implications for the university.

In other information technology department's definition, higher education institutions are strongly aware of their role in strengthening campus services, adequately support the various stages of research activities and particularly, how resulting research data is managed throughout its life [15]. Therefore, successfully addressing these evolving needs, a formal research DMP service can be part of a larger data-lifecycle management process. Data management is much broader, having more to do with an institution's culture than its systems.

Though, a good data management is all about making sure people understand the data, trust that it's accurate, and use it in their decision-making [22]. Therefore, the bigger problems with how people manage data are people problems, not technology problems.

On the other hand data and information management are becoming the cornerstone to all operations of the organization by providing quality and timely data to the decision support [25]. Therefore, information technology have progressed to cover the wide varieties of asset management. Which including all of the actions such as: asset registration, financial management, process scheduling and controlling, materials management, maintenance management, condition monitoring, risk management, reliability management, and safety management.

As a whole, data can play a major part in how we understand, often challenged nature of higher education governance and ensure that institutions are not only able to respond effectively to changes happening within and outside them[10]. But they also remain relevant to their purpose in the societies that they serve. Therefore, the first global trend that affecting institutions of higher education is explores the potential of big data and analytics in addressing these changing trends. Secondly, outlines the opportunities and challenges associated with the implementation and governance of big data in higher education institutions.

2.2.3. Concepts and Definition of Data Management from Business Perspectives

There is also concepts of data management in business perspective, which described by different investigators such as:

The strategic data management is the set of frameworks that enable an organization to proactively manage its data asset, help to deliver its business objectives and the key for the ability to measure the impact of data initiatives based on both activity and value [12].

The ability to handle huge amounts of data has long been a core capability for financial institutions. In addition to that, the outside pressure to improve data management is probably nowhere bigger than in the financial services industry [29]. Therefore, financial authorities should be examine every bit of data stress test and asset quality reviews that impose new regulations with far-reaching consequences of data management. Subsequently, in-house asset managers and the speakers deal with the ever increasing requirements on data management in a daily basis of any company.

The “data-oriented culture”: is a pattern of behaviors and practices by which a group of people who share a belief that having, understanding and using certain kinds of data and information that plays a critical role in the success of their organization [19]. Therefore, in a data-oriented culture, behaviors, practices and beliefs are consistent with the principles of business decisions at every level are based on analysis of data. Though, leaders within the organizations should have mastered this competency set an expectation, decisions must be arrived at analytically and explain how analytics is needed to achieve their long-term vision.

Though, data management can be seen as a routine and best left to people with no imagination and it can be a matter of life and death. Consequently, failures in data management can lead to economic failure [30]. Therefore, the big issue here is, how to ensure the record or data in any organization

depends remain valid and useful beyond the life of individual systems and facilities. This requires good design resting on sound principles that validated through extensive practical experience on institutional data management.

The term data management is used to describe vary widely across the various investments evaluated. The emphasis on a program of data management center upon and data sharing is a practices which applied by individual researchers [2]. Therefore, each type of investment that should be evaluated in institutional data management are organized by the relevant and up-to-date components. Such components included: data management and data planning, ethics, agreement and confidentiality, managing or sharing the research data, consideration about data copyright and rights management , contextualizing, describing and documenting data property, identifying data formats and software up-dating, data storage, back-up and security and finally roles and responsibilities of data management.

2.3. Strategic Plan and Principles of Data Management

The strategic plan in higher education institution data management, require exclusive links with changing views of ICT and users requirements. Therefore, strategic plan should be kept in mind that providing to make the necessary change, when in any system needs to adapt new technologies. Hence, strategies should be appropriate to reach pre-defined goals and objectives of the institution. Though, the data quality management in higher education institutions are largely dependent on two strategic elements.

The first element is study of users' requirements which including their roles and the second element is the adaption of new technologies that enhance to easily process the data management, in order to achieve institutional data quality management and easily access the customer data from the source. Accordingly, in any organization, the current institutional information communication technology development must be reviewed and their suitability should achieve objectives and strategic plans of the institution. On the other hand data management principles are the role and regulations which provide to the institution have strong data management plan in place, with the improvement regarding to the good data management practice.

The principles of data management outlines, the best practices at a high level within the university and ensure contributions to data quality at all levels. Therefore, these principles must guide all data management procedures [32]:-

- ☞ Every data source must have a defined custodian in a business leadership role, who has overall responsibility for the accuracy, integrity and security of those data.
- ☞ Wherever possible, data should be simple to enter, be clearly defined and accurately document their subject. They must also be in a useful, usable form for both input and output.
- ☞ Data should be only collected for a specific and documented purpose.
- ☞ Data must be readily available to those with the appropriate business need.
- ☞ Data capture, validation and processing should be automated wherever possible.
- ☞ Processes on update a given data element must be standard across the information system.
- ☞ Data must be recorded as accurately and completely as possible, by the most informed source, as close as possible to their point of creation and in an electronic format at earliest opportunity.
- ☞ Data should be recorded and managed over time in an auditable and traceable manner.
- ☞ Data must be protected from unauthorized access and modification.
- ☞ Data must not be duplicated unless duplication is absolutely essential and has the approval of the relevant data steward.
- ☞ Data structures must be under strict change control, so that the various business and system implications of any change can be properly managed.
- ☞ Data should be defined consistently across the university.
- ☞ Users must accurately present the data in any use that is made of them.

2.4. Data Quality Management Vs Information Technology

The concept of data quality management in this study described as the state of completeness, validity, consistency, timeliness and accuracy which enhance to make data appropriately access for a specific use in to higher education institutions.

However, according to Jonathan G. Geiger**,** slide, the definition of data quality management involves the formation and placement of roles, responsibilities, policies and procedures, that concerning on the acquisition, maintenance, dissemination and disposition of data. Therefore, it's a vital for partnership between both the organizational profit and technology groups of data quality management effort to succeed. Though, the business areas are responsible for establishing the business rules that govern the data and are ultimately responsible for verifying the data quality.

While in the context of information technology (IT) groups, it is responsible for establishing and managing overall environment of data management, such as architecture, technical facilities, systems, and databases that enhance to acquire, maintain, disseminate and dispose of the electronic data assets of the organization. Therefore, organizations in all kind make decisions and service customers based data they have at their institution. In addition, data warehouse is often used to examine business trends and establish strategy regarding the future scope of customer relationship management (CRM) program. So that, data about the customer is used to make appropriate decisions concerning the customer interest and data in the financial systems is also used to understand the profitability of past actions.

Though, the feasibility of business decisions is dependent on good data and good data is dependent on effective data quality management. Again, Jonathan G. Geiger view an initial emphasis on new data quality management initiatives launched in recent years has been depend on customer data and technology has walked up to the challenge by automating solutions to many of data quality problems associated with customer data in any institutions.

Normally, nowadays technology outspreads the reach of data in higher education institution, with the corresponding increase in impact of university service and data management, which centered on technology or cyber infrastructure. Though, currently cyber infrastructure provide to the progressive data acquisition, storage, management, security, governance, integration, mining, and visualization, as well as other information processing services.

However, many universities' in Ethiopia, information technology infrastructure is decentralized to data components, departments and individual workshops, students laboratory with varying degrees of coordination by the central information technology department. But large-scale data storage and data preservation represent most parts of the technological infrastructure. So that, duplicating these function in multiple locations needs to be careful consideration. While some workplaces may have no reasonably and reliable systems that keep unique data on personal storage devices or they are keeping data without documentation and backup and with redundancy. All infrastructure must now include systems for documenting, depositing, managing, archiving and preserving data, in order to facilitate the well-organized search, retrieval and providing access to proper users with the right time.

Though, a coordinated information technology departments are increasingly aware of their role in strengthening university services in order to adequately support the various stages of data activity and particularly, how the resulting data and datasets are to be managed throughout their existence.

As high-performance computing technology become more reasonable; preparing training about data management of each stakeholder will be needed. In order to place data management in larger research and information environment, technology leaders (chief Information Officer) and other integrated administrators of the organization need to integrate data management system with related systems.

In summary, data quality management in this research context includes the management of accuracy, internal validity, external validity, timeliness, interpretability and improve the value of data in every organization. Each data quality management towards higher education institution aims to evaluate usability of the data and it is also measured by different activities. Data quality management provides to the utilization by internal data management staff, as part of the quality assurance process and the administrator of the team as responsibility mechanism.

2.4.1. Reactive and Proactive Components of Data Quality Management

A successful data quality management plan in higher education institution should have both proactive and reactive mechanisms. The proactive component consists of establishing overall governance of data, establishing strategic plan, defining roles and responsibilities of data managements, establishing the data quality expectations, preparing documented policy about data management and supporting institutional practices. That enhance to organizing a technical environment which supports these data management activities. Specialized technological tools are often needed in this technical situation. Rather the reactive component dealing about the problems that are inherent the data in the existing databases. Because, most of time the quality of data in legacy systems were developed without a data quality management program in place may be inadequate for meeting new institutional goals.

Typically, from this research the researcher want to create awareness' on data quality management framework within Ethiopia higher education institution. Which will be expected to the service and information technology intended to support the specified data quality procedures and processes. Therefore, this research supports the level of data quality services (i.e. validation, description and standardization) by reference data sets and validate the data values and records to explicitly defined

data quality prospects. The research will incorporate facility components and strategic direction that can enhance to improve the data quality management with enhanced by technology and rule based institutional validation, Verification of data accuracy, Searching and indexing the library resources, data quality issues, data quality performance management, record management and record splitting and merging when necessary to the institutions data storage and location.

2.5. Strategic Benefits of IT in Higher Education Institution Data Management

The strategic benefits of information technology in higher education institution and in business organization is various. In general, it enhance to improving strategic data management exercise and providing to recover institutional goals of competitive advantage with the strategic alignment , better customer relationships, and strategic decision making achieved through: innovation, renewed facility, increased quality data management and better technological improvement. Therefore, benefits can be attained through the following components, which enable to control information follow, better integration, upgraded quality of data and support for better decision making [39], and it has different profits such as:-

Informational Benefits→ As different scholars defined, benefits of information in higher education institution with regards to IT that leads to better accessibility, quality and flexibility of data to support the management control, decision making, planning, and the stakeholder's communication.

Transactional Benefits→ The transactional benefits of information technology in higher education institution data management, focused on that brings through automation of operational transaction or repetitive activities. The objective is to cut costs by substituting human labor with technology, to increase the volumes and speed of transaction processing and ultimately reduce the unit costs of information follow.

Transformational Benefits→ Transformational benefits refer to the benefits that should be derived from organizational building and the changes as a results of information technology share. The changes can enable the development and improvement of resources for future benefits and can be derived from improved institutional processes, new skills and new organizational structures.

Benefit dimension	Benefits of IT in Higher Education Institution
Strategic Benefits	✶ Enhance to create competitive advantage through: ✓ Right decision at the right time to the right data ✓ Increase in competitiveness on data management practice ✓ Encouragement on innovation of new technology
Information Benefits	✶ Improved data management practices that enable: ✓ Better quality information and up-to-date information can spread to user ✓ More flexible reaction to new information needs ✓ Faster and more accurate reporting in appropriate destination ✓ Rich reporting capacity on time ✶ Improved decision support through: ✓ Increased efficiency and effectiveness of decisions ✓ Institutional wide data driven decision making capability ✓ Upgrade of faster decision making through IT
Transactional Benefits	✶ Cost savings through: ✓ The application of powerful IT that enables data management and visualization to reduce the cost of decision making ✓ Improved efficiency that leads to improved productivity ✓ Optimization of resource allocations
Transformational Benefits	✶ Consistency across institutional environment that promotes better and faster departmental collaboration ✶ Improved decision making processes through better collaboration of the staffs

Table 1. Summary about benefits of IT in context of higher education institution data management dimensions [39].

2.6. Data Management and It's Importance

Managing data in higher education institution have various significance. From these significance it enhance to the institution properly control and actively manage data assets. Likewise, it ensures that data is available for re-using for next generation research inputs. Because, these data will be re-used by other investigators that enhance to further study and provide policy-makers simplify the decision

in each sector and the general public. The data delivered by research agencies or extra communities in higher education institution, sometimes the basis for financial and policy makers or revolutionary research publications and can be particularly subject to study.

As described in chapter one by Data Management Association (DAMA): the phrase data management is the development, execution and supervision of plans, policies, programs and practices, which providing to control, protect, deliver and enhance value of data and information assets. From these association perspective data management plays a significant role in an organization's ability to generate revenues, control costs and mitigate risks. Therefore, data management in higher education institution provide to successfully able to share, store, protect and retrieve ever-increasing amount of data can be provide the competitive advantages needed to grow in today's organizations.

In addition, managing customer data results in improving customer relationships, which enhance to ultimately drive revenues. While expanding the data storage requirements have increased equipment investments and many also other hidden costs associated with data management. Some of these costs include human power consumption, cabling, backup management and data recovery. Therefore, within all of these costs there is need for more time and space leading to increases in payroll. Lastly, but just as important, data management plays a key role in helping an organization mitigate risks.

Although, management of data commonly focused on defining data element, how it is structured, stored and moved. But rather management of information is more concerned with the security, accuracy, completeness and timeliness of multiple pieces of data. These all are concerns about data recorders are trained to assess and help to manage an organizational facilities. Most organizations today are flooded with the volume of data is increasing at an alarming rate. Therefore, it is interesting to differentiate which data are most relevant and essential from an organization-wide perspective; identifications and classifications of higher education institution critical data should be performed by a team of senior-level representatives from each line of university or department stakeholders.

Therefore, these team members must have knowledge of relevant contribution on universities data management systems and processes, the requirements of their respective stakeholders, systems and processes. In general, most data management functions include:- data governance , data architecture management, data development, database operations management , data security management ,data

warehousing & institutional intelligence management , document & content management , meta data management and data quality management. So that, data recorders can play a key role in enabling the data governance and ensuring that the data should be aligned with an organization's overall corporate governance processes. The data governance principles should be included all of these actions: - data integrity, transparency, auditability, accountability, checks-and-balances, standardization and change management.

Normally, nowadays improving data management practice in higher education institutions is an important activity. Because of a huge data has come to be recognized by the number of fundamental characteristics. Among these key fundamental characteristics 6Vs, are listed as follow [10]:-

Volume → The excessive quantity of data often challenging to store, process, transfer, analyses and Present.

Velocity → Linking to the reaching rate that increasing at which data or information flows within an organization such as higher level manager to at department level.

Veracity → Denotes to the biases, noise and abnormality in data. It also looks at how data is being stored, and meaningfully mined to the problem being managed.

Variety → Mentioning to data in diverse format both structured and unstructured.

Verification → Refers to data verification and security.

Value → Most importantly, the data has been used to generate value of the insights, benefits and institutional processes within an organization.

2.7. Data Management Skills and Responsible Professionals

Data management roles and responsibilities are separated into three categories: these are, data users, data owners, and data custodians (upholders) [36]. Therefore, data user refers to the individuals/ divisions who improve to engage the institutional data, such as: students who access library journal archives and other materials. Data owner's referrers to responsible stakeholders that enhance to create the content and submit materials to institutional databases, such as: professors that post lecture notes online for students. While the other is data custodians, who can maintain data without owning the information, such as Oracle, who maintains entirely the banner product data, but does not own or use this information.

But in this research context the responsibilities of data management in higher education institutions, lie all of the communities that including data recorders, department teams, CIO (chief Information Officers), Senior IT executives, mid-level IT managers, researchers, team leaders, managers, librarian and including students. Because, all societies should be give care on data they produced and used in their institution. This data is an asset of higher education institution and organization that can promote the competitive advantages based on achieving the interests of its costumer. So that, establishing roles and responsibilities to all parties enhance to the successful data management and sharing in higher education institutions.

From Laura Molloy and Kellie Snow, in 2012, together mapping and synthesis work on Data Management Skills Support Initiative (DaMSSI), and enhance to support the production of different guidance on documents management and raise data management awareness inside and outside academic environment [26]. Therefore, these initiative suggested a series of career profile that help to illustrate facts about data management and essential component in clear and unclear ways in a wide range of professions. So, any community together with students in a wide range of disciplines need to acquire and improve their data management skills. And each job profile provides a description of the profession outline of key roles and responsibilities, which enhance to deliver an explanation of how data management (DM), skills fit into the day-to-day responsibilities of the profession and each participants of the institution.

Therefore, effective data management is an essential and intrinsic aspect of day-to-day activities in a varied range of professions. With explicitly describing role of a data manager and chief information officers. After evaluating the skills in a number of data management professional, the description enhance to gathered from staffing agencies and from data Centre, should be built a profile of a data manager incorporating elements of the roles of data scientist, data manager and data librarians are responsible body of data management in higher education institutions.

On the other hand, as defined universities function in a complex and data-oriented environment, requires those who are responsible for collecting, managing and disseminating data, so it needs to do in a systematic, planned and managed way. Data generated and held by the university are the key assets which should be managed correctly, in order to ensure the university functions effectively [32]. Therefore, the policies outlines; data management framework that covers the roles, responsible and

accountable for the data collection, storage, security, maintenance, dissemination and data quality. So that, custodian (guardian), is a member of the Senior Management Team (SMT) responsible for the collection and dissemination of data in an information system.

Though, the custodian is primarily responsible for the business function supported by a corresponding line of higher education institution system and data used by it [32]. Therefore, those responsible for university operations are also responsible for the institutional data, which concerns the university. So that, maintaining the data quality is crucial to maximize the value of investments that the university has made in data collection, maintenance and internal and external decision-makers have confidence and trust in the information they rely on.

In other hand, library-based data management experts can serve as a sources of specialist on newly enacted policies and requirements. Besides the different levels of data management knowledge exist in a single institution, such as: faculty may have a greater stake in good data management, but individuals who are managing data (staffs and students) may not have as great understanding regarding institutional data management or general aspects of good data management [34]. Therefore, the library and its partners can provide guidance on these performs. Additionally, specific information technology roles, defined as information technology is area of data quality management, that have the responsibility on extends to the technical infrastructure, organizational databases, communication infrastructure and all computer applications inside the organization.

2.8. The Use of Data Management in Higher Education Institution Policy Makers

The successful data management in higher education institution today requires effective managers for these policy making and system monitoring through adapting data and information management program. To this end countries around the world have invested significant resources into collecting, processing and managing more and better data through education management information systems (EMIS) [28].

