

**JIMMA UNIVERSITY**  
**SCHOOL OF GRADUATE STUDIES**  
**DEPARTMENT OF INFORMATION SCIENCE**

**CLOUD LIBRARY FOR EFFICIENT UTILIZATION OF E-  
RESOURCES AMONG LIBRARIES IN ETHIOPIAN PUBLIC  
HIGHER LEARNING INSTITUTIONS**

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**Cloud Library for Efficient Utilization of E-Resources among Libraries in  
Ethiopian Public Higher Learning Institutions**

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As member of the board of examiners of MS.c thesis open defense examination of  
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**Dedicated**

To

My beloved families

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## Table of Contents

	Page
Table of content	ii
Acknowledgement .....	ii
Abstract .....	viii
CHAPTER ONE .....	9
INTRODUCTION .....	9
1.1. Background .....	9
1.2. Statement of the problem .....	11
1.3. Objectives of the study .....	13
1.3.1. General objective .....	13
1.3.2. Specific objectives .....	13
1.4. Scope and limitation of the study .....	14
1.5. Significance of the study .....	14
1.6. Operational definition .....	16
CHAPTER 2 .....	17
LITERATURE REVIEW .....	17
2.1. Theoretical concept .....	17
2.2. History of E-library services .....	18
2.3. Changing Information Environment in libraries .....	19
2.4. Library Resources and Services in ICT Environment.....	21
2.5. Cloud computing .....	24
2.5.1. Cloud resource allocation model .....	25
2.5.2. Cloud Computing Deployment Models.....	27
2.5.3. Impediments of using cloud technology.....	30
2.6. Libraries in the cloud technology.....	31

CHAPTER THREE .....	41
RESEARCH DESIGN AND METHODOLOGY .....	41
3.1. Research Design.....	41
3.2. Description of the Study Sites.....	42
3.3. Study Population .....	44
3.4. Inclusion and exclusion criteria.....	44
3.5. Sampling method.....	45
3.6. Sample size determination .....	45
3.7. Data Collection.....	47
3.8. Data Collection Procedure .....	48
3.9. Pre-test of data collection instrument.....	48
3.10. Data Quality Control .....	50
3.11. Data Analysis, Presentation and Interpretation .....	50
3.12. Ethical consideration .....	51
CHAPTER FOUR.....	52
Results and Discussions.....	52
4.1. Results .....	52
4.1.1.1. Proportion of respondents and Response Rate .....	52
4.1.1.2 Demographic Analysis for librarians, students and staff.....	53
4.1.1.3. Computer Literacy Skills of students and staff .....	53
4.1.1.4. E-library service use. ....	54
4.1.1.5. E-library service provision .....	55
4.1.1.6. Device used to access e-library .....	57
4.1.1.7. E-library services usage frequency.....	58
4.1.1.8 E-library service quality measurements .....	60
4.1.1.9. Source of e-library services use.....	63
4.1.1.10. Knowledge of cloud library.....	64

4.1.1.11. Services used from cloud.....	64
4.1.1.12. Benefit of cloud services for users .....	65
4.1.1.13. National library system.....	66
4.1.2 Responses of Librarians.....	67
4.1.2.1. Internet connectivity in the universities.....	67
4.1.2.2. E-library service provision .....	68
4.1.2.3. Respondents opinion on adequacy of resources and services .....	70
4.1.2.4. Factors affecting to develop e-library services.....	73
4.1.2.5. Cloud Library .....	74
4.1.2.6. Cloud library development model .....	75
4.1.2.8 Reason to have cloud library .....	77
4.1.2.9. Expectation of library service on cloud.....	78
4.1.2.10. Challenges and constraints to development of cloud library.....	79
4.1.2.11 Responsible bodies to cloud library implementation.....	81
4.1.3. Qualitative data result.....	82
4.2. Discussion .....	85
4.3. Proposed Framework for Cloud Library .....	91
4.3.1. Components of cloud Library.....	91
CHAPTER FIVE .....	101
SUMMARY, CONCLUSION AND RECOMMENDATION.....	103
5.1 Summary of findings.....	101
5.2. Conclusion and Recommendation .....	102
5.2.1. Conclusion.....	102
5.2.2. Recommendation.....	103
References.....	105
Appendixes .....	111