However, frequently all of EMIS design and development has been limited to information technology enhancement or data storage and maintenance, with inadequate attention regarding the management of data environment. Though, EMIS needs to work on operation and utilization of the data, in order

to improve organizational policy making principles. This examined the technical, organizational, and institutional conditions should be met the success and enable information-based decision-making for effective system management. Therefore, it is highlight facts that technical capacity building should be convoyed by creation of demand for the information and enhance to develop the culture of open communication, information sharing and information use in any institutional environment.

2.9. Higher Education Data Management Policy

As described above higher education institution in present era, operate in progressively complex data-oriented situation, which required the effective collection, management, governance, analysis and dissemination of data. Though, data generated and held through higher education institutions are an important assets, which needs to be managed correctly to support universities strategic development, improve essential functions and academic integrity of the institution. Therefore, in order to managing these increasingly alarming rate of data; higher education institutions (HEI), are need to always take consideration regarding institutional data management and every stakeholders have shared their own responsibilities. Such stakeholders have responsibilities; investigators, staff members, leaders, lectures and students should be work together in order to implement good data management with the university's commitment for the highest ethical standards. In general, this is enhancing to protect the rights of data owners, reaching right data (information) at the right time to the right users, self-respect, security and privacy of communities' data with collaboration.

This research provides a corporate framework that defined roles and responsibilities concerning on institutional data management policy for collection, quality, storage, records, governance, security, maintenance and dissemination of institutional information. As a whole, data management policies and procedures can ensure that institutional data in all formats should treated as equally. Therefore, implementing such policies and procedures in higher education institution, offer different benefits such as: harmonized and clear data from the use of common definitions, improve academic quality, better care of data holdings through the effective data policies and best practice, improved knowledge and understanding of data holdings, availability, interpretation and use, with the subsequent reduction of risks on duplication or loss, through better cataloguing and better access to data via an integrated data management atmosphere.

In order to implement this policy, the following stages need to be taken into consideration:-

- ☞ In the case of recording personal data (information) the agreement should be taken with regards to preservation, confidentiality, access and re-using of the data must be observed;
- ☞ Recognized the significant information, which involved, in adequately safeguard and security of data and records;
- ☞ The institutions should be establish procedures and policies for the preservation of data and should be uphold a register of the data and records in their appropriate location; such as data and records will normally be kept in the organizational module and repositories.
- ☞ The data which provide the basis of publications or the basis for research must be available to the discussion with other researchers and should be kept in a way that allows reference by third parties.

Commonly, based on the above policy expressed two privacy and confidentiality protection issues that need to include:-

(1) **Security,** which includes the action in place that data and records are not lost, stolen, destroyed, illegally accessed, or otherwise it is useless. Therefore, data needs to store in computers and other appropriate repositories. Because it is essential and interesting to a high level of protection, which provides integrity and availability to the customer.

(2) **Access,** the data is restricted by the owner and significantly limits who can view the data and for what purposes.

2.10. **What is Data Governance**?

The phrase data governance defined as the whole arrangement of data that enhance to guarantee the data integrity. Therefore, the arrangement provide to safeguard the data, regardless of the process, format or technology in which it is generated, recorded, processed, retained, stored, retrieved and used. So that, it will ensure a complete, consistent and accurate record throughout the data lifecycle in every organizations. The phrase "data lifecycle" refers how data is generated, processed, reported, checked, used for decision-making, stored and finally rejected at the end of retention period. From the different scholars perspective data governance should be integral to the improvement of higher education institution quality education systems. Though, it should address the data ownership throughout the lifecycle and consider the design, operation and monitoring of processes / systems in order to fulfill the principles of data integrity, including control over intentional and unintentional change and deletion of information or data if necessary.

2.11. Knowledge Discovery and Data Mining Approaches

Based on abundant quantity of data, the discovery of knowledge in many institutions are the product of new technology called data mining. Therefore, this data mining technology and approach provide to the better decisions regarding the organizations strategic and operational direction that enhance to improving their Knowledge discovery in database (KDD) activities. KDD is an interdisciplinary area, which provide to the organization that encourage for identifying and extracting useful and meaningful patterns from large data sets.

Although, one of the biggest challenges that higher education institution faces today is predicting the paths of students and alumni [35]. Therefore, data mining provide to the institutions to know which action is performed to the institution. For instance which students will enroll in particular course programs, and which students will need assistance in order to graduate. Consequently, it is the one way to effectively address these student and alumni challenges through the analysis and presentation of data. Though, data mining enable to higher education institutions to use their current reporting capabilities to uncover and understand hidden patterns in a vast databases. Though, the patterns are built into data mining models and used to predict individual behavior with high accuracy. As a result, higher education institutions are able to allocate resources and staff more effectively.

Therefore, data mining on data management, provided different actions for instance; it provide to the institution the necessary information to take action before a student drops out and efficiently allocate resources with an accurate estimation of how many students will take a particular course. So the general idea, with this data mining provide a combination of an explicit knowledge base, sophisticated analytical skills, and domain knowledge to uncover hidden trends and patterns. These trends and patterns form the basis of predictive models that enable analysts to produce new observations from the existing data of the institution.

In other investigator definition such as Ben Daniel, Knowledge discovery in database (KDD) is an interdisciplinary area, which focusing on methodologies for recognizing and extracting useful and meaningful patterns from large data sets. From the researcher concept, KDD draws upon research in statistics, databases, pattern recognition, machine learning, data visualization, optimization and high performance computing. As Ben Daniel described KDD first proposed in early 1990s, is called as

data mining, applying data analysis and discovery algorithms to produce a particular enumeration of patterns over the data and became a major aspect of KDD. Over the years, clustering, association, classification algorithms, regression models, predictive methods and factor analysis are the key approaches, come to dominate data mining research. Generally, discussed each algorithms that used in data mining applications, such as [10], [40]:-

"Clustering algorithms or data segmentation approaches group data items based on clearly defined logical relationships. The goal is maximize the inter-cluster similarity and minimize the intra-cluster similarity. Related to data clustering is feature selection. Feature selection refers to the process of identifying the most useful feature for clustering".

"Classification, is another approach within the data mining research that tends to classify data into predetermined categories. Classification approaches often referred to as machine learning algorithms. These algorithms can learn from a large set of pre-classified data. They can detect persistent systemic differences between items in each group and apply particular rules to further classify data".

"Association approaches are also a set of algorithms intended to extract particular characteristics of data within a group and to finding associations with other characteristics. These approaches are driven by rule-based algorithms, which mostly examine relationships within data set (correlation between variables)". The aims of association rules mining to study the frequency associated with relationships among items or data in transactions A simple association rule expresses the relationship of one item to another.

2.12. Data Warehouse

Data warehouse is the place where different types of data are stored in higher education institutions and other companies. Which support to store a massive amounts of unstructured data and a specialized database containing combined historical data drawn from a number of existing databases to support strategic decision making of the organization.

In other word data warehouse represents an ideal visualization of a central data repository and living memory of data that can be force for better decision making of the administrative in higher education institutions. As recent development in relational database technologies made it possible to collect and

maintain large and complex amounts of data in many formats and from several sources. In addition, there are a critical tools available that can turn this complex data into meaningful patterns and value, this phenomenon referred to as superabundant of data. Superabundant describes as, the data that is fundamentally too large and difficult to transfers fast, thus exceeding the processing capacity of conventional database systems. It also covers advanced techniques and technologies to capture, store, distribute, manage and analyses larger sized data sets with diverse structures and natures this known as data warehouse.

2.13. Data Security

The phrase data security is defined in different concepts by different researchers. In the context of this research, the expression data security in higher education institution and other organization, defined as protecting database and data repositories against unauthorized users. This includes: all of the physical security, network security and computer systems security and paper based data or files that need to be considered. This ensure that the security of data and prevent illegal access, changes to data, expose or destruction of data. The consideration is needed regarding data security when data is destroyed, because sometimes may interesting data can destroyed with unessential data. In addition, data security may needed to protect intellectual property rights, such as copyright, patent right, which help to keep personal or sensitive information to be safe. Commonly, let's show in detail, what means physical security, network security, computer system security and paper based data security.

1. **Physical data security includes:**

- ☞ Moving physically sensitive data under remarkable circumstances such repairing purposes, for instance giving unsuccessful hard drive which containing sensitive data to a computer manufacturer may cause on security.
- ☞ Controlling all of the access rooms and buildings where data, computers or other media are stored.
- ☞ Classifying the vital and unnecessarily data or hardcopy material in store rooms and repositories.
- ☞ Regularly back up electronic data files (both on and offsite) and create both hard and soft copies.

2. **Network security includes:**
   - ☞ First it described that not storing confidential data such as those containing personal information on servers or computers connected to an external network, mainly servers that host internet services.
   - ☞ Second firewall protection and security-related advancements and covers to operating systems to avoid viruses and malicious code.
3. **Security of computer systems and files may include**:
   - ☞ Implementing password protection and controlled access data files, such as no access, read only, read and write or administrator-only permission.
   - ☞ Controlling access to restricted materials with encryption. Because this encryption mechanism provide to keep the security of data during transmission.
   - ☞ Protecting servers by power flow protection systems through line-interactive uninterruptible power supply (UPS) systems.
   - ☞ Securing computer systems with a password and installing a firewall system with virus intrusion.
   - ☞ Not sending personal or confidential data by email or through File Transfer Protocol (FTP), but rather transmit as encrypted data. And destroy the data in a consistent manner when needed.
   - ☞ Keep updated anti-virus protection on every computers of each department.
   - ☞ Maintain up-to-date versions of all software and media storage devices.

2.13.1. Personal Data Security

Collectively, personal data security is defined us safeguarding of individual data in higher education institution and any other organization. Which involved based on international legislation of the data protection Act 1998, and orders personal data should only accessible to authorized individuals. This personal data may also exist in non-digital format, such as: student marks on hardcopy format or student interview records. So these should be protected in the same way as digital files are secured. This privacy data security is explained to who has the legal rights to have and who retains the data after the protection is completed. Which including personal right to transfer data between institutions and companies. So as the rapidly changing pace of information technology, produces new innovations in data storage, linkage and mining techniques, policies and procedures regarding data privacy must be re-examined. This section will define the minimum standards and best practices for ensuring data privacy throughout institutional data management process.

So that, data management professionals should be familiar with basic data privacy issues and follow principles that established by their institutions to ensure the privacy of customers. The minimum standards, regarding data privacy includes; educate all employees who directly or indirectly handle personally identifiable data on institutional procedures and data privacy concepts. Data management training meetings should include institutional policy, regulatory agency policy and applicable to the organization, state, federal and international laws are some of the lists.

2.14. Data Management Framework

Data management framework is the organizational construction and architecture, in which it provide to manage higher education institution data source and asset. It is also takes the arrangements of a list of components through issues and cases for each component. The management of institutional data such as administrative data, library data, curriculum and registrar data, human resource data, financial data, research data, student data and other customer data which are required for the operation of the higher education institutions.

There are different theories about data management framework done by different investigators, data quality assessment comprises the valuation of accuracy, internal validity, external validity, timeliness, interpretability and value [33]. Therefore, each assessment aims to evaluate the usability of data and measured by a single/more indicators. And the other is data governance framework, which focus on data management implementation and data governance policies, procedures and rules. Since, the purpose of data management is to eliminate data storage tower and increase data re-use through the use of common tools, database operations, technologies, architectures, standards and methodologies.

Though, institutions in higher education should be placing an original data strategy, which provide to a broad-based portfolio of data management tools to support various data integration, data quality tasks and automate processes where possible. As the types and capacities of the data expand, the data management portfolio must expand with it. Mainly data management framework include the elements such as: data governance, occupational framework, the guiding principles, decision making bodies, decision rights, process and policy, data requirements, data administration, metadata management, data quality and security & access rights.

So that, for this research the researcher enhanced by ideal data management framework, which done by British Journal of Educational Technology Ben Daniel, (2015), and from the data management policy framework adopted from university of Canterbury which is approved by university registrar that lastly modified (Sep, 2015). Therefore, the focus of this research is based on a combination of ideal data framework from Ben Daniel and university of Canterbury which is approved by university registrar. This university of Canterbury data management framework is done on data management Policy.

According to this article the university operates in a complex, data-oriented environment that requires those who are responsible for collecting, managing and disseminating data, in a systematic, planned and managed way. Data generated and held by the university are key assets that must be managed correctly in order to ensure that the university functions effectively. Therefore, their policy outlines data management framework, covers the roles, responsible bodies and accountable for data collection, storage, security, maintenance, dissemination and data quality. So that, the framework is indicated in the following Figure 1.

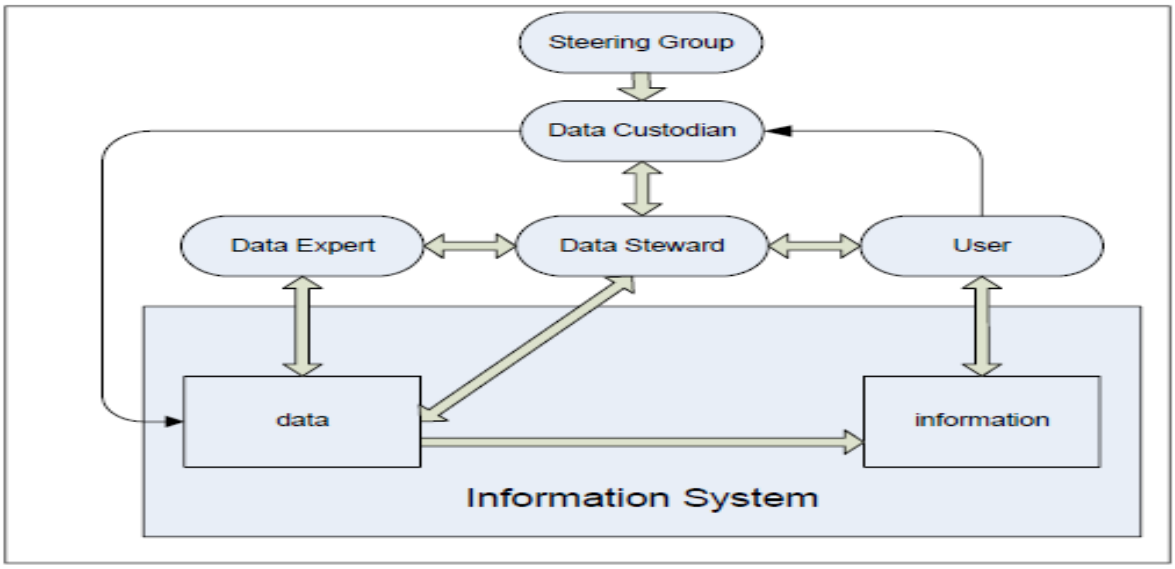

Figure 1. Data Management Policy framework adopted from university of Canterbury [32].

From this research framework that approved by university registrar of Canterbury, which is defined each term as follow:-

Custodian→ These teams are participants of the Senior Management Team (SMT) responsible for the collection and dissemination of data in information system.

Data→ The overall term such as; facts, numbers, letters and symbols collected by several means and processed to produce information. From their perspective data could be include personal or sensitive personal elements and needs to be managed in accordance with relevant and legal obligations. Therefore, data has always been a significant asset for higher education institutions and has been used to inform their day-to-day operational decisions as well as longer-term business and strategic decisions. To take the common instance, creating the timetable for each semester, which requires illustration on a range of different types of data across the institution. To work out how many lectures, tutorials and labs to schedule per module, time tables need to bring together information about student enrolments, staff numbers in each faculty (including staff with the relevant expertise/qualifications in lecturing and leading labs), which estates data on rooms available with the necessary capacity and any equipment required in institutions.

Data management→ Refers to management of institutional administrative data i.e., data which are required for the operation of the university.

Data management framework→ Refers to the organizational structure in place to manage the university's data resource. The purpose of data management framework is to remove data storage tower and increase data re-use through the use of common tools, such as: information technology and architectures, standards and methodologies, in order to reduce replication of institutional data. Therefore, higher education institutions should be staying on innovative data plan and need data management tools, to support various data integration and quality tasks and computerize processes where possible.

Data quality → Refers to the accuracy, completeness, validity and currency of data. Along with data quality all of concerning stakeholders of higher education institutions in Ethiopia, must be frequently manage data quality functions, such as: assessing source data, defining data quality rules, defining data potential requirements, identifying, regulating and uniting duplicate records, matching records from identical families, observing and reporting data quality metrics.

Data Expert → Refers these organizational staffs with a comprehensive practical awareness and experience in their respective data processing and application areas. Also they recognize technical framework supporting the university's data processing and management activities. As Canterbury

university research article suggested data experts cannot act as data stewards or data custodians, because those positions are responsible for the university processes and also responsible for the institutional data, concerning these operations.

Information→ Refers to the data that have been processed into a meaningful format.
Steward→ Refers to the person who has oversight of the data and the intermediary between users and experts.

General System Management Team→ These are the representative group, from information technology and other data stewards (agents) which makes the recommendations related to data, issues, and standards that affect more than one administrative area. The team will establish, document integrate standards and crosswalks between administrative applications with the system, that insure the individual responsibilities and procedures clearly outlined and appropriately communicated.
Data User's → Refers to the staffs who use administrative data as part of their day-to-day work. In other words, individuals who access university data in order to perform their assigned duties or to fulfill their role in the university community. Data users are responsible for protecting their access rights and proper use of the university data they access in daily activities.

In overall terms, the research in this study delivers a comprehensive data management framework, which is reliable in all of Ethiopian higher education institutions. Data management in this circumstance refers to the management of institutional data such as data are necessary for the process of organizational improvement.

According to Ben Daniel, the university ideal data framework which is done in British educational technology indicated results of IT analytics are used to develop difficult data representative and analysis to expose obstacles of student access, usability and to evaluate any attempts at intervention. From the perspectives of his study IT systems can help by filtering the associated institutional processes to collect critical data that might not have been collected institutionally and showing how data in separate systems can become very useful when captured and associated.

In general, the educational data mining community and learning modelling communities have already discovered ways to track student behaviors, recording variables such as: number of clicks and time

spent on a page and increasingly more shadow the information, such as flexibility and retention of concepts. From this impression learning investigation is concerned the measurement, collection, study and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning environments in which it occurs. Generally, the framework is indicated in the following Figure 2 with each components of the framework.

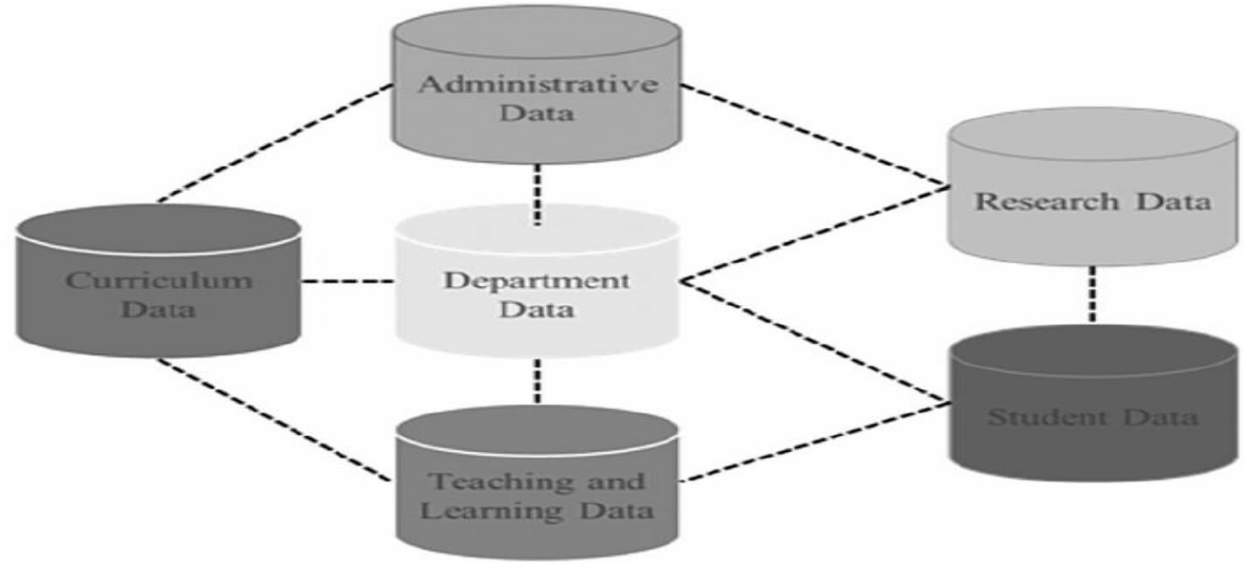

Figure 2. University Ideal data framework adopted from Ben Daniel (2015) which is done in British Educational Technology [10].

As we understand from this ideal framework in university, there are different data need to manage in a various staffs. Such the necessary components are administrative data, department data, curriculum data, teaching and learning data, student data and research related data. Which enhancing to work through grouping each other for achieving organizational goal. But for this research the researcher tried to put the improved research framework, in chapter three based on the research variables and the types of data that needs to manage in higher education institutions.

CHAPTER THREE

3. Methodology of the Study

During this study the researcher involved in many subtopics throughout this chapter, such :study area, target population, research method, inspiration on using mixed research, sampling techniques, data collection instruments, questionnaire design procedures and modified framework was deliberated concisely as follow and data analysis while undertaking in chapter four.

3.1. Study Area

The study has been conducted in Madda Walabu University by engaging all concerned stakeholders in data management of the organization. The university is one of the public universities in Ethiopia which was established in 2006 (1999 E.c). It is located in Bale Zone, in the town of Robe, about 430 km away from the capital city of Ethiopia. It was established by the government of Ethiopia, as an independent higher education institution. Therefore, presently, this university has four branches, namely Madda Walabu Robe campus (Main Branch), Goba branch (Goba Referral Hospital), Dodola Branch Health related and others and finally Ginir Branch. In addition, the university has many colleges: namely under institute of technology there are two colleges, such as: college of computing and college of engineering and other colleges are: - college of agriculture and natural resource, college of business and economics, college of education and behavioral sciences, college of natural and computational sciences, college of social sciences and humanities, Goba referral hospital and school of law (www.mwu.edu.et).

The university is a government-funded higher education institution with an international standing for teaching and research activities. It has developed collaborative understanding with other national and international institutions. Since its establishment, it has been proved to be one of the fastest growing universities in Ethiopia. The fundamental elements of the university mission is to produce competent entrepreneurial as well as employable graduates, provide need based community services and demand driven or problematic solving research outputs through relevant and quality education, research, training and consultancy service to foster socio-economic development in the country. And the vision of this university is it become one of the top three societal problem solving universities in Ethiopia by 2025.

Thus, its ultimate goal is to pursue standards of excellence in teaching, research and community service for the betterment to the society. In order to narrowing down the scope, this research was concentrated only in main campus of the university, which located at Robe city. The research area was selected by two main reasons. Primarily, the main campus is comfortable to the researcher, but the other three branches were far away from the main campus, and population are not large in number in these branch colleges. And secondly, the main campus is one of the principal branch, which is majorities of the respondents were found. Therefore, it was remarkable to study on data management habits of main campus, which can support to the researcher as representative to all other branches of the university.

3.2. Target Population

The term target population, as defined by Hair and Bush (2006), is the specified group of people or objects for which questions can be asked or observation made, in order to develop required data and information. Therefore, the target population, these participated in this research were drawn from Madda Walabu University main campus. This university is one of second generation higher education institutions in Ethiopia. Currently, the university encompasses many branches; such as: main campus which is found at Robe, majorities of the students are served. As described above the other branches are found in different direction. In main campus, there are many undergraduate and some graduate programs.

3.3. Research Method

In order to study appropriately the researcher used case study method. Because, it has been noticed the most suitable for addressing the research questions and specific objectives, that described in chapter one and enhance to better understanding the enquiry of target populations.

In general, this study consisted institutional data management in higher education institution, which took multipart approach. Firstly, it consisted the literature review to examine data management frameworks and definitions to define issues and establish research questions.

Second, quantitative research method is used which enhance to the researcher analyze the information based on descriptive statistics. This descriptive statistics was enhanced to put information by both

frequency distribution with percentage analysis and graphical representation of the outputs, then interpreted and wrote the result based on the data collected form the respondents. And thirdly, qualitative method was used. In qualitative approach the data can be analyzed and wrote the report based on data collected from the respondents comment and observation. In general, the methods used for this study were contained both confirmatory (quantitative) and exploratory (qualitative) in nature. This mixed research method enabled to the researcher simultaneously analyzed and answered both types of research questions. In general, the study results were appropriately presented in chapter four. The literature reviews that facilitated to this researcher were determined workable definitions, and reasonable scope. In the quantitative approach, the researcher used to analyze the information based on descriptive statistics, by using both frequency distribution with percentage analysis and graphical representations of the outputs of the result, then interpreted and wrote the result based on the data collected form the respondents.

3.3.1. Motivation in Using Mixed Research Method

Numerous of the researchers have argued about the advantages and disadvantages of mixed method research. In general, as described by Teddlie and Tashakkori (2003), there are three areas by which mixed methods are found to be better in research [37]. The first advantages of using mixed research method is be able to answer research questions that cannot be completed by other methodologies. This is due to the confirmatory nature of quantitative research, which involves theory verification by Punch, (1998), while on the other hand, he described qualitative research is exploratory in nature and involves theory generation. Therefore, when a research is in both confirmatory and exploratory in nature, the mixed research method enables to the researcher simultaneously answer both types of research questions.

Second, mixed method research can provide better implications Teddlie & Tashakkori, (2003), since it may balance the disadvantages over other methods have. In a way, this offers the complementary strengths and non-overlapping weaknesses which may lead to better and more accurate implications.

Finally, mixed method deliver the opportunity for presenting a greater diversity of different views Teddlie & Tashakkori, (2003), which may lead to a reconsideration of conceptual frameworks and the assumptions that underlying each of the quantitative and qualitative components.

Normally, under this study the quantitative data was collected using some adapted questionnaires from the past researcher and mixing self-administered questionnaire, which consisted three parts. In the first part which consisted of demographic information, second consisted the research variable, with different categories that represented. While in the third portion open end questionnaire that is commented by respondents opinion based on this research. The questionnaires was distributed to Madda Walabu University communities for the sample of individuals.

In order to analyze the collected data, processing and evaluation of the resulting was done with the help of statistical package for social science software (SPSS, Version 20.0). This chapter also introduced sampling techniques used, in order to collect information from target population using questionnaires by different variables, and implemented the SPSS program to process the consistency assessment and subsequent empirical analysis is used. In addition qualitative data was collected through observation of the organizations data management practice in different departments and staffs.

3.4. Research Design

As defined by different agents, the research design is an overall outline of a research that defines the direction and method to be used in the study to collect the evidence needed, either from primary or secondary sources Malhotra (2007). Likewise, from Neuman (2006), the quantitative method has the characteristics of calculating independent facts using variables, where data is separated from theory that statistically analyzed and emphasized with its reliability.

3.4.1. Sample Size Determination Procedure

In order to collect the appropriate and representative data, the researcher is used implication about sample size determination technique. Rather, it described, "How big a sample is required to the study?" because, it is one of the most commonly asked questions by many researchers. Though, the main purpose of sample size determination is to get a balanced and representative participants under the investigation. However, if the sample size is not engaged appropriately the results and conclusions drawn from the investigation may not reflect the real condition. The sample size is the number of participants that should be included in a study in order to answer the research question.

Therefore, determining the sample size is the key step on overall statistical procedures. Because, it was definitely difficult to include all of the populations found in the study area within this fixed period and resources available for the study. Hence, determining an appropriate sample size is the means of gaining high precision, accuracy and confidence with the minimum cost. Hence, the reason most of the population excluded from this research is due to the fact that, the population in the main campus that used as representative to other branches was also many in number. Thus, a decision was made to include the sample population of the study in Madda Walabu University in main campus.

In general, the population from three branches were excluded from the study. Because, it is difficult to include all the population found in the main campus, within this short period and resource available to the study. Thus, a decision was made, from the entire population 112 representative participants were randomly selected from the study population in main campus. These representative participants were selected from similar populations. Because, the assumption indicated that sample from similar population reduce sampling error whatever services they provide in differently and tasks performed by separate units. In general, in order to develop this sample size researcher used the following (Cochran, 1977) sampling size determination formula.

$$no = (Z\alpha/2)^2 pq/d^2$$

$$n = no/1 + no/N$$

Adopted from (Cochran, 1977) for sample size determination.

However, in order to calculate the sample size taken the values of P and q from the default value; which is indicated, the symbol represent as follow with the appropriate value:

P = probability of success = 0.5

q = 1-p is probability of failure = 0.5

d = margin of error at = 0.09

N = is total population = 1681

n = sample size of the respondent that participated from the main campus.

Assume $Z\alpha/2$ = confidence level of significance the Z value at α = 0.05 is known 1.96

$no = (Z\alpha/2)^2 pq/d^2 = (Z\alpha/2)^2 * 0.5 * 0.5/(0.09)^2 = 119$, and $n = 119/1 + 119/1681 = 112$

3.5. Data collection Techniques

In this section, there would be designed on what methods is used in collecting whether the primary and secondary data. In order to collect the data which enhance to get information for this research was collected from data source and later used to solve research questions that labelled in chapter one. Therefore, the study was used questionnaires containing the coverage, demographic information and 20 general main variables with one open end question which required respondents comment and other techniques used to the study was observation.

3.5.1. Questionnaire Design

Under this research, the questionnaires used by the investigator were closed-ended or structured in order to simplify process of analyzing the data collected from the respondents. As a whole, the study questionnaires contained coverage and three pages that included demographic and 20 questions with one open-end response questions that located at the end of the questionnaires (see Appendix A). At the headline (cover page) of the questionnaires, the purpose of the study was providing to the respondents gain better understanding about the research topic and focus areas. The first section gathers respondent's demographic information such as respondent's gender, age interval and position (respondents working staff).

The second section seeks the main parts of the questionnaires that included different variables of the research, such as: awareness towards data management, type and size of data, data storage devices, and participants willingness towards data sharing and assistance or training desired, data management plan, data management awareness, roles and responsible bodies on data management, types of data need to manage in the university. And the 5 point likert-scale questionnaires (1=strongly disagree, 2 = disagree, 3 = neural, 4 = agree and 5 = strongly agree). While the last section contains the information that general intentions of the respondents based on their suggestions. The individual feeling was expressed in different ideas, because not the whole respondent's expression are similar. In addition, also the researcher used observation methods that helps to expand the research, during the study the researcher observed some departments, based on their data management practice and their data repository, the result is described under chapter four in detail.

Many of the questions were adapted from previous study, such: (2009, EDUCAUSE, institutional data management and Margaret Henty, July, 2008, data management practices). And the researcher altered these questions based on the research variables. The questions are planned by clear and simple English language to reduce misunderstanding and uncertainties of the questions by the respondents.

The data was collected between February 7, 2017 and February 21, 2017. It was collected from the entire departments in main campus by using simple random sampling technique.

3.5.2. Observation Methods

In addition to the above described research questionnaires this case study also includes observation method as one of the data collection technique. This observation technique is used as supplementary to the questionnaires that gathered from the respondents. In this technique the researcher observed some academic staffs and administrative staffs, how to store and manage their students and customer data in their departments. In general, from the observation certain information were acquired that reflected in detail under analysis and result section in chapter four.

3.6. The Novel and Modified Data Management Framework

3.6.1. The principle for underlying conceptual framework

Conceptual framework and literature review

In order to develop framework there are roles and principles that any researcher needs to consider. So that, for this study, conceptual framework and literature review were developed in parallel, one activities informing to other happenings. The literature selected for this research were chosen from the research that could contributed by former investigators work. Though, the conceptual framework was done based on the framework already structured, but there is modification to some extent, the area they covered and provided definitions or further elaborations of classes already within the framework. Because, the wide-ranging nature of conceptual framework there is little detail on some of the separation and kinds of data management in higher education institutions.

In addition to established data management framework that reviewed in chapter two, the researcher tried to put the following points, where data management is needed in higher education institution. Commonly, all of the components are described under the following conceptual framework that needs to be included in higher education institution, “Good Data Management Practice”. These components

are essential to improving all higher education institutions data management; especially, in Ethiopian higher education institutions, particularly, in Madda Walabu University. As we understand from the following conceptual framework there are different data's need be to managed in higher education institution various staffs, such components are: research data, student data, teaching and learning data, human resource data, administrative data and technological database operations, library data, department data and curriculum with registrar data and others. Because, almost data are the asset of higher education institution which provide to improve institutional development.

Therefore, as data management become emerging activities in higher education institution, numbers of researchers have struggled that data management framework is well positioned to address some of key challenges currently facing in higher education institutions. Therefore, data management in higher education institution covers database operating systems which provides to store the large quantities of electronic data and paper based data, that enhance to the students' and customers have the right to specific transactions and participating on learning and teaching activities.

Encouraging the development of good data management in higher education institution, providing to the reliability of all data generated and recorded by the whole staffs. Therefore, these practices should ensure the data is accurate, complete and reliable to the customer. In addition, the main focus of this study is to identify the relation of data integrity, principles and conceptual frameworks. Which should be considered in wider context of good data management of higher education institutions.

Though, data integrity defined as the degree to which all data are complete, consistent, reliable and accurate, throughout the data lifecycle. And it is also fundamental for bringing quality education by guarantees the required quality on its activities of higher education institution. Poor data integrity and vulnerabilities on data management in higher education institutions can brining challenges on quality of records and evidence. In addition, it may ultimately undermine quality of decision making. Data integrity applies to all components of quality management and principles now regarding to this study was focused on apply equally to data generated by electronic and paper-based systems.

The responsibility for improving good practices regarding data management and integrity lies with the whole responsible stakeholders of the organizations. Hence, they all have full responsibility and obligation to evaluate their data management practice for potentially avoided vulnerabilities and take

steps to design and implement good data governance to ensure data integrity is maintained. In order to achieving organizational goal each of the following component or department should be working together. These kinds of data that need to manage in higher education institutions are described in the Figure 3.

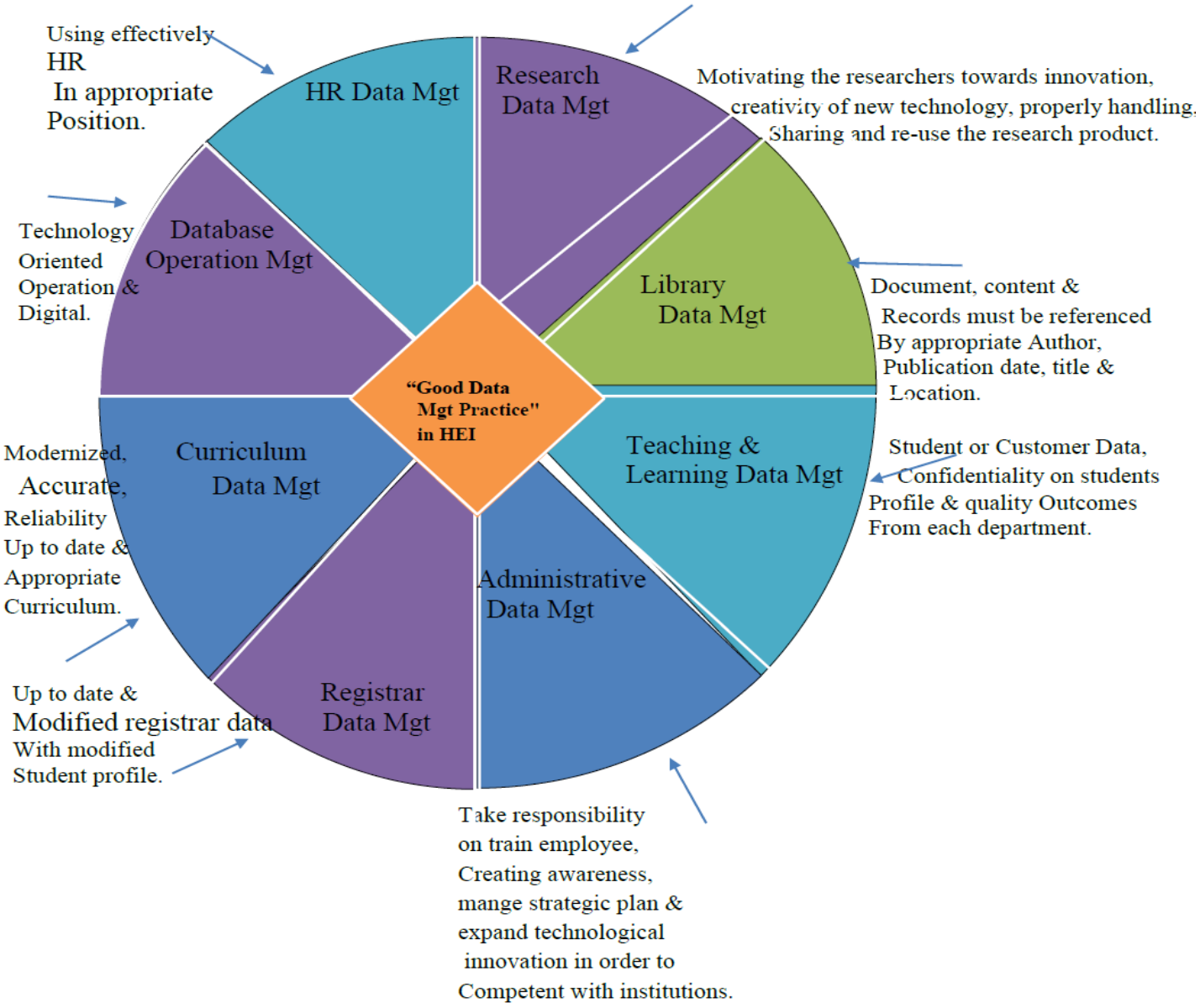

Figure 3. Conceptual framework components in higher education institution, Data Management practice (DMP)

Within this conceptual framework each of these eight classifications regarding data management in higher education institution needs to further be broken down in to separate functionalities and each have different activities. For instance:

Human Resources Data Management→ Human resources departments should be responsible about the institutional employees' data management and finance department could be responsible for organizational financial data management.