## **List of Figure**

Figure 2.1 The NIST cloud computing definition framework .....	29
Figure 2.2: Application of cloud computing in university library .....	39
Figure 4.1: Levels of respondents' computer literacy .....	54
Figure 4.2: Use of university e- library services in the universities .....	55
Figure 4.3: Devices used for access services .....	57
Figure 4.4: sources of e-library service.....	63
Figure 4.5: Awareness about cloud library.....	64
Figure 4.6: Services used from Internet.....	65
Figure 4.7: Need for library being part of national system.....	67
Figure 4.8 Level of Internet connectivity at universities .....	68
Figure 4.9: Cloud library is the best solution.....	74
Figure 4.10: Cloud Computing Deployment models in libraries .....	75
Figure 4.11: Level of cloud computing in libraries .....	76
Figure 4.12: Expectations of library services through cloud library .....	78
Figure 4.13: Reason to not have cloud library .....	80
Figure 4.14: Responsible bodies for establishing Cloud Library .....	81
Figure 4.3.1.2: Cloud library service model .....	92
Figure 4.3.1.3. Proposed cloud library framework for EPHLI .....	99

## **List of Tables**

Table 3.1: The total population for the study .....	44
Table 3.2: sample size from each university .....	47
Table 4.1: Response rate of samples .....	52
Table 4.2: Profile of respondents .....	53
Table 4.3: Summary of provision of e-library services.....	56
Table 4.4: ANOVA table of service availability among the three universities .....	56
Table 4.5: The Usage Frequency of e-library by the Respondents .....	58
Table 4.6: ANOVA table for service usage investigated .....	59
Table 4.7: Respondents' opinion about the quality of services in the Library .....	60
Table 4.8: ANOVA table for service quality measurement .....	62
Table 4.9: Respondents' opinion about the benefit of cloud library use .....	66
Table 4.10: E-library service provision of university library .....	69
Table 4.11: Respondents' opinion on adequacy of resources and services .....	70
Table 4.12: ANOVA table for resource availability in the university library .....	72
Table 4.13: Respondents' opinion factors affect to develop e-library .....	73
Table 4.14: Drivers for librarian's interest in cloud library system .....	77
Table 4.15: summary of factors affecting cloud library implementation.....	79

## **List of Abbreviation**

**ENISA**-European Network and Information Security Agency

**EPHLI**-Ethiopian Public Higher Learning Institution

**HU**-Hawassa University

**IAAS**-Infrastructure as a Service

**ICT** – Information Communication Technology

**ILS**-Integrated Library System

**IT** – Information Technology

**JU**-Jimma University

**MARC**-Machine Readable Cataloging

**MOE**-Ministry of Education

**MTU**-Mizan Teppi University

**NIST**-National Institute of Standards and Technology

**OCLC**-Online Computer Libraries Center

**OPAC**-Online Public Access Catalog

**PAAS**- Platform as a Service

**SAAS**-Software as a Service

## **Abstract**

Academic libraries of Public Higher Educational Institutions in Ethiopia (PHEIE) suffer from common problems like flexibility associated with e-library services, lower levels of efficiency, unequal distribution of information resources and huge costs involved in managing the entire Information and Communication Technology (ICT) infrastructure. The main aim of this study was to investigate ways in which resource sharing among Ethiopian university libraries could be enhanced through the use of cloud technology with a view of suggesting a framework for effective application of cloud library in resource sharing. The methodology employed to conduct this study was survey research and the respondents' drawn from Jimma, Mizan-Tepi and Hawassa Universities, which comprised of librarians, ICT professionals, students and staffs. Simple random sampling method was used to select samples from study population and a purposive sampling method was used to select study areas and samples for interview. Data for the study was collected through questionnaire, semi-standardized face-to-face interview and observation. The preliminary results of the research show that 76.5% of respondents agreed cloud library was best means to increase resource sharing among universities. The majority of the respondents indicated that cloud library will benefit users in many ways; by-access to all services at one point with  $M=4.7$ ,  $SD=1.2$  as well as ease to get disseminated information with  $Mean=3.6$ ,  $SD=1.3$ . The study found that cloud library had a potential to minimize duplication of e-library projects with  $M=3.75$ ,  $SD=1.28$  and to enhance abilities to integrate libraries with each other by a  $M=3.79$ ,  $SD=1.28$ . It found also that cloud library technologies are not available in EPHLI and thus can be said that their impact on resource sharing had not been felt. Hence, the recommendation for the availability of cloud library technology applications for access of EPHLI libraries in Ethiopia was provided.

# CHAPTER ONE

## INTRODUCTION

### 1.1. Background

Student intake capacities in Ethiopian universities are on the increase from time to time (MOE, November 2013). With the same rate, institutions are working individually to enhance their library services and resources to meet the information needs of their patrons at all levels. Without quality service, establishing libraries by itself cannot be the solution we seek for. Libraries should be supported by information technology (IT) infrastructure, web 2.0 applications, enough information resources, up to date information and services with better system for delivery (Faiz.A, 2012). The theoretical ground for this research was systems theory of organizations in which a library and its interrelated activities are viewed as an open system that exists in a dynamic environment and must be adaptable and be able to change.

Clients tend to measure the relevancy of information according to the “newness” of the technology used in libraries. In other words, technology is defining the “notion of what makes a library successful” (Holt, 2007). But more than half of the public universities in Ethiopia have no technology oriented e-library services and resources for use, especially third generation universities. Since Cloud computing has emanated with its own set of standards, nomenclatures and practices that require clear understanding for its acceptance in the libraries and realization of Cloud library development and management in the future.

It is obvious that library is not only a knowledge ocean; its ultimate aim is to provide satisfactory services for all people. So in the new era, library should improve itself constantly by adopting many new IT technologies (UNESCO, 2003).

According to Kumar and Mandal (2013) Cloud library is the use of library resources that are delivered as a service over a searching information. However establishing such system by itself is meaningless unless users' system acceptance is studied hand in hand.

In Ethiopia different preliminary works were done as part of a national capacity building program that includes schoolNet and WoredaNet that aims to provide connectivity and specialized applications for schools and local governments (Sewale, 2012). The Ethiopian Education and Research Network (EthERNet) was launched in 2009 to build and deliver highly interconnected and high performance networks for Universities and other Educational and Research Institutions in Ethiopia. More specifically, EthERNet was aimed to build and deliver high performance networking that connected these institutions with each other and similar institutions in the world, and by doing this to enable them to share educational resources and collaborate both within Ethiopia and globally (Shaik & Saidhbi, 2012) .

Today in EPHLIs there exist a technological divide, dissimilar distribution of information resources and replication and redundant procurement of information resources and library projects and technological infrastructure among university libraries. Moreover, information poverty is what these universities are epitomized

with. If the concept of cloud library is applied in a university all the colleges that are under that university can be connected directly to the library cloud. All the information related to the library can be uploaded to the cloud and without worrying about the infrastructure users can access this information and the research articles.

Cloud library mostly implemented and administered either by private, public or cooperatively. The resources that can be shared by multiple organizations were placed in the cloud and then it can be available to all hosted universities. For example, in Ethiopian universities e-granary is required by every university; this means there is a need to buy the database for all the 33 universities in the country. If the e-granary for one university costs 35 thousand birr, then we can imagine how much cost we will invest to have the e-granary in all the 33 universities. The same is true for other library services. But this cost can be significantly reduced by deploying a single copy of the e-granary in to the cloud library.

## **1.2.Statement of the problem**

Currently, in EPHLI library development is at an infant stage and not more than 5 universities out of 33 started working on building IT based library services. The reasons for such a scenario to occur could be, among others, the lack of qualified professionals, infrastructure and economic conditions, the rest of the university libraries are less capable to develop IT based library system. Library resources available in different universities vary. Data resources of various universities are relatively independent, building redundant projects is thus the case, which has

resulted in manpower shortage, financial resource constraints and wastage of resources and as a consequence led to inefficient and ineffective utilization of the limited resources of the country (Rupesh.S and Gaurav. K, 2011).

Building and sustaining electronic library at each institution requires qualified librarians with the required skills to manage and maintain the technology infrastructure required for the purpose at each university. However, there is immense scarcity of professional digital librarians in Ethiopia and electronic library building requires specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities (Waters, 2010).

In the era of digital libraries, library users pay more attention to electronic journals, electronic databases and so on (Rupesh.S and Gaurav. K, 2011). This is hardly possible in all university libraries in Ethiopia because majority of the universities have no e-resources especially 2<sup>nd</sup> and 3<sup>rd</sup> generation universities. So, it is difficult to meet users' information need in such condition. This indicates users are not equally served or there is no balanced service among universities under the same umbrella. Thus, it is high time to establish cloud library and provide timely and equal service to library users of all higher education institutions in Ethiopia.

To this end, this study attempted to answer the following research questions:

- How could technology like cloud library solve the digital divide between public university libraries?

- Is the present EPHLI e-library service delivery system efficient?
- What are the factors affecting e-library service development?
- Can cloud based libraries potentially benefit the institutions?
- What are the existing impediments and the challenges to adapt cloud library application?

### **1.3.Objectives of the study**

#### **1.3.1. General objective**

The main objective of the study is to investigate ways in which resource sharing among Ethiopian university libraries could be enhanced by use of cloud library.

#### **1.3.2. Specific objectives**

- ❖ To examine the current e-library services provision and effectiveness
- ❖ To observe factors affecting e-library service development
- ❖ To understand the level of resources and service differences between Ethiopian Public Higher Learning Institutions (EPHLI) library.
- ❖ To audit cloud library as a means to share e-library resources and project technological solution to make the digital divide even between EPHLI libraries.
- ❖ To investigate how cloud libraries benefit Ethiopian Public Higher Learning Institutions.