Library Data Management→ As described by Ricky Erway (Dec, 2013), library is the well placed and key player regarding to institutional data management and preservation which given its extensive experience. It enhance to the selection of metadata, collections, institutional repositories, preservation and access.

Though, the roles and activities taking place within higher education institution libraries are changing. These changes are expected to affect the higher education library as well as the physical building. Because, traditionally libraries have been research resource supported center by maintained 'physical' collection and archives. But nowadays, the higher education institution library is challenged with the developments in information technology. Therefore, dramatically growing traditional collections and increased student rate or capacity in each years.

So that, in this study the term library data management defined as, documents, contents & records should be referenced by appropriate author, publication date, title & location. Hence, library data management enhance to improve the awareness and understanding of data available for current and future use, consequential from better cataloguing and data archiving in appropriate repositories. Data quality and more timely information relatively it means; access to the right information at the right time to the right user. Therefore, by adapting the rapid change in information technology and library data management which providing to teachers and students with appropriate new tools and continue to make an important impact on the educational process of the future.

Administrative Data Management→ The universities administrative bodies require with local data managers discharge the responsibilities. Directing the development, implementation and maintenance of detailed data policies, standards, procedures and guidelines across the whole institution. And they should be take responsibility regarding institutional data management training, creating awareness, preparing documented policy, managing strategic plan, control resources & expand technological innovation in order to competent with other universities around the globe.

Research Data Management→In this investigation research data management means; the storage, sharing, preservation and provision of ongoing access to digital and paper based research data. In other context research is one of the motivating activities in higher education institutions. Research data management incorporates all the aspects of looking after, handling, organizing and enhancing research data. Managing research data well enhance the scientific process, ensures high quality data and also increases the durability of data and opportunities for data to be shared and re-used for further research.

Consequently, research data management supports to researchers to plan their own data management and to implement their own good data management practices through specific data policy and strong emphasis on data sharing. Researchers need a clear information on how to plan data management in meaningful and often need additional support to develop good management procedures. Especially, where research data is confidential or sensitive, researchers need the essential guidance about suitable procedures and guidelines. Therefore, in order to competent in research, higher education institutions need to engaging researchers into designing suitable data management and archiving research data in appropriate repositories. Because, the research data management is mandatory in any institutions of higher education. So that, the exercise in research data management are the responsibilities of all individual researchers of the institution.

Curriculum Data Management→ As the study intended **c**urriculum is a fundamental substance for the comfort and effectiveness of higher education institution. Since it is ever changing and evolving, up to date curriculum could be referred to as curriculum-in-action. There are lots of change in higher education institutions (HEI). For instance, always the students are changing and their learning styles are changing as well as their demands are changing. Therefore, higher education institutions need to formulate students for a more global future. Which means higher education institutions are most of the time facing on challenges and contributions on curriculum design, student holding, changing in new technologies, quality of learning and teaching, increase quality of research. To provide best service to the newly generated students, higher education institutions need to change and respond the challenges by making good collaboration with other institution on curriculum management.

Registrar Data management→ which refers up to date and modified student profile with students' academic result.

Database Operations Management→ Database operation management refers to the process of planning, controlling, maintaining and supporting to structured data assets across institutional data

development; since creation to acquisition over archival and data repositories based information technology products**.**

Teaching and Learning Data Management → Any higher education institutions are not only the responsibilities of teachers and employees on managing teaching and learning data. But also students are responsible for backing up and saving their coursework data, such as: term papers or project work, assignments, grade reports of each semester, registration slips, cost-sharing papers and other related data. Commonly, they must be use the backup copies on CDs, DVDs, flash drives, and external hard drives or other home computers. Because, if their laptops and other data storage devices are stolen and the student was careless with his / her backup procedure, the students can lose hundred hours of coursework.

CHAPTER FOUR

4. Data Analysis and Results

This chapter described the analysis of data followed by a discussion of the research results. The study aimed to identify and investigate about data management in higher education institution; particularly, Madda Walabu University, roles, responsibilities and stakeholder's awareness on institutional data management and to discover how they improve data management culture in the future. In addition, as defined under chapter three, the data were collected by the questionnaires and observation of some departments. Therefore, according to these criteria, it was possible to describe and analysis a set of variables responsive to the objectives of the study.

Data were analyzed in diverse mechanisms, in order to identified, described and explored the respondent's gender, age interval and position were described in the following demographic data analyzed section. Secondly, the analysis studied the relationship between individual awareness regarding to institutional data management, strategic plan of the institution concentrated on data management, documented policy regarding data management, data storage devices used by employees, responsible bodies on data management, institutional data value and comparable variables were described next to the demographic information. In addition, there were three 5 scale likert-questionnaires that identified the stakeholders view on each variables of the questionnaire.

In this section, the researcher reflected on the data analysis procedures, the results and validity of the research undertaken during the study. Quantitative and qualitative data analysis was used. The major source of data were questionnaires and some extent by observing certain departments based on their data management and handling cultures. So that, the results were labelled both in quantitatively and qualitatively in detail in the following sections.

Response Rate: Initially, 112 questionnaires were distributed to the respondents in Madda Walabu University main campus. However, 101 useable study questionnaires (approximately 90% response rate) were returned from the whole distributed questionnaires. The reason eleven questionnaires were unreturned due to the fact that in availability of the respondents after distributed questionnaires and respondents would not be able to complete some questions or partially completed. These respondents participated in this research were selected by simple random sampling techniques from the total of

1681 population in main campus of the university. Again since the whole employees, 551 is academic staff, which included all of the local and foreign teachers. Once more from 551 teachers, 75 are female teachers, while 476 are males. And also 1130 employees are administrative staffs that have 605 females and 525 males. Though this research was concentrated in all of the department's data management in both manual and digital formats.

4.1. Methods of Data Analysis and Data Presentation

The quantitative and qualitative data analysis was used. The major source of data were quantitative, the other sources being qualitative, consequently quantitative analysis was regarded as appropriate. Therefore, descriptive statistical analysis was used to identify frequencies and percentages to answer all of the questions in the questionnaires. Though, not all respondents answered all of the questions, as a result percentages reported corresponding to the total respondents provided to answering the individual questionnaire. Under this investigation the level of significance was set at 0.05, which is the default value.

4.1.1. The Use of Descriptive Statistics and Graphs

Commonly, in order to analyzed and described study results, researcher was used both two analyzed methods, such as: descriptive statistics and graphical representation methods to facilitate the proper labelling of findings, analyses and discussions. Therefore, in descriptive statistics used to describe the frequency of variables and percent's of respondents choice corresponding to the total choices of answer in the list. While in graphical analysis the researcher was using to present the answers of each respondent by graphical illustration that enhance to describe by percentage.

4.1.2. Demographic Relationships and Study Variables

When the participants were asked about their demographic information, almost all of the participants were emphasized their demographic information accordingly. The demographic questionnaires were part of the purpose of this study and it enhanced to set data that intended to describe demographic variables of the sample and assess any influence on the research findings.

4.1.2.1. Participants Age Interval of the Study

Participants were asked to make (x) their age interval appropriate to them (see Table 2 below). Therefore, all of the participants or 100% were responded to the question. So that, since the total participants 26.7% were found between 20-25 years, 52.5% participants were found between 26-30 years, 12.9% participants were between 31-36 years and the remaining 7.9% respondents were above the age of 36 years. As a whole, it specified that from the total participants, 52.5% of the employee's age interval were found in the interval of 26-30 years. Therefore, it is vital to this university, because at this stage of respondents age is young which will provide to acquire more knowledge regarding institutional data management to the future.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-25 years	27	26.7	26.7	26.7
	26-30 years	53	52.5	52.5	79.2
	31-36 years	13	12.9	12.9	92.1
	above 36 years	8	7.9	7.9	100.0
	Total	101	100.0	100.0	

Table 2. Association between the participant's age intervals in frequency and percentage

4.1.2.2. Gender differences of the participants in the study

Similarly, when participants were asked their gender differences in demographic section, almost all of the participants were specified their gender. From the total participants that were asked to indicate their gender by placing (x) next to the relevant option provided male or female. All of the participants were or 100% responded. So that, since the entire 101 respondents 61.4% were male and remaining 38.6% participants were female.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	62	61.4	61.4	61.4
	female	39	38.6	38.6	100.0
	Total	101	100.0	100.0	

Table 3. The participant's gender difference

4.2. Graphical data analysis and presentation

In addition to the above demographic data analysis method in frequency and percentage distribution table, the researcher used graphical data analysis techniques, in order to characterize each variable results collected from representative participants of the institution. Therefore, representing the results in graphical data analysis method is one of clear and accurate procedures that enhance to indicate the outcomes graphically by percentage. So that, the researcher is described each variables output in the following sections.

4.2.1. Is there any relationship between individual awareness and data management practice?

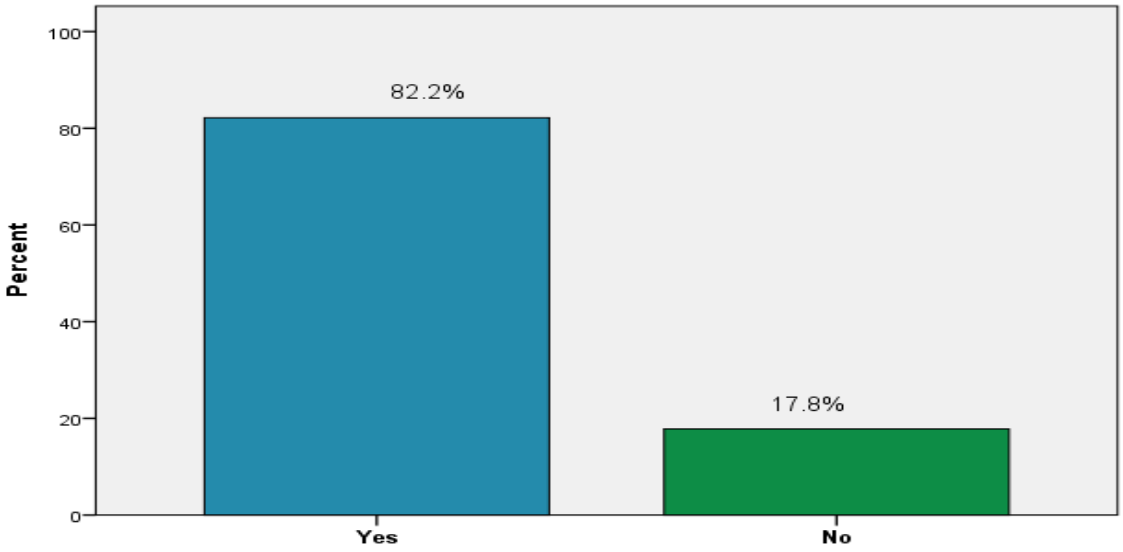

Figure 4. Relationship between individual awareness and data management practice

When participants were asked, whether there is a relationship between individual awareness and data management or not, almost all of the participants were highlighted their view accordingly. So that, as indicated in the above Figure 4, from the total of 101 participants 83 or approximately 82.2% were agreed individual awareness and data management have strong relationship. While the remaining 18 participants or approximately 17.8% participants were selected "No", which indicated that these who selected "No", argued there is no problem whether individual employee have awareness regarding institutional data management or not. This indicated us in order to manage this increasingly alarming rate of data in higher education institution, creating individual awareness in this university is essential. Because, almost the whole participants in both academic and administrative staffs, approximately

82.2% of the participants were agreed that individual awareness is energetic to data management in higher education institutions.

In any case, this institution should be have the habit to offering training program in fixed period regarding data management to all staffs, in order to appropriately use the resources and materials that serve in different departments. Such materials and resources that needs to manage, research products, library materials, teaching and learning materials, student's and customer data, human resources data, electronic materials, laboratory resources and the like . Therefore, quality data management might be considered as a typical feature that contributing to the overall quality of the institution, along with scientific status and the quality of learning situation. So that, in both academic and administrative employers should be take consideration regarding institutional data management outcomes. And the institution should have documented policy regarding data management, which will encouraging the employee's data management habits and quality teaching and learning outcomes.

4.2.2. Do you have awareness about data management practice in your institution?

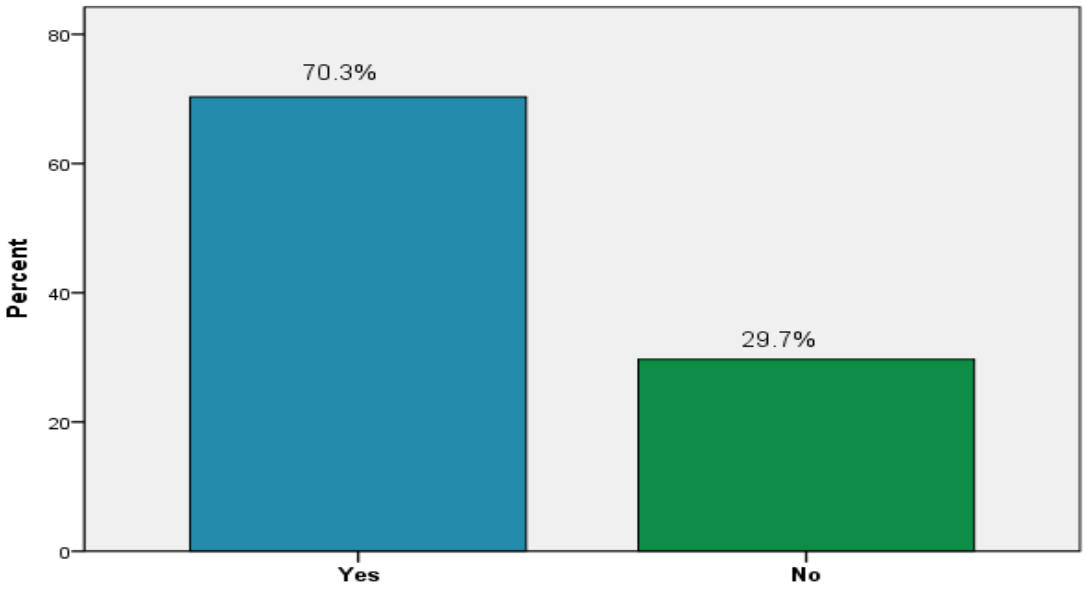

Figure 5. Individual awareness on institutional data management

From the above Figure 5, what we understand is since the entire participants more than two- third or approximately a mean average 70.3% of both academic and administrative participants have an awareness about data management in their institution. But, when separately considered, from 54 academic staffs whether they have awareness on data management or not almost all of the participants emphasized their view accordingly. So from the overall 54 academic participants 37 or more than

68.5%, have awareness on data management, while around 17 or approximately 31.5% participants have not awareness on institutional data management.

Likewise, since the whole 47 administrative participants 34 or approximately 72.3% were agreed that they have awareness on data management, whereas 13 or approximately 27.7%% participants were have not any awareness on data management in there institution. Therefore, this result indicated us whatever majorities of workforces familiar to data management, there is a gap in some case. However, overall employees are not aware on institutional data management it makes difficulty, since data is progressively increase in alarming rate in higher education institution within each day.

In this situation, the institution should be build awareness towards individual mind concerning on institutional data management. Otherwise, this minor participants Vulnerability may cause for the institutional failure on its data management. In order to become competent and reduce this gap the institution should be committed to working on data management and preparing training to all of the staffs that provide appropriately use the resources and materials that assist in different departments.

4.2.3. Is there a formal data management plan in your institution?

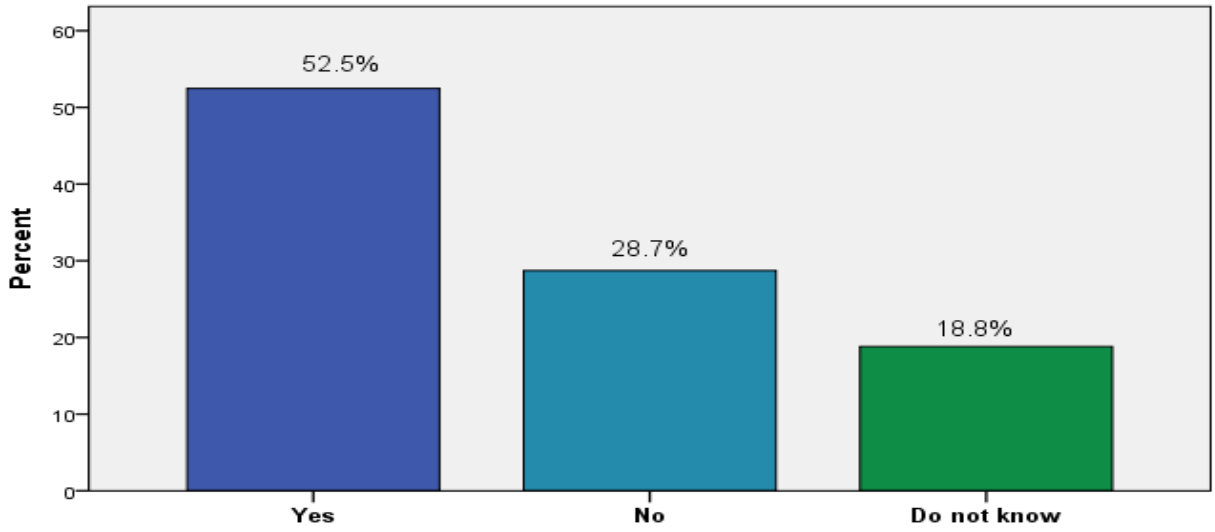

Figure 6. The current data management plan of the institution

Participants were asked whether already, their institution has or not appropriate data management plan. As indicated on above the Figure 6, from the total participants, approximately 52.5% of participants were answered “Yes”, while almost 28.8% were selected “No”, and the remaining 18.8%

participants were said “Do not know”. Though, as we understood since the total participant’s response rate the average respondents that said ”yes” their organization have formal data management plan is great in number.