#### **1.4.Scope and limitation of the study**

The main intent of the study is to investigate benefits of cloud library for Ethiopian Public higher learning institution library and put forward a framework that could be used as a baseline for implementation. The study was focused on exploring the current e-library service delivery approaches in 3 selected Ethiopian Public Higher Learning Institutions (JU, HU & MTU) libraries. The study also limits itself to the study population in the selected universities based on frequent use of e-library services. Because of time constraints and resources the researcher did not go further to evaluate the proposed framework.

#### **1.5.Significance of the study**

The primary goal of this research is to identify the research gap cloud technology in Ethiopian university libraries and their effect on resource sharing. In order to evaluate the technical and non technical obstacles to use cloud library, couple with exploring the corresponding opportunities to overcome those challenges. Some recommendations will be explored when applying cloud libraries across different boundaries and countries. Furthermore, a designed and developed a flexible cloud library framework for patrons in different geographic locations for easily exploring diverse resource for their use through internet. The thesis results can also be used as a reference point for other similar research to determine whether (or how) to migrate from traditional isolated computer system to cloud based services.

Libraries in Ethiopia are facing many challenges. With the advent of Information technology, libraries have become learning commons, automated and digitized which is the basic need towards advancement followed by networks and more effort towards cloud libraries. The emergence of e-publishing, digital libraries, internet usage, web tools application for libraries, consortium practices leads to further developments of library and the services they give to their patrons. The latest technology trend in library is the use of cloud computing for various purposes including library economic improvement.

Cloud library technology offer many interesting possibilities for libraries that may help to reduce technology cost and increase capacity reliability, and performance for some type of automation activities.

Cloud library increases efficiency by improving resource utilization. It will help university libraries to share the server in many application procedures, realizes the resource sharing, thus also reduce server's quantity, achieves the effect of reducing the cost, effective use of limited professionals in the country; therefore utilizes cloud library application in the library bring about efficient and effective utilization of the available e-library resources found at various universities in the country.

## **1.6.Operational definition**

**Cloud Computing:** is methods of using applications and services that run on a distributed network that can be accessed by a common internet protocols

**Cloud library:** it is the use of library resources that are delivered as a service over searching information.

**Cloud:** a visible mass of IT infrastructure moving and being processed in a single place.

**Ethiopian Public Higher Educational Institutions:** is an educational institution which is governed by MOE in the country and deliver the education level beginning from higher diploma program to PHD level.

**Infrastructure:** the basic physical and software structures of systems that need for the operation cloud application.

**Libraries:** A source of organized, classified, and sorted information resources where found.

**Library system:** is a system in which done through the help of IT.

**Platform:** a raised level surface on which software's, services and infrastructures can stand.

**Resource sharing:** A mode of operation whereby library functions are shared in common by a number of libraries.

**Resources:** are a sources or supply from which benefit is produced for users.

**Virtualization:** Is the process of converting systems to a computer generated simulation of reality.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1. Theoretical concept**

The theoretical framework that was used to inform this study is derived from the Systems Theory of Organizations advanced by Ludwig Von Bertalanffy in the early 1950s which stipulates that a system consists of various subsystems which must function together for the system to work (Oso and Onen, 2005). It also stipulates that a system is an open entity that interacts with the environment. Systems Theory was selected for this study because of its fundamental notion of interaction in that libraries can be studied as open systems that have subsystems that interact with each other and with the environment.

Systems Theory stipulates that a system consists of various components or subsystems which must function together for the system to work. Oso and Onen (2005) argued that if a subsystem fails, the whole system is put in jeopardy. They further argued that the fundamental concept of System Theory is the notion of emergence and interaction.

Systems take inputs from the environment, process them and produce outputs to the environment. Systems are also characterized by self-regulation and control. They monitor, regulate, and control their outputs in order to remain stable and achieve goals. Because a system exists in a dynamic environment, it must be adaptable and able to change (Littlejohn and Foss, 2005).

The system theory was preferred because of its concept, i.e., a system consisting of subsystems that are interrelated and that work together for the system to work and open systems interact with the environment and are affected by the changes that take place in the surrounding environment. Resource sharing as a subsystem of the library system has functions that are interrelated and that are affected by changes in the surrounding environment. The goal of resource sharing in academic libraries is effective utilization of resources, cost saving, provide relevant and up to date information to library users and lower level of efficiency among libraries. Cloud library has impacted heavily on IT infrastructure, e-information resources and e-library services environment within which academic libraries operate. Higher user expectations, changes in information use, changes in the provision of services, are all changes driven by cloud library that are forcing academic libraries to change the way they do business.

## **2.2. History of E-library services**

The use of e-libraries began with the development of the machine-readable cataloging (MARC) format in the mid-1960, a full 30 years before the introduction of the World Wide Web and its subsequent ubiquity. Bibliographic databases became available at around the same time. Databases on CD-ROM began to contain full text. Search interfaces became more straightforward and simpler to use. Online catalogs became more common, and libraries began to offer them through the pre-World Wide Web Internet. Web-based electronic resources were widely available beginning in the mid-1990. Libraries offered Web-based catalogs, bibliographic and full-text databases, electronic journals, and

eventually electronic books through the Web. Ranganathan's (1963) in his five laws of library science stated the motivation that drove libraries to incorporate electronic resources into services and collections. Paraphrased to better suit electronic resources, the laws read: "resources are for use, every person his or her resource, every resource its user, save the time of the user, and the library is a growing organism" (Ranganathan, 1963). Each technological development in library electronic resources during the 20th century was intended to make access to resources more direct, convenient, and timely for the user.

### **2.3. Changing Information Environment in libraries**

E-networks and diverse information formats are varying information access processes worldwide. A recent study conducted by Morrison & Stein (2013) showed that Universities and Colleges have a great role in preparing students to handle the quickly increasing range of information formats. Information and knowledge are the basic tools of the present age. The rise of the Internet has led to 'free information services'. Lennon (2010) looked into how 'free' information actually is and whether we can go on to expect high value information to be available without cost using the internet. This study was conducted by using survey research method. Accordingly, the study found out that not less than 70% of libraries in North Carolina state university were changing their traditional library system to e-library/internet based. Also the study reveal that in to-days incrassating numbers of information users internet based information provision were the best solution to access information anywhere any time.

Ghiselli & Padula (2011) in their survey research proposed that the integration of tools to provide combined access to remote and homogeneous libraries, the contents of which can be grouped under the same subject, and which have been integrated to allow the users to navigate easily.

Veeranjaneyulu & Singh (2013) studied the impact of centrally delivered library service for all through the help of IT on academic libraries. Thinking sincerely about changing privately managed library setting to shared library management system. Rockman (2008) feels that the impact of library service provision can be handled well if a well thought reengineering plan is in place for shifting skilled human resources at a center and supporting the services with technology (Gaur, 2010; Tyckoson, 2009).

Information technology in combination with changes in organizational structures and methods of sharing library system has led to an increasing amount of information and also to totally new forms of information as well as in the use of resources. Asproth (2012) has studied some problem domains of long term preservation and how ongoing research matches these domains. It appears clear that although much of the challenges associated with infrastructure, organizational structure, lack of skilled human resource, less library budget, less e-resource and not only technical. The research by this author mainly concentrated on solving the technical issues through integrated library system.

Gakibayo, Ikoja-Odongo, and Okello-Obura (2013) assessed in their study on the utilization of electronic information resources in Mbarara University Library by

students by addressing four objectives namely; identifying the availability e-resources in Mbarara University library, determining the extent of the relevance and use of e-resources in Mbarara University library and lastly proposes strategies to promote the usage of e-resources by students and the study found that utilization of e-resources was not only affected by lack of computer skills and information literacy skills but also lack of enough computers and slow Internet connectivity (Gakibayo et al., 2013). The frequency of use of these resources indicated that a lot need to be done to increase e-resource use.

#### **2.4. Library Resources and Services in ICT Environment**

An academic library is expected to provide materials for courses, research projects and institutional academic activity to satisfy the needs of the well defined specialized clientele like staffs, students, researchers and administrators. Boakye (2010) explained about the academic libraries of developing countries and their services. In this study the role of librarians in developing countries has changed due to the IT appearance in the educational system.

Boissonnas (2009) discussed in detail about the managing technical services in a changing environment, specifically touching the experience of Cornell University, New York. He reported the study made in Cornell University on technical services, which include, reference services, library loan services, and citation management services. In the changing Information Technology environment, the library can expand resource sharing efficiently by overcoming the traditional methods. Giving the example of the changing Ohio environment, Kohl (2009)



focused on the issues in resource sharing and illustrated possible solutions with actual examples. Lynch (2007) reported the changing role of the library in a networked information environment. He concentrated on the Authentication and Authorization services during the transition from stand alone computing to networked environments. Prabha and Donnelley (2011) touched upon resource sharing in a changing environment. They explained how library can overcome the problems involved in the services. Mittal (2012) also addressed the changing role of the librarians in an electronic environment. According to this author, today's librarians' responsibilities can be those of a system analyst, an information manger, a database manager, a network manager and as an intermediary.