Therefore, institutional data management plan would be necessary to all concerned stakeholders of the organization, if institutional data units and stakeholders of the institution understand policies and plans surrounding the formation and management of data. However, approximately, 47.5% of the respondents acknowledged that they do not have a formal data management plan in their organization. So this suggested that the institution need the encouragement and preparing training program within the universities. There were a pressure from participants especially, who participate on this research to ensure that data once created, it needs to properly managed and recorded. In addition, there are many activities would prefer issue of institutional data management raised at the beginning of data recording process rather than later, which might be enhance too late to prevent data losses and difficulties in any organizations.

4.2.4. Dose IT strategic plan in your institution clearly address data management issues?

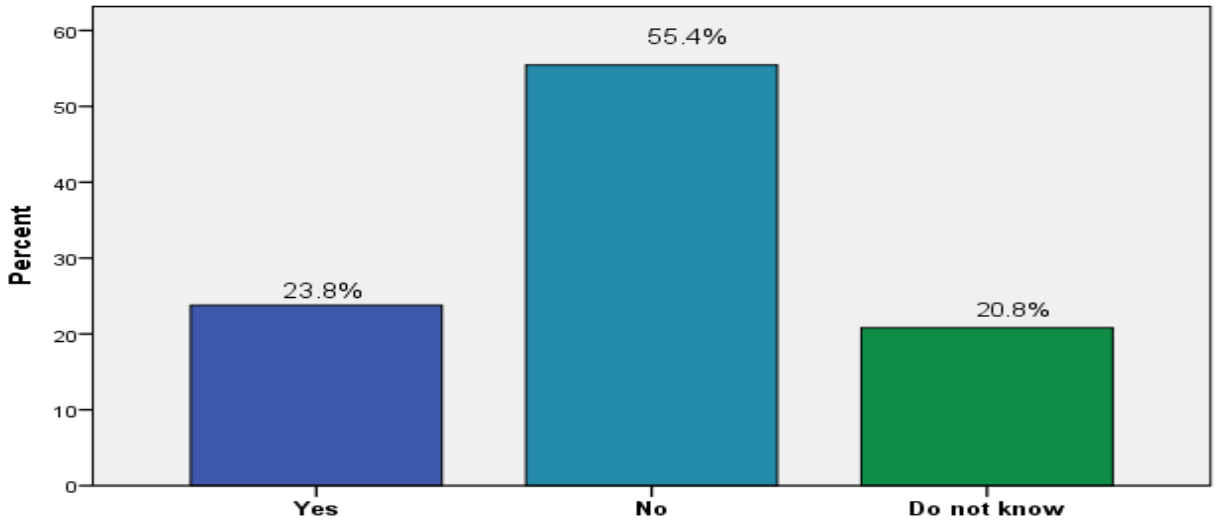

Figure 7. IT strategic plan on addressing data management issues

Also in order to easily understand, the researcher asked about the information technology strategic plan regarding addressing institutional data management issues. However, as the result indicated us since the total 101participants, approximately 55.4% were answered information technology is not addressed the strategic data management issues in their institution. While the other 23.8% participants

were agreed the infrastructure or strategic plan of information technology is addressed the strategic data management plan of the organization and the remaining 20.8% respondents were indicated that they "Don't know" whether information technology strategic plan addressed institutional data management issues or not. In general, this result showed us the participants in this institution is not sufficiently award on information technology products. From my observation the primary reasons for why the majorities of participants said "No' information technology strategic plan is not addressed institutional data management issue is, there is no enough internet connection and infrastructure. So that, the institution should requires institutional review on its information technology improvement and strategic data management plan, in order to competent with other higher education institutions and should work on technological expansion.

4.2.5. In your institution, is there a documented policy about data management and security*?*

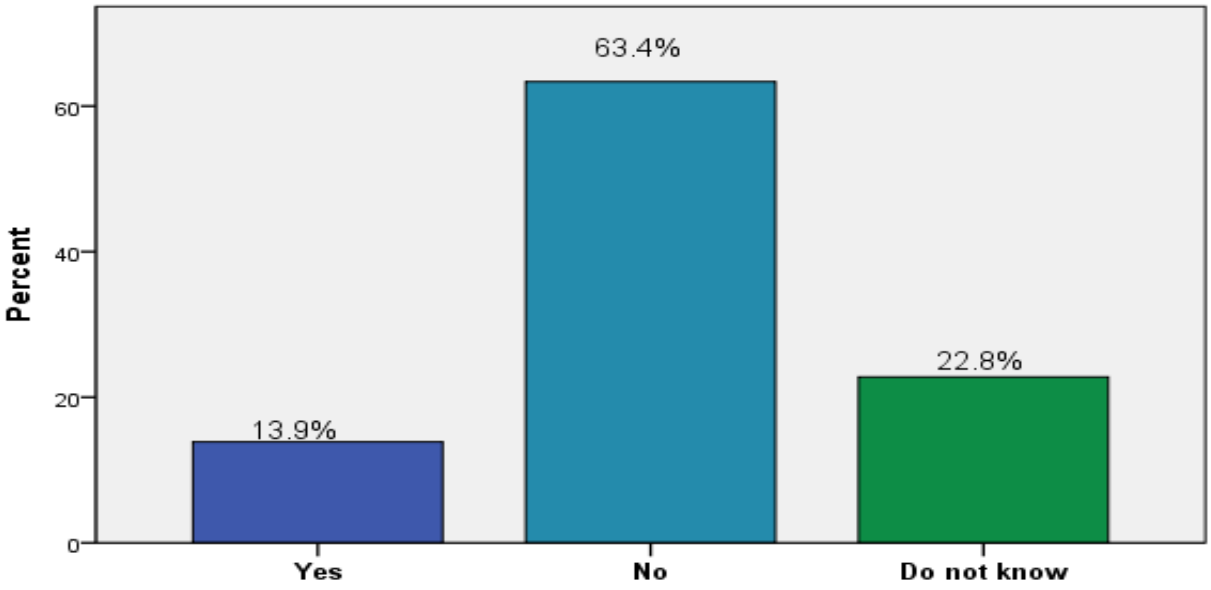

Figure 8. Documented policy on data management and security

As the above Figure 8, indicated us participants were asked question about their institution, whether the institution has a documented policy regarding data quality management and security. Since the total participants only 13.9% were answered "yes, "while majorities of participants 63.4% reported that the institution does not currently have documented policy. While the remaining 22.8% answered, "do not know," which could be associated with a "no" response, because the participants' lack of

knowledge could suggested that even if a policy were in place, it is not being enforced to a degree that requires awareness or procedural changes.

4.2.6. **Does your organization face problem from the lack of understanding on data management?**

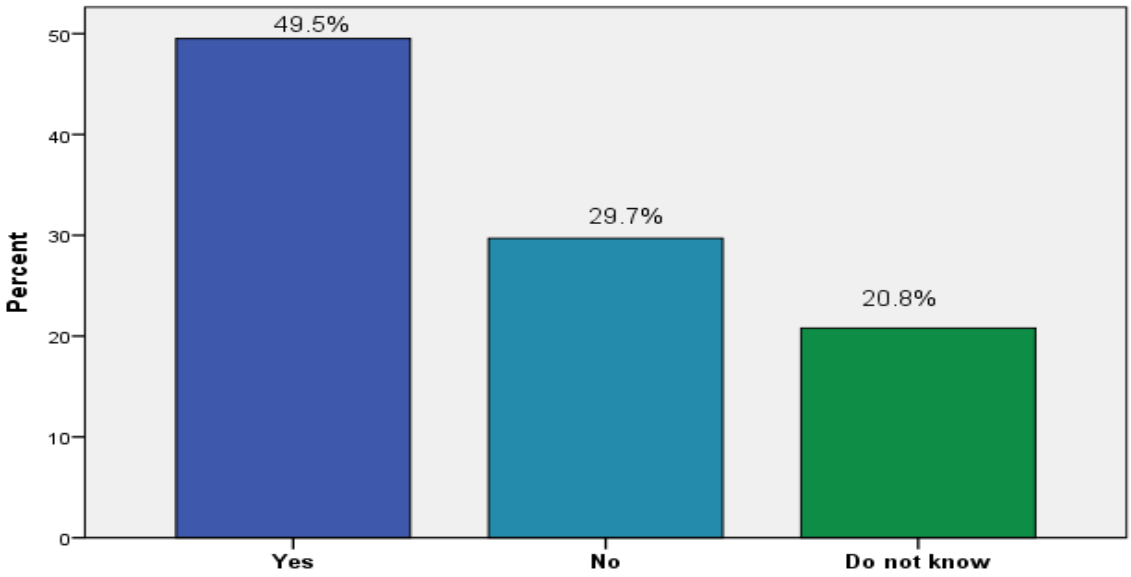

Figure 9. Data management problem due to lack of understanding

From the above Figure 9, when the researcher asked to the respondents, whether their organization faces problem due to lack of understanding on data management practice. From the entire participants just around 49.5% participants were reported "yes", whereas 29.7% of the participants said "No" and the remaining 20.8% were reported "don't know. As a whole, this result specified us approximately 50% of the respondents understand, in this university there is a problem regarding institutional data management. And the researcher asked the respondents who selected "yes", about the root of the problem regarding data management. So that, approximately, 30.7% respondents were selected that the root of the problem regarding data management is lack of technical expertise, the other approximately, 5% were select that data sharing is hindered by concerns about data security and the remaining 8.9% respondents were selected that senior managers are not appreciate the importance of a data management culture. While the other 27.7% respondents selected that their organization does not face problems regarding data management culture. Finally, 27.7% of the respondents were not

selected any answer. So that, these 27.7% of respondents were reported us missing the questionnaire. So SPSS output indicated that this 28 respondents were understand missing system.

4.2.7. If there is a problem from lack of understanding on data management, which one is described as the root of the problems?

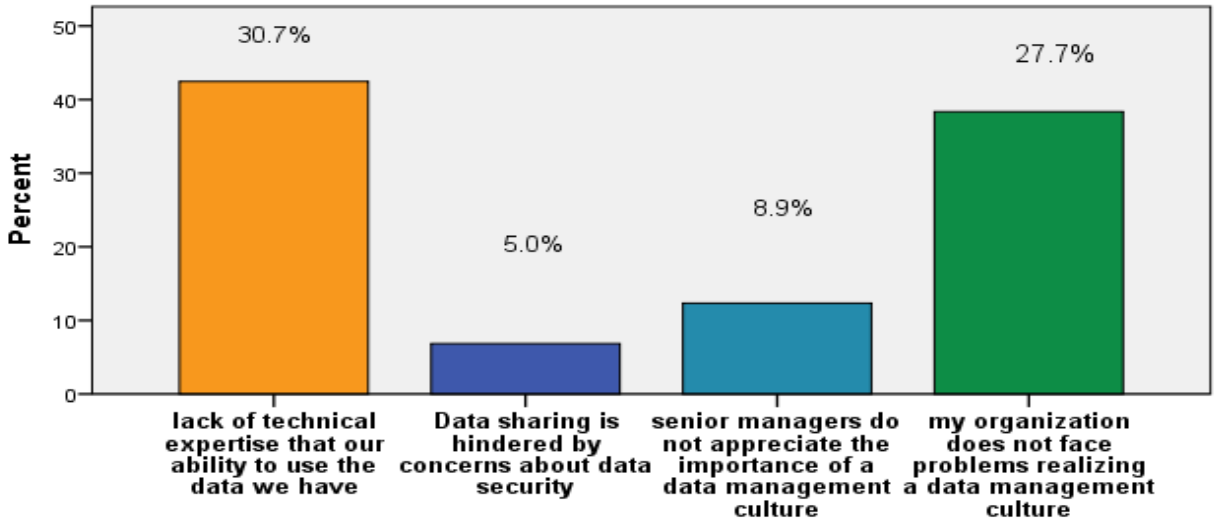

Figure 10. Roots on lack of understanding to institutional data management

In the above participants were requested to identify the roots of problem based on institutional data management understanding in their organization. Though, from the total participants, 72.3% response rate were received, with the remaining 27.7% missing value were replied. Therefore, since the entire participants, around 30.7% were reported that "lack of technical expertise is one of the problem that hindered their ability to use their data properly", 5.0% of the participants were reported that, the problem of understanding on data management is "data sharing is hindered by lack of data security", whereas, 8.9% of the participants were selected that "senior managers don't appreciate the importance of data management " and the remaining 27.7.8% participants were reported that "their organization still doesn't face problem " regarding lack of understanding on data management.

4.2.8. Based on the following ranges where does your work experience fall in this university?

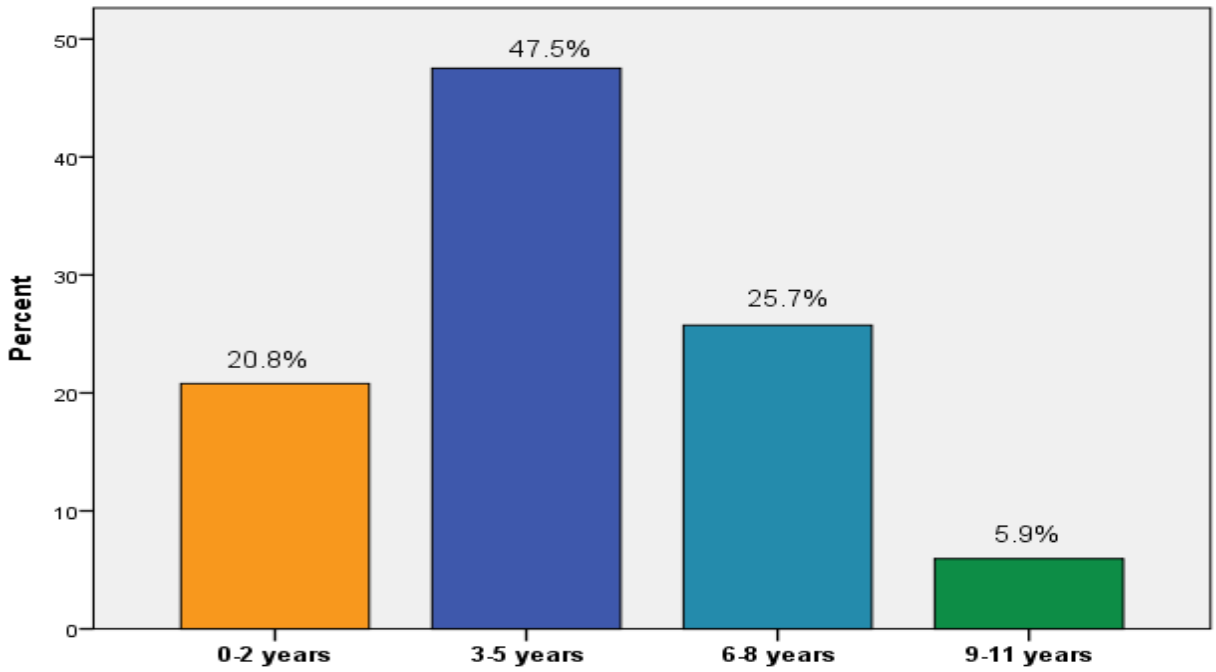

Figure 11. Participants work experience

As indicated on the above Figure 11, span of working experience was specified and respondents were asked to select relevant option provided (refer to Appendix A). Again a total 100% response rate were achieved, that means entire participants were replied the question. From theses 20.8% of respondents were reported their working experience is found between 0-2 years , 47.5% respondents were reported their working experience is found between 3-5 years, 25.7% respondents were reported their working experience is found between 6-8 years, and finally 5.9% of the respondents were reported 9-11 working experience. As a common sense, when working experience is increase, similarly data management awareness of individual respondent will also increase related to a more positive attitude toward care of institutional data. However, as this study showed that majorities of the working forces are found in the intervals of 3-5 years, so for the future 47.5% of working force will easy to acquire knowledge on data management of the institution.

4.2.9. In your opinion, which of the following types of data is highly needed for management of the organization?

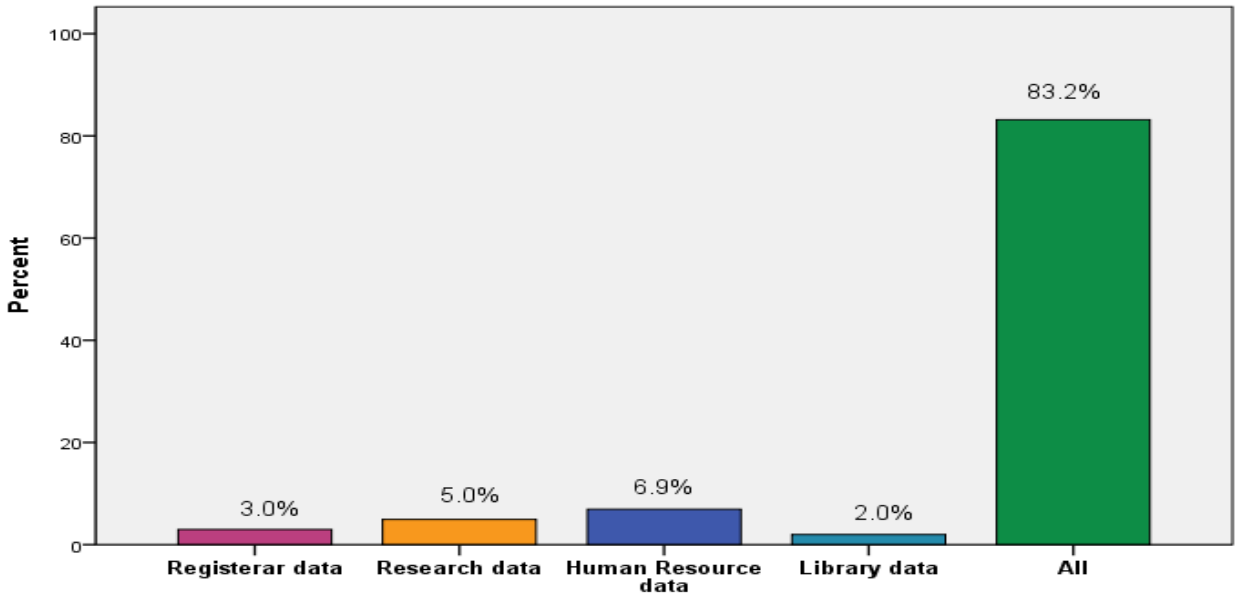

Figure 12. Types of data highly needed for management of the organization

In general, the respondents were fairly positive in judging which types of data needed to effectively manage in their institutions. From the total 101 respondents all responses 100% response rate were received. Therefore, since the entire respondents 3.0% reported "Registrar data", 5.0% respondents were nominated "Research data", 6.9% respondents selected "Human Resource data", whereas 2.0% respondents said "Library data" , besides from the total 101 respondents the remaining 83.2%, argued that all kinds of institutional data is need to manage. Consequently, in higher education institution all categories of data require to manage in different departments. Because, the term data by itself is the asset of any organization and it is essential for strategic decision making. As a common idea not only the data that indicated in this choice, but also other types of data included a wide variety of data types: such as day to day outputs of organizational activities, teaching and learning materials, bibliographic databases, conference output and others need management in any organization.

4.2.10. How does your institution manage research related data?

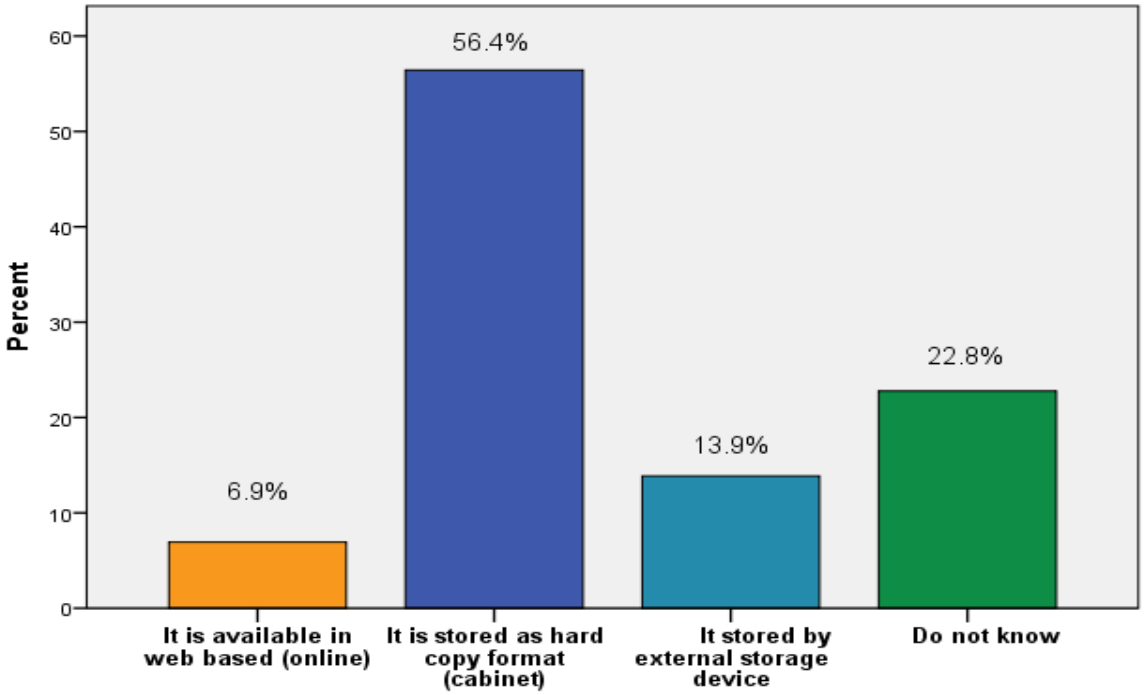

Figure 13. Research related data management mechanism

As the result indicated in the above Figure 13, participants were asked about, how to manage research related data in their institution. From the total participants 100% response rate were received without missing reply. Since the entire participants 6.9% reported "It is available in web based or online", 56.4% respondents were selected that research related data were stored as "hard copy format or (cabinet)", whereas 13.9% of the participants were selected, this research related data is manage by "external storage device" and the remaining 22.8% participants selected "Do not know". In a general sense, we understand from the whole participants only 6.9% were selected that this research data is available online. But indirectly 56.4% of the respondents selected data were managed by manually in hardcopy format, this indicated us in this university has not enough internet access and the institution should work on this technological improvement. Because, nowadays technology makes the world as "village", that means this research related data should be sharable to all the community online rather than kept it by hard copy format and it must be available to other researcher as literature to the future.

4.2.11. In your opinion, who is primarily responsible for your organization's data management strategy?

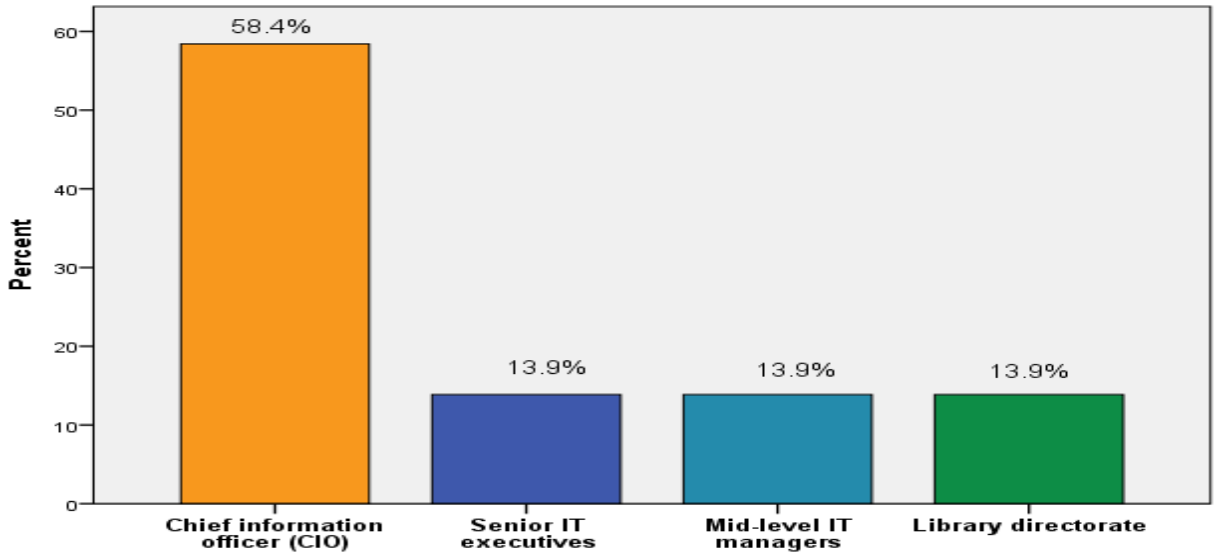

Figure 14. The responsible bodies regarding organizational data management strategy

When the researcher asked respondents who should primarily hold the responsibilities of institutional data management strategy of the institution. Since the entire respondents approximately 58.4% of the participants were reported that primarily data management strategy responsibility should hold by Chief information officer (CIO), 13.9% of the respondents designated that the responsibility of data management strategy should take Senior IT executives, on the other hand 13.9% of the respondents were argued that this data management strategy should take responsibility by Mid-level IT managers, while the remaining 13.9% respondents argued that this activity should take responsibly by library directorate.

Though, there are the pain point that lack of full internet connection inside the institution was the barrier to speculation in institutional data management that respondents most often named and followed by knowledge gap in chief information officer, senior IT executives, mid-level IT managers and organized library directorates, staff expertise and a decentralized institutional culture. Even if, respondents to assign their answer based on the appropriate choice given above, in common the responsibility of data management in higher education institution does not fall exclusively to the chief information officer and others listed above. But rather, institutions and organizations that must be support data management. As well as the institutional leaders have key roles in data governance and

institutional data management. In general, these groups have responsibility on institutional data management, such as: libraries, institutional repositories, information technology offices, research support services, data security offices, institutional review boards, registrars, human resources offices and information technology offices have the responsibility on data management and security issue.

4.2.12. **What do you think about the degree of information technology effectiveness on improving data management practice of the institution**?

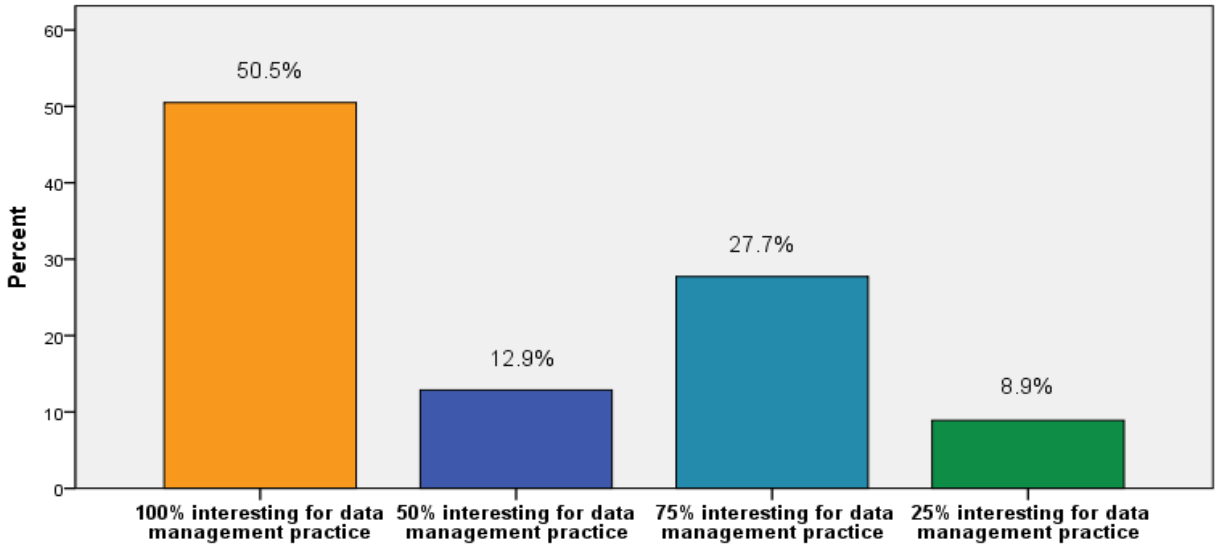

Figure 15. IT effectiveness on improving data management practice of the institution

Correspondingly, this study aimed to identify and investigate the current roles and requirements of information technology effectiveness on improving data managements of the higher education and to explore how it evolve in the future. Though, in order to better understand on this the researcher were asked the degree of information technology effectiveness on improving data management of their institution. From the total participants all 100% response rate were received. As indicated in the above Figure 15, over 50% of respondents were reported that information technology is 100% remarkable for improving data management habits of their institution, 27.7% respondents were reported that information technology is 75% interesting for the improvement of institutional data management, whereas approximately 13% of the respondents selected that information technology have 50% capability on improving data management practice of their institution and the remaining 8.9% of the respondents selected that information technology is 25% motivating for data management practice of their institution. As whole, what we understand from this result information technology and data

management are the two integrated words. If the infrastructure of information technology is fully available in any organization, so there is no doubt there is data quality management and strategic data governance.

4.2.13. How long do you think your inststitutinal data will have value?

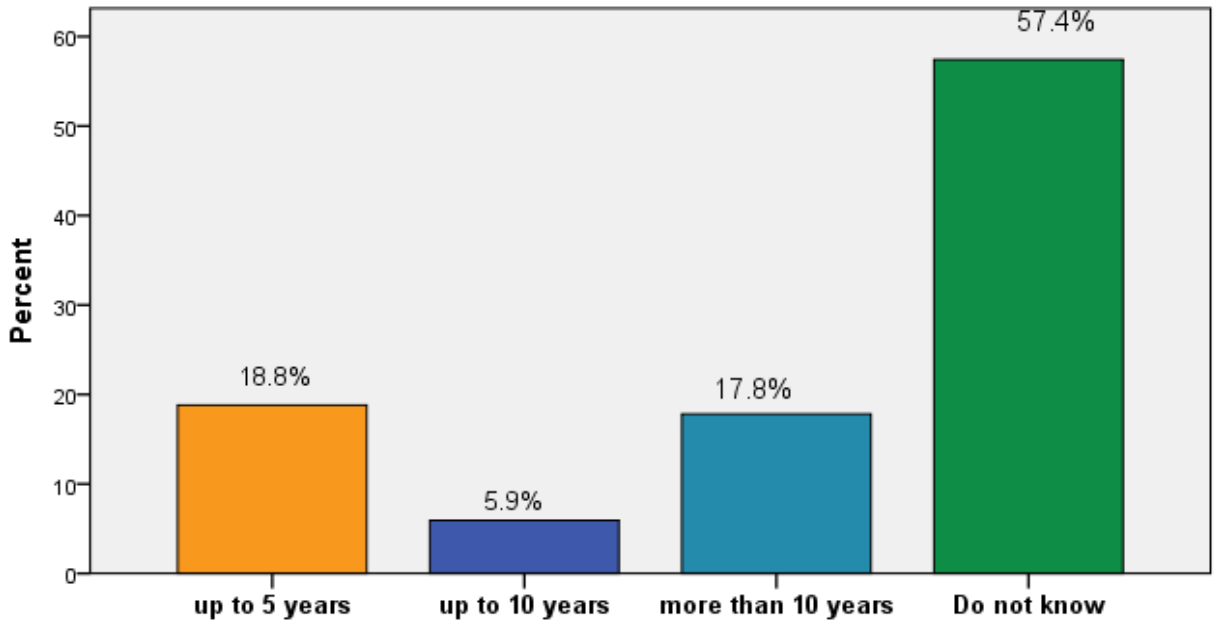

Figure 16. Length of period institutinal data value

In the same way, the researcher need to know how long they will be expected to keep institutional data in there organization. This questionnaire therefore, asked respondents to provide an estimation how long they think their data will have value. Almost, all of the participants were prepared to make an estimation based on this questionnaire, so since the entire participants around 18.8% suggested up to five years, 5.9% participants were suggested up to ten years, whereas 17.8% participants were suggested more than ten years and the remaining 57.4% participants were suggested "Do not know". This indicated us more than fifty percent said they did not know, there were no comments sought to this question. But the fact that a very large number of people answered in this categories indicated that data is usable for a long period, if it is appropriately managed in the organization.

4.2.14. How long do you store and preserve your student academic record data, after completed the semester course?

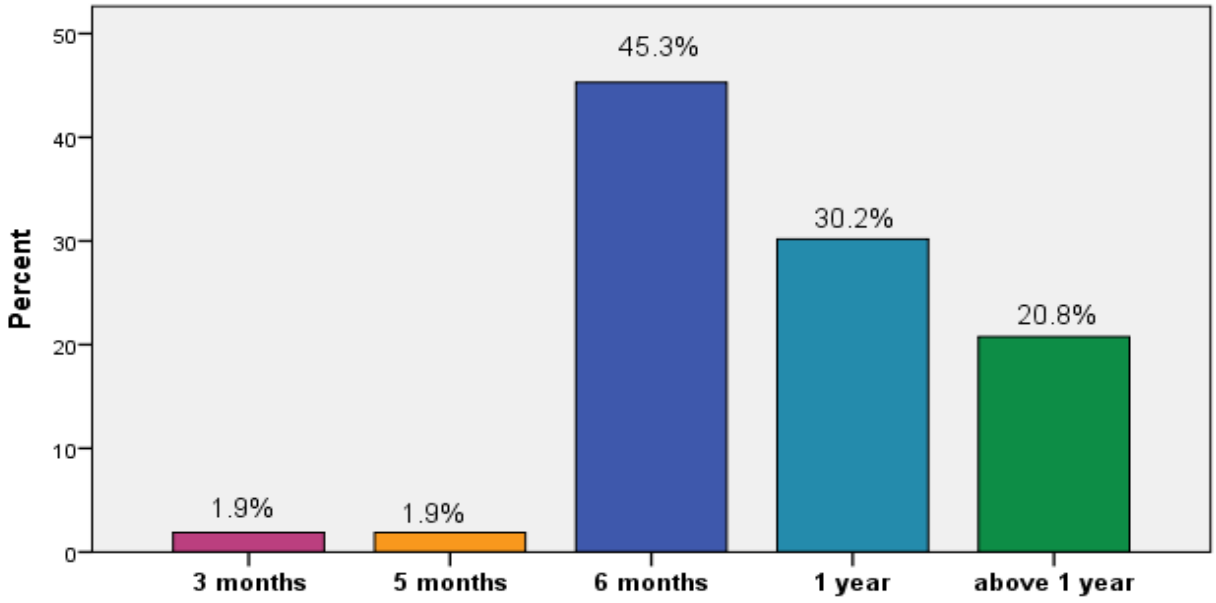

Figure 17. Students' academic record data storage and preservation period, after completing semester course

The researcher need to know how long they will be expected to keep students' academic record data, after completing the semester program. Therefore, the questionnaire asked academic participants to provide an estimation how long think their students' academic data records will have value. As this questionnaire only asked academic staff respondents, the results show that participants store data in a variety of different ways. From the whole academic participant only one participant were missed the questionnaire. Therefore, from the entire 101 participants 52.5% academic staffs were reported.

Because, this specified as, the questionnaire was not including the remaining 47.5% administrative staffs. So that, since the 54 academic respondents, approximately 98% participants responded their options. But 1.85% respondent was missed the questionnaire and 45.3% participants were suggested up to six-months, 30.2% participants were suggested up to one year, 20.8% participants were report that they store above one year, whereas one participants 1.9%) reported that store or preserve student academic record for only three months, and similarly one participant 1.9% were suggested up to five months. Therefore, the fact indicated us majorities of the response was between six months and one

year storage period. From the researcher view this result is advice able, because if the students' academic record discarded below six months sometime there may be mistake by teachers on student's mark. Similarly, if it stored above one year it occupy more space.