Chopra & Mukherjee (2012) traced the need of networking among academic libraries by pointing out its basic targets. This article highlights the situation of networking among the academic libraries of Jabalpur, India, before and after 1995 and the result showed that the resource sharing activities and collection size of the libraries were increased by thousands in number. Sridhar (2008) explained the purpose of modernization of library services through the introduction of information technology (IT) and indicated the unlimited potential of IT for modernizing the library services. Clyde (2010) explained how computers could make changes in the library services: as an administrative tool, as a resource for teaching information skill; and as part of the library collection in the form of software and databases. Rockman (2011) emphasized on e-library environment.

In the changing academic environment, the libraries have to develop their electronic resources with the existing print sources. It is difficult with a limited

budget, especially in developing countries to develop the electronic resources. Cholin & Karisiddappa (2013) highlighted the consortia approach for the academic libraries as a remedy. I.e. communities (a cooperative) of two or more libraries which have formally agreed to coordinate, cooperate in, or consolidate certain functions to achieve mutual objectives.

Sharma (2012) gave an idea to design an integrated common digital gateway and use of the same will be mandatory to all. Recently, Xiao (2013) made a valuable effort to make use of Web 2.0 technologies such as blog, tags, YouTube, RSS feeds, Instant Messaging, online presentation, etc. The author argued that these web 2.0 technologies function as catalysts to lower the human barriers and experienced it with library users by reaching them virtually.

As libraries move their focus from print collections to digital resources residing in the “cloud”, the library and user relationship has also changed dramatically. Power has clearly shifted from the library to the user and the dependence relationship has been inverted. It is therefore important to think about how to ensure that users continue to use and value libraries. Chou (2011) discussed the changing relationship between libraries and their users in the changing ICT environment. The sharp test of libraries success is whether they will be used frequently. Four factors are suggested in line with this, i.e., convenience, attention, awareness, and perception of value that are likely to influence the future use of libraries.

## 2.5. Cloud computing

There has been more literature as to what cloud computing actually means. The term cloud computing seems to originate from computer network diagrams that represent the internet as a cloud. Most of the major IT companies and market research firms such as IBM (2009) , Sun Microsystems (2009) and STATEN (2008) have wrote a lot that attempt to define the meaning of this term. The US National Institute of Standards and Technology (NIST) has developed a working definition that covers the commonly agreed aspects of cloud computing. The NIST working definition summarizes cloud computing as:

“A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell, & Grance, 2009)”.

The NIST definition describes cloud computing as having five essential characteristics, three service models, and four deployment models.

The essential characteristics are presented as follows:

- ❖ **On-demand self-service:** computing resources can be acquired and used anytime without the need for human interaction with cloud service providers. Computing resources include processing power, storage, virtual machines etc.

- ❖ **Broad network access:** the previously mentioned resources can be accessed over a network using heterogeneous devices such as laptops or mobiles phones.
- ❖ **Resource pooling:** cloud service providers pool their resources that are then shared by multiple users. This is referred to as multi-tenancy where for example a physical server may host several virtual machines belonging to different users.
- ❖ **Rapid elasticity:** a user can quickly acquire more resources from the cloud by scaling out. They can scale back in by releasing those resources once they are no longer required.
- ❖ **Measured service:** resource usage is metered using appropriate metrics such as monitoring storage usage, CPU hours, bandwidth usage etc.

### 2.5.1. Cloud resource allocation model

The above characteristics relate to all clouds but each cloud provides users with services at a different level of concept, which is referred to as a service model in the NIST definition. The three most common service models are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). These models are described as follows:

**Software as a Service (SaaS):** this is where users simply make use of a web-browser to access software that others have developed and offer as a service over the web. At the SaaS level, users do not have control or access to the underlying infrastructure being used to host the software. Salesforce is Customer

Relationship Management software and Google Docs are popular examples that use the SaaS model of cloud computing.

**Platform as a Service (PaaS):** this is where applications are developed using a set of programming languages and tools that are supported by the PaaS provider. PaaS provides users with a high level of abstraction that allows them to focus on developing their applications and not worry about the underlying infrastructure. Just like the SaaS model, users do not have control or access to the underlying infrastructure being used to host their applications at the PaaS level. Google App Engine and Microsoft Azure are popular PaaS examples.

**Infrastructure as a Service (IaaS):** this is where users acquire computing resources such as processing power, memory and storage from an IaaS provider and use the resources to deploy and run their applications. In contrast to the PaaS model, the IaaS model is a low level of abstraction that allows users to access the underlying infrastructure through the use of virtual machines. IaaS gives users more flexibility than PaaS as it allows the user to deploy any software stack on top of the operating system. However, flexibility comes with a cost and users are responsible for updating and patching the operating system at the IaaS level. Amazon Web Services, which is known for online book sales, EC2 and S3 are popular IaaS examples. This provides storages and easy elastic network services.

Erdogmus (2009) described Software as a Service as the core concept behind cloud computing, suggesting that it does not matter whether the software being delivered is infrastructure, platform or application, "It is all software in the end"

(Erdogmus, 2009). Although this is true to some extent, it nevertheless helps to distinguish between the types of service being delivered as they have different abstraction levels. The service models described in the NIST definition are deployed in clouds, but there are different types of clouds depending on who owns and uses them. This is referred to as a Cloud deployment model.

### **2.5.2. Cloud Computing Deployment Models**

Four cloud computing deployment models have been developed in order to address different requirements and environments (Dustin et al, 2010, CSA, 2009). These four models are public cloud, private cloud, community cloud and hybrid cloud (Dustin et al, 2010; CSA, 2009, Grance, 2010; Mell and Grance, 2009; Catteddu and Hogben, 2009).

**2.5.2.1. Private cloud:** is a cloud that is used exclusively by one organization. The cloud may be operated by the organization itself or a third party. The St Andrews Cloud Computing Co-laboratory and Concur Technologies (Lemos, 2009) are example of organizations that have private clouds, as it only opens up to limited users, not to any unknown third parties. The cloud resource in the model is managed by the user organization premises or offsite. This model will not significantly reduce the IT infrastructure investment as the public cloud does (Dustin et al, 2010).

**2.5.2.2. Public cloud:** is a cloud that can be used by the general public and shared in a pay as you go model of payment. Internet is used to transfer the information between different users, as the provider is responsible for ensuring the economies

of scale and the management of the shared architecture (Dustin et al, 2010). Public clouds require significant investment and are usually owned by large corporations such as Microsoft, Google or Amazon.

**2.5.2.3. Community cloud:** is a cloud that is shared by multiple organizations or institutions that have shared concerns or interest, for example, compliance considerations, privacy needs. The infrastructure may be operated by the third party (Dustin et al, 2010). The Open Cirrus cloud tested could be regarded as a community cloud that aims to support research in cloud computing (Open Cirru, 2009). It is applied to serve a common function or purpose. It may be for one university or for several universities, but they share common concerns such as their mission, policies, online resources, union catalogues, security, regulatory compliance needs, and so on (Amit 2013).

**2.5.2.4. Hybrid cloud:** is a cloud that is setup using a mixture of the above three deployment models. Each cloud in a hybrid cloud could be independently managed but applications and data would be allowed to move across the hybrid cloud. Hybrid clouds allow cloud bursting to take place, which is where a private cloud can burst-out to a public cloud when it requires more resources.

Figure 2.1 below gives a general idea of the common deployment and service models in cloud computing, where the three service models could be deployed on each of any deployment models.