4.2.15. What storage device do you use for your data handling practice?

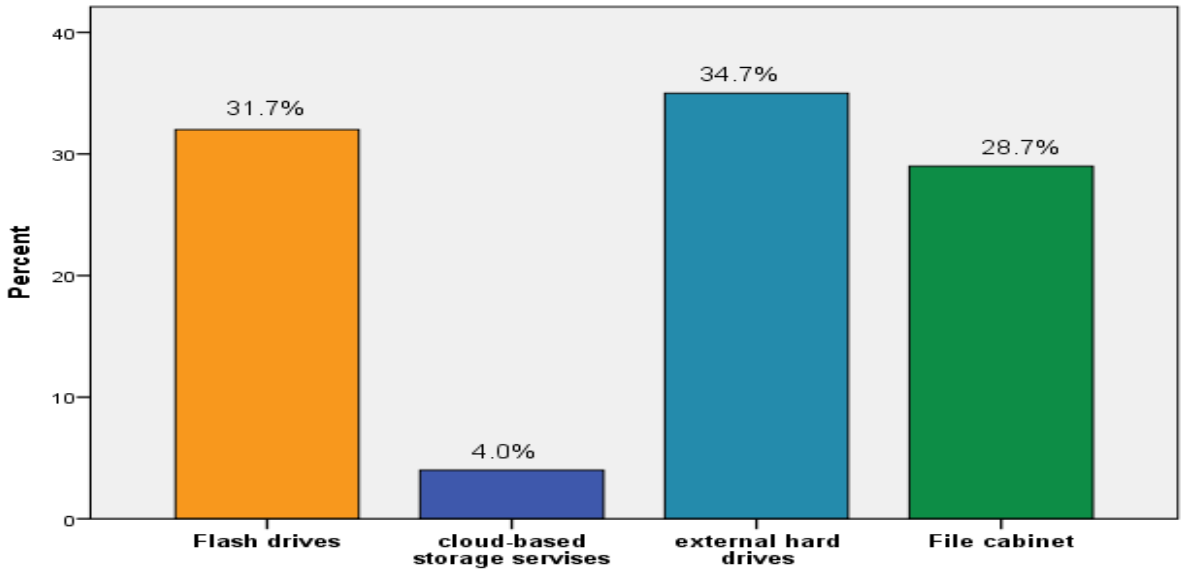

Figure 18. The storage device participants used for their data handling practice

In order to better understand participant's data storage devices, the researcher were asked what type of data storage device and backup they used. Almost 99.1% participants were responded and only one participant not answered the question (missed). As a whole, there was a wide variety of responses to a question about data storage device for handling their institutional data and used as backup. As showed in the above Figure 18, from the total 100 participants around 31.7% participants were report that they used "Flash drives", 4% participants were report they used" Cloud-based storage service", whereas 34.7% participants were reported that they used "External- hard drives" and the remaining 28.7% participants were used " File- cabinet". Though, as the result indicated us, more than two-third of participants were use external-hard drives for their institutional data handling, reservation and as backup. This presented only four participants were used cloud-based storage service. Consequently, it is essential to improve and innovate this cloud based technology in this university more broadly to the future.

4.2.16. Which departments would be most beneficiary from improved a data management practice?

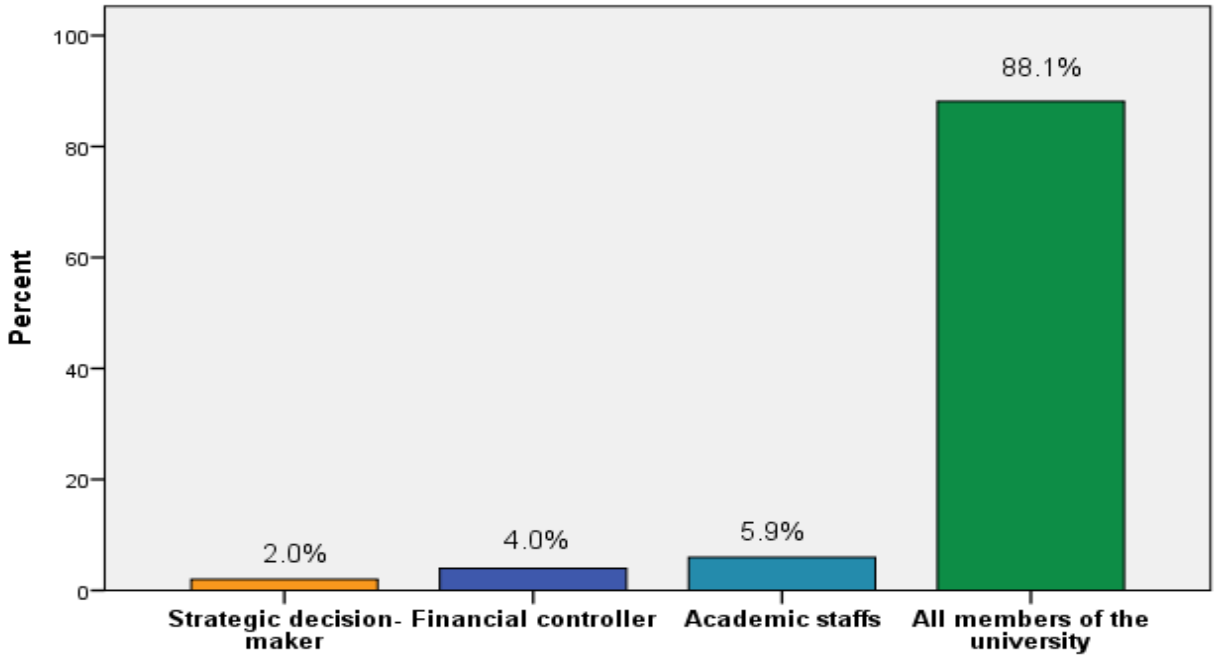

Figure 19. Benefiting departments from improved a data management practice

As a better recognition about which departments would be most benefiting from improving a data management practice in higher education institution, the researcher were asked the respondents this question. Though, the respondents could choose their answer based on this question.

According to the respondents view and results show that, almost all departments are most benefiting from improving a data management practice in higher education institution. as a whole, 88.1% of the participants were select that "all members of the university" are beneficiary from data management in higher education institution, 5.9% participants were reported that "academic staffs are beneficiary", whereas 4.0% participants were reported it is essential for "financial controller", and the remaining 2.0% participants were reported strategic decision-makers" are more beneficiary, if improving data management practice in higher education institutions. As commonly, this indicated us improving data management is not used to the particular staffs. Rather, it is essential in overall departments of the institution. Therefore, a key component of data management in higher education is the comprehensive description of the data and contextual information that future organizations need to understand and

use. Though, an effective data management program would enable customers extended in the future to discover, access, understand and use particular data.

4.2.17. **What is the future need regarding data management practice of your institution?**

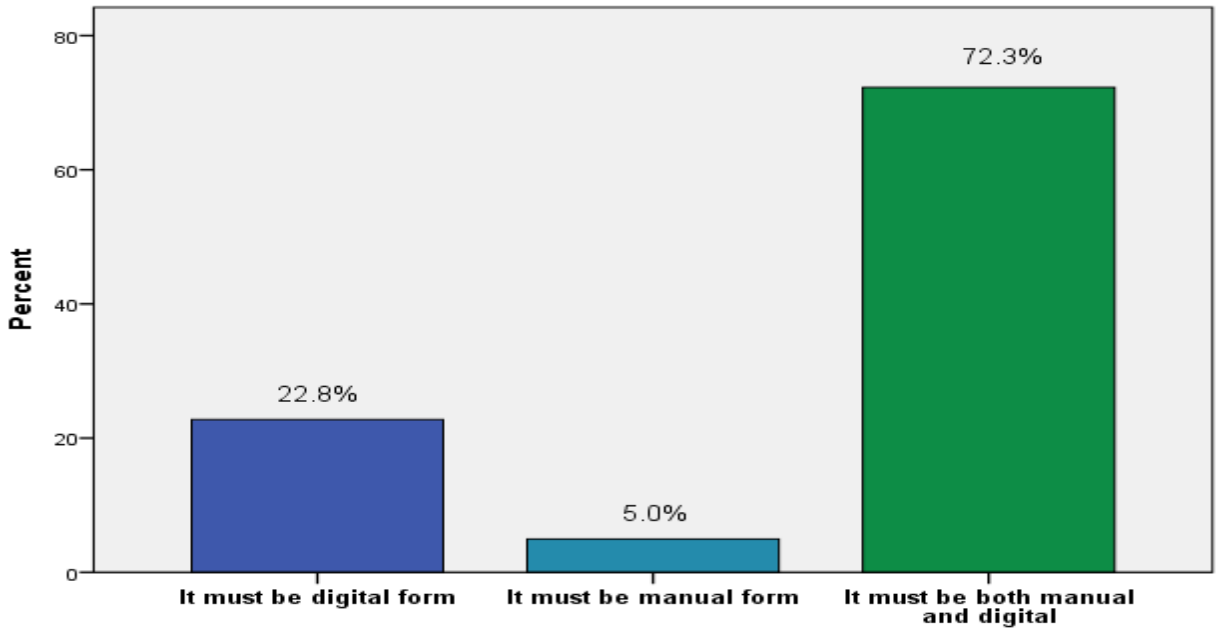

Figure 20. The future need regarding data management practice of the institution

As the study involved to described in chapter one, data management should be in both digital and manual format. Correspondingly, when the researcher were asked the participants, about future needs of their institution regarding data management practice. Whether it will be manual or digital format, after the analysis of the respondent's suggestion and interest the future data will be managed in both digital and manual format.

As displayed above 72.3% of the respondents were reported, their institutional data will be interested to manage in both digital and manual format. This indicated us the data in manual is supplementary to the digital format, whereas 22.8% respondents were selected that data must be digitally managed, while the remaining 5.0% of the respondents were reported data will be managed in manual format. The maximum respondent's interest is similar to what, the researcher suggested to data management in both digital and manual format. Though, in order to effectively manage the institutional data, staffs should be indicate their ability to communicate efficiently and successfully with institutional success.

4.2.18. From the existing data management, the institution gets academic and administrative value adequately.

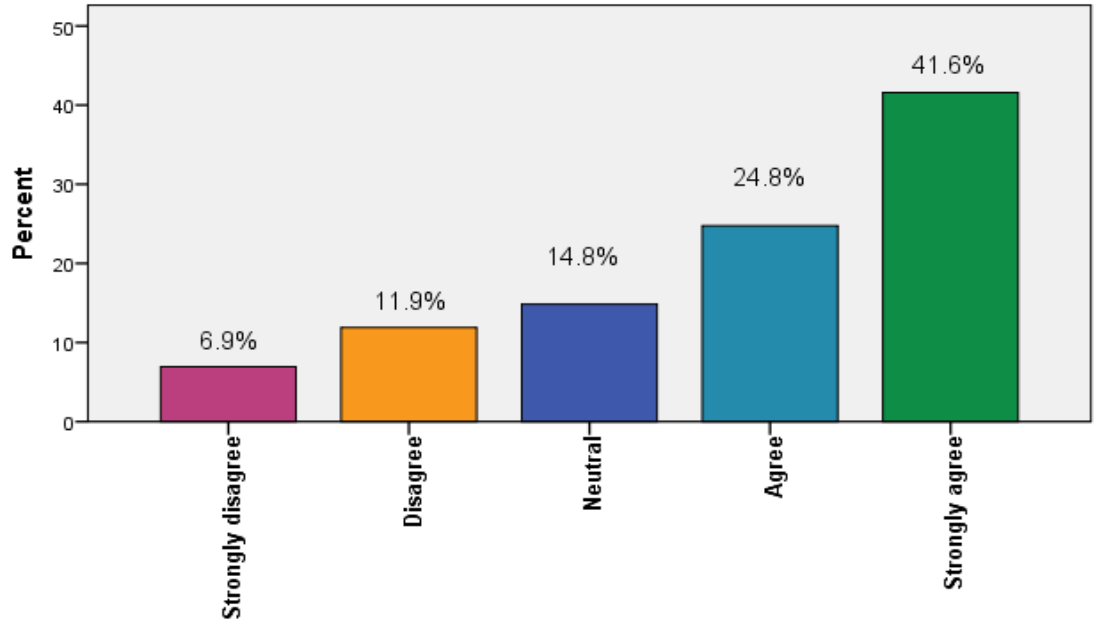

Figure 21. Academic and Administrative data value, from the existing data management

Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

Also in this research respondents were asked to choose likert-scale questionnaire in order to identify their institutional existing data management's significance, in terms of academic and administrative. Though, as the analysis result indicated above there were institutional data value adequately in both academic and administrative staffs from the existing data management. Commonly, since the total 101 respondents, approximately 41.6% participants who were strongly agreed that their institution have adequately value from the existing data management, whereas 24.8% of the respondents were selected agree, 14.8% of respondents were neutral, 11.9% of respondents disagree and the remaining 6.9% of respondents were strongly disagree. So that, this indicated us majorities of the participants argued that, the existing data management in their institution were significance. As entirely, from the overall participants, who agreed or strongly agreed on existing data management value is large in number, it's averaged 3.82 (above neutral).

4.2.19. Everyone should be involved in data management practice and planning in the organization.

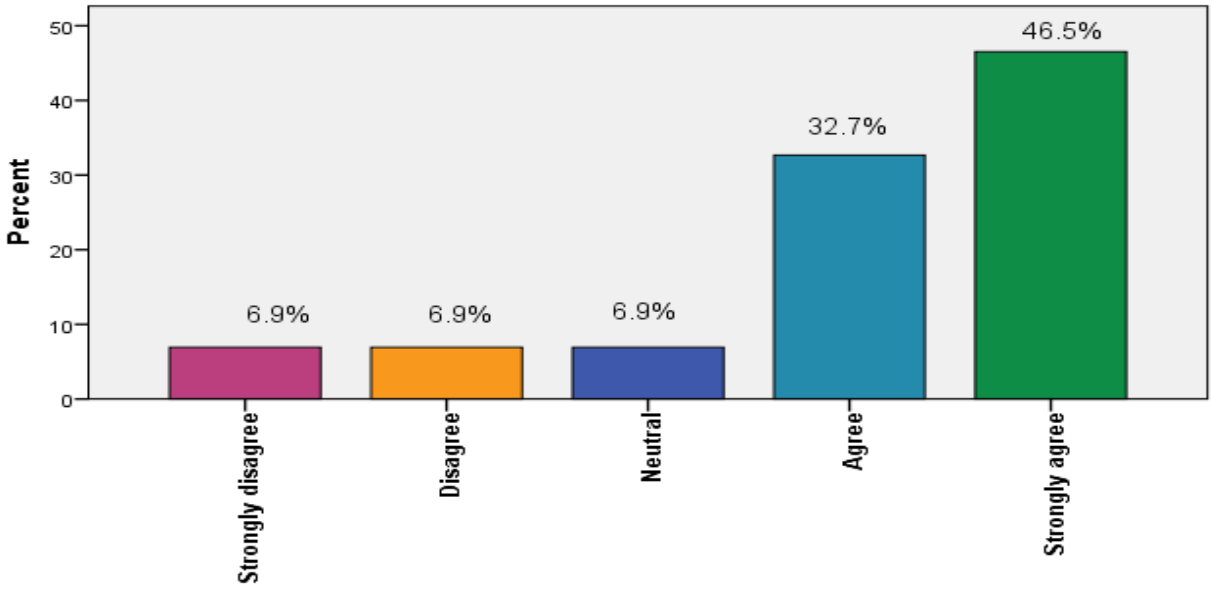

Figure 22. Individual involvement on data management and planning of the institution

Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

In addition, when the researcher asked participants this five scale question about their willingness, towards individual involve on institutional data management and planning**.** Almost, majorities were strongly agree that in order to have good data management and plan, it have relationship between individual involvement and institutional data management.

As entirely 46.5% of the respondents were indicated, they strongly agree that in order to improve institutional data management in their institution, individual should be involved, whereas 32.7% participants reported they were agree, 6.9% participant reported they were neutral, whereas 6.9% selected that they were disagree and similarly six point nine 6.9% of the respondents were strongly disagree. As general, approximately 79% participants were reported that agree and strongly agree the individual involvement regarding data management plan is interesting for institutional development. As commonly, overall participant were willingness to participate on their institution data management plan which is averaged mean**=4.05** (above neutral) and agree.

4.2.20. **The institution should be committed to offer training program on data management practice**.

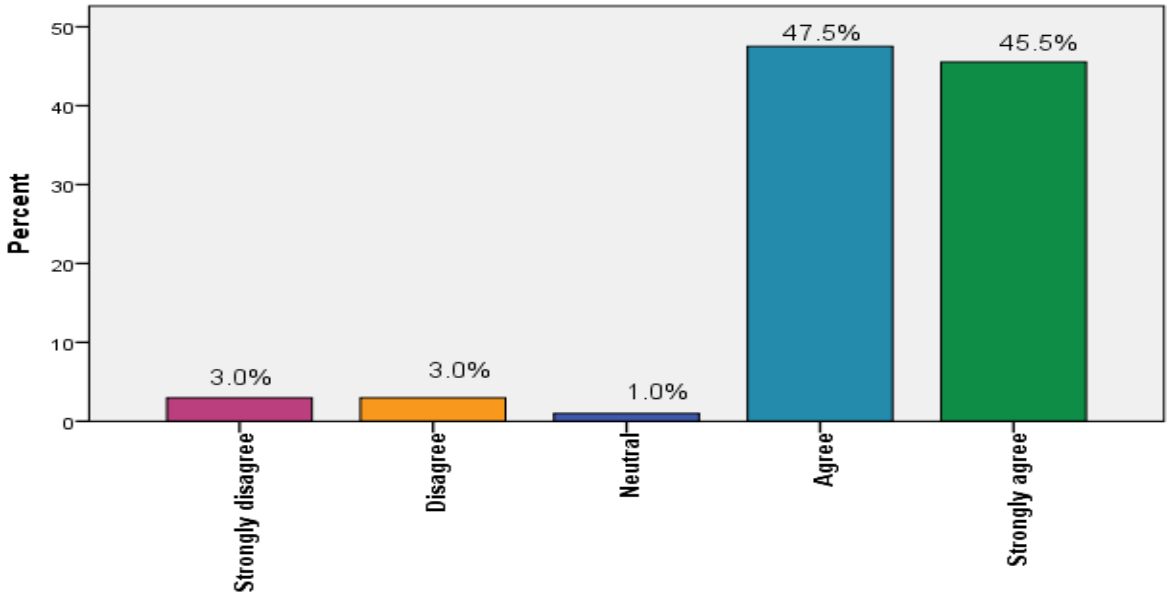

Figure 23. Institutional commitment to offer training program on data management practice

Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

One of the purposes of this study was to find out participant's interest, on receiving training program in different aspects of data management in there institution. Therefore, if the institution be committed to offer training program on data management, whether the respondents have motivation on acquiring training based on data management or not. The researcher asked respondents to choose likert-scale questionnaires, as Figure 4.20, indicated us majorities of respondents strongly agreed or agreed, that the training is interesting for enhancement of institutional data management. Consequently, the administrative and leaders of the institution should be take attention on giving a training program on data management issue.

Commonly, since the total participants around 45% were suggested strongly agreed, 47.5% of the respondents were suggested agreed, 1% of respondents were neutral, 3% of respondents disagree and the remaining 3% of respondents were strongly disagree, on institutional commitment to preparing data management program. So these indicated us training regarding institutional data management

issues was highly advice able among those who agreed or strongly agreed, because the respondents are interested on receiving training. Therefore, this was notable for all staffs or respondents who agreed or strongly agreed that need to receive training in data management averaged mean = 4.3 (above neutral) and agree. Taken as a whole, then, this results suggest that understanding of data management issues should widespread in to each departments. Though, in order to improve the institution data, giving training in individual level is essential and interesting.

In addition to the above quantitatively described result, there is also qualitatively analyzed, what the researcher saw in different departments concentrated on data handling and sharing activities of each staffs. Though, from the researcher observation there is minor a problem in this institution regarding to data management. Which needs the critical attention form the administrative and each departments, that enhancing and coordinating the institutional data management habits. Because, in a greater parts of the employees in each staff have no awareness regarding institutional data management.

The institution should carry out institution-wide evaluations of the relevance and effectiveness of data management in all departments. Otherwise, there is a wastage of materials that needs to repairing or maintenance, such material: chairs, tables, boards and electronic materials also malfunction in some departments, which included computers, cables, and others that needs consideration. Because, all of these materials are an asset to the institution. Why the researcher recommended this, there is a gap concerning on this activities and specific skills required to undertake thorough training, which is often prompt employee's efficiency regarding institutional data management.

Therefore, in a certain department data is located simply on table, shelf, and cabinet without separated year by year, not only this sometime there is a problem regarding data or information transferring from department to department at the necessary time. Though, if the important information is not transferred at appropriate time, it is meaningless to the user or the customer. Therefore, this research will notify the information to the institution regarding future development of data management habits and should expand technological infrastructure within the university and take a critical attention to the role of chief information officer and IT Services that will be increasingly focused on institutional data management.

Generally, what the researcher observed in this research, there is a vulnerability regarding data management and up to date information distribution to the appropriate stakeholder. Because, from the observation results, different staffs have minor problems. In each department data or information

is not categorized year by year, and sometimes information is arriving in appropriate department after the required time is expired. Since, data is the major driver for economic competitiveness in any organization. The institution need to work on imperatively to organizational improvement and each individual employee's skills calls for quality data management within educational environments. In addition the roles of academic librarians were described as key people with regarding to research data management and cataloguing different resources, enhance to particular activities, such teaching and participating in research meetings of the organization.

Finally, participants were asked to give there comment on this study. So that, the result indicated as positive, some respondents were grateful for being asked for their input on current research regarding institutional data management. Therefore, responses to this investigation especially, written replies to open end questions, suggested that Madda Walabu University is similar to other higher education institutions. Therefore, it should be committed to manage training program to all stakeholders of the organization, in order to manage appropriately institutional data. Particularly, over the long-term this institutional data management is an issue of concern for preparing documented policy and strategic plan regarding to institutional data management.

4.3. Key Findings

This study was concerned with how higher education institution data management improved with strategic goals of chief information officers and IT units, capacity and varieties of data the institution should to manage. And the researcher also drew conceptual framework from a number of institutional data management frameworks and components that identify topics of institutional data. So that, the researcher illustrated selectively diverse components of data from the number of data management frameworks and standards in order to identify topics of data management. In general, the following are the findings:

- From questionnaires, analyzed in this chapter, whether there is a relationship between individual awareness and data management, respondents were asked, approximately 82% of the participants agreed that individual awareness is vital for institutional data management in higher education. So that, the institutions in higher education should be committed to creating awareness in to individuals mind, in order to accomplishing the institutional success regarding data management.

- Participants were asked question about their institution, whether the institution has a documented policy regarding data quality management and security. Since the total participants only 13.9% were answered "yes", while 63.4% participants were reported that the institution does not have documented policy, while the remaining 22.8% reported "do not know". So that, what researcher recommended here is the administrative department should be make documented policy and addresses to the participants.

- From entire participants approximately 55.4% were answered information technology is not addressed strategic data management issues in their institution. Therefore, this institution need to review its information technology improvement and strategic data management plan, in order to competent with other higher education institutions and should work on technological expansion.

- Consistently, when the researcher asked to the participants about future needs of their institution, regarding data management and data format, whether it will be manual or digital format. Though, after analyzed of respondent's suggestion and interest 72.3% of the respondents were reported that, their institutional data will be interested to manage in both digital and manual format.

- Respondents were fairly positive in measuring which kinds of data needed to effectively manage in higher education institutions. Since the total participants 83.2% contended that all kinds of institutional data is need to manage in higher education institutions.

- However, data management strategies of the institution is responsibilities of all stakeholders, as stated above, from the total 58.4% participants reported that, it is the responsibilities of Chief information officer (CIO), 13.9% respondents designated the obligation of Senior IT executives, on the other hand 13.9% respondents argued that this data management strategy should take responsibility by Mid-level IT managers and while remaining 13.9% argued that this activity must take charge by library directorate.

- In order to understanding institutional success respondents were asked to choose likert-scale questionnaires to identify their institution existing data management value in terms of academic and administrative sectors. Since, the total participants, around 41.6% participants were "strongly

agree", whereas 24.8% respondents were selected "agree", institution have adequately gained value from existing data management, remaining are reported that neutral, disagree and strongly disagree. So this indicated majorities of participants argued existing data management in their institution were significance. As averaged mean response 3.82 (above neutral).

- ☞ As indicated above researcher asked respondents to choose in likert-scale, whether they are interested to attend training regarding institutional data management. Since the total participants 47.5% "agreed" if the institution committed to offer training regarding data management, whereas 45.5% "strongly agreed". In general, 93% of the respondents are interested to take training concerning institutional data management, if the institution is loyal to offer training. This result was notable for all staffs or respondents who agreed or strongly agreed on the need to obtain training regarding institutional data management, an averaged mean response was 4.3 (above neutral) and agree.

- ☞ Participants were also asked another five scale questionnaire about their willingness, towards individual involvement on institutional data management and planning**.** From the entire, 46.5% of respondents specified "strongly agree", that means they have willingness on institutional data management and planning, whereas 32.7% respondents were reported "agree", similarly, these who selected agree have willingness on participating institutional data management activities. In general, approximately 79% of the participants were reported that agreed and strongly agreed on individual involvement regarding institutional data management. Overall, participants who have willingness to participate on institution data management and planning, which is averaged mean response 4.05 (above neutral) and agree.

- ☞ There were findings from researcher view that supported by observation. Though, according to the job description of academic librarians and their roles regarding institutional data management should be deliver appropriate library facilities. This implies that their duties might change in line with technological and needs of users. In addition, these librarian should be work together with information science professional's to offer the right level of service to researchers, staffs, students and external customers.

CHAPTER FIVE

5. Conclusion, Future Work and Recommendations

This chapter deals about the conclusions, future work and recommendations based on this research. Because these are parts of this study according to the conducted review on data management in higher education institutions.

5.1. Conclusion

This research will expected to provide an input to the decision makers and administrators in higher education institutions and other organizations. Therefore, the researcher will be expected institutional stakeholders and customers gain a better understanding regarding institutional data management and trends towards the greatest improvement and implications for their institutions. Because, nowadays, the rapidly changing in information technology has created the novel and regularly development regarding institutional data management and these success on information technology required new skills, that facilitated significant progress in accommodating needs of a broader range of stakeholders in data management. It can also provide to transform quality education and allowing access to quality data in higher education, for the greatest numbers of customers at lower cost and with more flexible activities.

Therefore, data management in higher education institution is the group of activities that relating to the planning, development, implementation and administration of systems and repositories for the acquisition, storage, security, retrieval, dissemination, archiving and disposal of data. Such systems are commonly digital, but the term equally spread to paper-based systems, whereas the term records management is commonly used. These description includes all formats of data, whether these datasets are contents of relational databases, multi-media datasets, images or scientific products, archives of the institutions and other organizational data formats.

In general, in this research the researcher was used both the quantitative and qualitative research methods. The quantitative data were derived from the questionnaires collected from different variables based on data management practices of Madda Walabu Unviversity, by distributed to representative stakeholders of the main campus. While the qualitative information were derived from observing different departments based on their data handling habits and some extent from the respondents comment.

Initially, 112 study questionnaires were distributed to participants in Madda Walabu University main campus. However, from the total participants 101 useable study questionnaires, approximately 90% response rate were returned from distributed questionnaires. These respondents who participated in this research 61.4% were male participants, while the remaining 38.6% participants were female. These participants were selected by using simple random sampling techniques since the entire 1681 population in main campus of the university. Again, since the entire employees, 551 is academic staff, which included both of the local and foreign teachers. Once more from 551 teachers 75 are female teachers, while 476 are males. And also 1130 employees are administrative staffs that have 605 females and 525 males.

Commonly, the benefits of this study in this institution is expected to enhance all users and customers with institutional policymakers improving the awareness and understanding towards institutional data management of the university. In addition, this provides to identify the types of institutional data available for current and future use, improved admission of information, freedom from unnecessary obstacles, safeguarding from disclosure of personal information/violation of legal and contractual obligations, better quality and more timely information (i.e. reaching the right information at the right time to the right customer). Resulting quicker identification of customer need and avoidance of wrong or conflicting information, through the use of effective metadata data management in this university.

However, the institution should be committed to implement data management planning and conduct training program regarding institutional data management, which support their unique institutional environment. Therefore, institutional leadership and chief information officer should remember that indicators point towards upcoming larger task that making DMPs is part of research data lifecycle, including implications for the movement to open access of published research. Consequently, all guidelines provided here are time-sensitive and careful checking of the current trends across the institution and will demonstrate valuable improvement regarding institutional data management.

In addition, institutions of higher education are operating in an increasingly complex and competitive environment. Accordingly, they are under increasingly pressure of data in each day to day activities. Though, they need to respond the requests of costumers need in countrywide and widespread economic, political and social change. Therefore, higher education institutions, should grow their

data management habits with the proportion of students in certain disciplines surrounding there workplace and need to improve data quality management in their day to day activities. Consequently, institutions are not only ensure to respond the changes happening within and outside them, but they also remain relevant to their purpose in the societies that they serve. As a whole, opportunities and challenges discussed in this research will enable institutional policymakers and information technology experts / chief information officer to make informed choices when considering to explore and implement institutional data management habit in their institution.

5.2. Future Work

There are several additional questions that further research on this topic could explore. For instance, the researcher will fully interested to give authorization, if someone who needs to do further research to other universities and organizations based on this research topic. Because, there are many works uncovered during this study within this short period of time and lack of local reference in the past.

Generally, the researcher recommends that further research can be held to extend and enhance this research particularly in terms of scope for better generalization. Because, this research discovered the current status of data management practice, in Madda Walabu University main campus, the factors that make difficult to extend data management practice and problems that hinder its implementation in this institution. In addition, the researcher, permits the same research topic with the same procedure can be repeated to investigate the situation in several Ethiopian higher education institutions.

5.3. Recommendations

To effectively manage institutional data holdings and fully realize their potential, an organization should first be aware of the location, condition and value of data assets. Conducting training program to the individual employee will provide to the institution; can create awareness on institutional data management and raise this awareness to the collection strength and data issues to improve overall strategy. It will also enhance to highlight inadequacies in data creation and data management. So that, an organization should knowledgeable about its data and puts itself in a position to maximize the value of its collection through continued use.

In general, based on findings, the researcher strongly agreed needs of the following measures, in order to improve the current Madda Walabu University data management and alleviate the problems they are facing.

- ☞ Majorities of workforce in this institution are young who are eager to know technology and data management. Thus, in order to bring the desired success, mass training on institutional data management needs to be delivered for all university staffs.

- ☞ In order to narrow dawn the gap among what is intended and what is achieved through data management and data security; responsible body should allocate information technology and internet resource sufficiently in all departments.

- ☞ The commitment in higher management and assigning responsibility to all stakeholders with sharing overall activities, including managing training and staff development are supposed to enhance good data management implementation in this university.

- ☞ Developing institutional data management culture is compulsory to all high level universities. Because, as the number of students increases every year, hence to increase institutional data asset with enough material resources and quality assured education. Therefore, it should be taken as a primary task in every higher educational institutions.

- ☞ The management of institutional data (school data, department data, library resource, human resource, registrar data, updating curriculum data, research data and learning and teaching materials), should be begin to properly manage. Therefore, this university should be decide how to implement and offer the responsibilities of institutional data management to each individual stakeholders. Because, data by itself is institutional asset and enhance as further research input.

- ☞ Responsible bodies should be work on conducting training program regarding institutional data management for all stakeholders. In addition, the current ICT and internet infrastructure cannot survive with the number of university communities. In certain departments laboratory rooms and materials are poorly maintained; especially, in many engineering and technology institute are almost permanently closed. Therefore, the university needs to invest well supported and maintained laboratory resources which are open 24 hours a day and seven days in a week, to ensure effectiveness and productive of human resource in their chosen careers.

- In order to meet strategic objectives the institution should be able to take advantage over vast amount of data available to it, which created and generated from its day to day activities.

- In addition, it needs building technological infrastructure that support to data-driven decision making.
- The institution should immediately review their internal data management approaches and put in place action to ensure that their data is fit for purpose.

- Institutional commitment regarding data quality management at the top leadership level and at department level enhance to call leaders and staffs to identify standards. These institutional standards can promote the improvements of good data management and scale up activities across departments and think up effectively.

- In general, the goals of information technology strategic plan regarding institutional data management is improve institutional competitive advantage. In addition, it provides to increase strategic alignment and better customer relationship with strategic decision making.

- In addition, quality data management framework allow to the institution to display pathway of employees and customer satisfaction. Therefore, this institution should have quality data management framework in each departments.

- Working properly with institutional data can help to all stakeholders improve both academic progress and understand which instructional practices are effective. The study also describes, how institutions can examine their own estimation on data management to identify their strengths and weaknesses and set institutional goals.

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Appendix A

Higher Education Institution Data Management Practice

Case study questionnaires

February 2017

Dear participant:

I am the undersigned graduate student of Addis Ababa University, as part of the requirement for the degree of masters of Science in Information Science. I am asking you for participate in this research by completing the allocated questionnaires. I hope that the questionnaire will require approximately 25 minutes. That all information will remain confidential, please do not include your name and complete all of the questions as honestly and each of individual question on the study is completely voluntary. The purpose of this questionnaire is to explore, what is the present practice about data management and cultural factors in the higher education institution, especially in Madda Walabu University, concentrating in all departments and staffs of in main campus.

As defined by different researchers institutional data management is "the policies and practices by which higher education institutions effectively collect, protect, and use both digital and manual information assets to meet academic and business needs". This study includes sections such as; awareness on data management, work experience, responsible body on data management practice, data quality and integrity, data governance, data security, content and records management, research data management, storage device, data management plan, information technology strategic plan , data management policy, the future needs of institution data management and data management outcomes.

Part 1: Demographic Information:

Your sex make it (X): A) Male ☐ B) Female ☐

Your age interval in years make it (X): A) 20-25 ☐ B) 26-30 ☐ C) 31-36 ☐ D) above 36 ☐

General Information:

Your duty (work): _____

Part 2: Questions:

Instruction: put your answer by circling the letter you choice in each question.

1. Is there any relationship between individual awareness and data management practice?
   A) Yes B) No
2. Do you have awareness about data management practice in your institution?
   A) Yes B) No
3. Is there a formal data management plan in your institution?
   A) Yes B) No C) Don't know
4. Does IT strategic plan in your institution clearly address data management issues?
   A) Yes B) No C) Don't know
5. In your institution, is there a documented policy, about data quality management and security?
   A) Yes B) No C) Don't know
6. Does your organization face problem from the lack of understanding on data management?
   A) Yes B) No C) Don't know
7. If there is a problem from lack of understanding on data management, which one is described as the root of the problem?
   A) lack of technical expertise that our ability to use the data we have
   B) Data sharing is hindered by concerns about data security
   C) Senior managers do not appreciate the importance of a data management culture
   D) My organization does not face problems realizing a data management culture
8. Based on the following ranges, where dose your work experience fall in this university?
   A) 0-2 years B) 3-5 years C) 6-8 years D) 9-11 years
9. In your opinion, which of the following types of data is highly needed for management of the organization?
   A) Registrar data B) Research data C) Human resource data D) Library data E) All the above

10. How does your institution manage research related data?

A) It is available in web based (online) B) It is stored as hard copy format (cabinet)

C) It stored by external storage device D) Don't know

11. In your opinion, who is primarily responsible for your organization data management strategy**?**

A) Chief Information Officer (CIO) B) Senior IT executives

C) Mid-level IT managers D) Library directorate

12. What do you think about the degree of Information Technology effectiveness on improving data management practice of the institution?

A) It is 100% interesting for data management practice

B) It is 50% interesting for data management practice

C) It is 75% interesting for data management practice

D) It is 25% interesting for data management practice

13. How long do you think your institutional data will have value?

A) Up to 5 years B) Up to 10 years C) More than 10 years D) Don't know

14. How long do you store and preserve your student academic record data, after completed the semester course?

A) 3 months B) 5 months C) 6 months D) 1 year E) above 1 year

15. What storage device do you use for your data handling practice?

A) Flash drives B) Cloud-based storage services C) External hard drives D) File cabinet

16. Which departments would be most beneficiary from improved a data management practice?

A) Strategic decision-maker B) Financial controller

C) Academic staff D) All of the members of the university

17. What is the future need regarding data management practice of your institution?

A) It must be digital form B) It must be manual form C) It must be both manual & digital

18. From the existing data management, the institution gets academic and administrative value adequately.

A) Strongly disagree B) Disagree C) Neutral D) Agree E) Strongly agree

19. Everyone should be involved in data management practice and planning in the organization.

A) Strongly disagree B) Disagree C) Neutral D) Agree E) Strongly agree

20. The institution should be committed to offering of training program on data management practice.

A) Strongly disagree B) Disagree C) Neutral D) Agree E) Strongly agree

Part 3: Comment:

I. What does your suggestion on currently undergoing research? Write down some suggestion what you feel?

_____

_____

_____

_____

_____End.