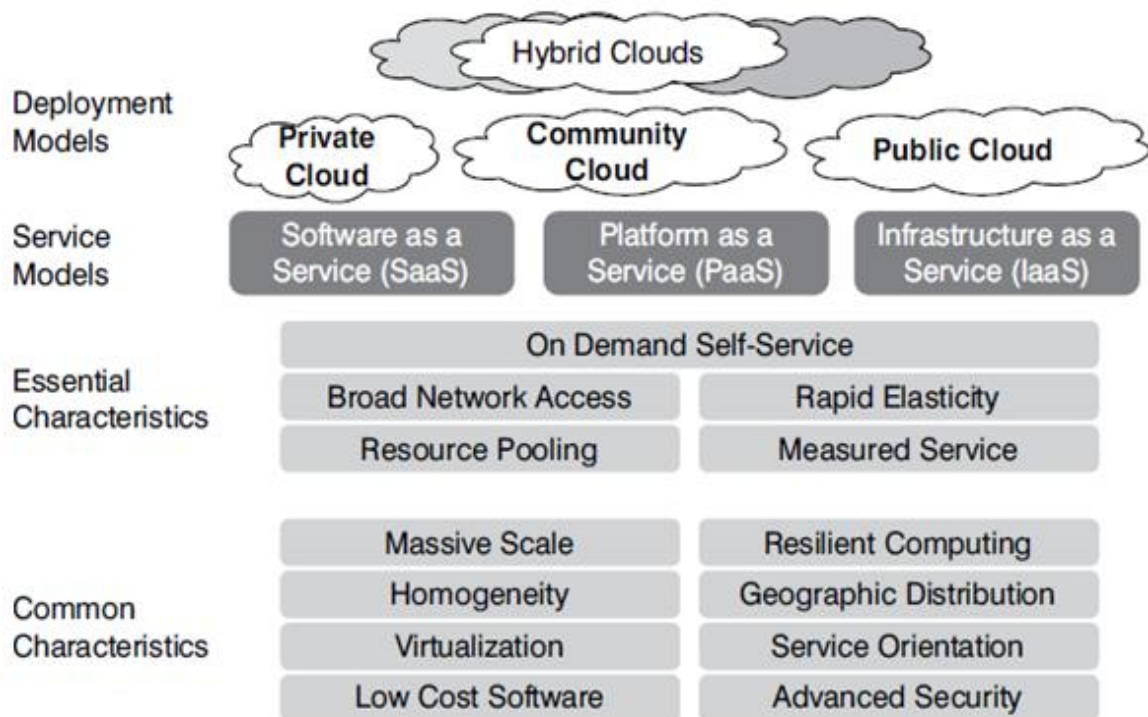


Figure 2.1 The NIST cloud computing definition framework (GRANCE, 2010)

According to Ko, (2010) “Cloud computing loosely means that software you use does not reside on your own computer, but rather on a host computer, accessed via the Internet, run by someone else.” The European Network and Information Security Agency (ENISA) has defined Cloud computing as “on demand service model for IT provision, often based on virtualization and distributed computing technologies” (Catteddu & Hogben, 2009).

According to Goldner, (2010), For many organizations, cloud computing can simplify processes and save time and money. Cloud computing could transform the way systems were built and services delivered, providing libraries with an opportunity to extend their impact.



### **2.5.3. Impediments of using cloud technology**

Most of the enterprises tend to move to Cloud Computing to save cost. The enterprises move to cloud and get the space for data storage. This data storage is certainly cheaper for them compared to the in-house data storage but the issue is, if this data storage in cloud is also secured and beneficial for enterprises. Hence, one of the most impending tasks for enterprises is the security of data storage (Gens, 2012).

Jensen et al. (2011) presented the technical security issues in Cloud Computing; however, these issues are more related with the problems of web services and web browser and not of Cloud Computing. These issues are still very important to Cloud Computing as Cloud.

Security controls in Cloud Computing are not different than security controls in IT environment. However, as Cloud Computing deploys different service models, operation models and technologies, so it presents different risks to an organization. The enterprise security is implemented on one or more layers ranging from the facilities (physical security), to the network infrastructure (network security), to the IT systems (system security), and all the way to the information and applications (application security).

The European Network and Information Security Agency (ENISA) presented 35 risks which are involved with the security while adopting Cloud Computing (Catteddu & Hogben, 2011). These 35 risks can be divided into the following categories:

- ❖ Policy and organizational risks such as vendor lock-in, loss of governance, compliance challenges, and cloud provider acquisition.
- ❖ Technical risks such as data leakage, distributed denial of service attacks, loss of encryption keys, and conflicts between customer hardening procedures and cloud platforms.
- ❖ Legal risks such as data protection and software licensing risks.
- ❖ Risks not specific to the cloud such as network problems, unauthorized access to data centers, and natural disasters (Catteddu & Hogben, 2011).

## **2.6. Libraries in the cloud technology**

The information technology (IT) revolution has led to the digitization of every kind of information (Gantz et al., 2010). Digital libraries are appearing as one more step toward easy access to information spread throughout a variety of media.

The growing need for virtual libraries to manage large amounts of data requires storage infrastructure that libraries can deploy quickly and economically. Cloud computing is a new model that allows the provision of information technology (IT) resources on demand, lowering management complexity (Sosa-sosa and Hernandez-ramirez, 2012). The paper was proposed cloud computing as a solution. The finding was, a file storage service that is implemented on a private/hybrid cloud computing environment is the best solution. Both the efficient strategy and the acquisition of storage services were discussed. Cloud

computing is a current trend that considers the Internet as a platform providing on demand computing and software as a service to anyone, anywhere, and at any time. E- Libraries naturally should be connected to cloud computing to obtain mutual benefits and enhance both perspectives (Yan, 2010). A cloud environment provides infrastructure and facilitates deployment of file storage services. It means that users can access their files via the Internet from anywhere and without requiring the installation of a special application. The user only needs a web browser.

In the library setting Fox (2012) likened cloud service to the contribution and distribution of machine readable catalog (MARC) records to the Online Computer Libraries Center (OCLC) database. In this situation, OCLC has functioned as a cloud computing vendor, provided cataloguing tools over the Internet, which let partner institutions to draw and contribute to the data store. Libraries are in a good position to choose for centralized cloud solution because they handle huge data but with limited finances to afford continuous upgrades of their own computing facilities. Malpas (2010, 2011) more described OCLC's initiative in contribution an appropriate infrastructure to sustain large network of libraries, which share cataloguing records, digitized prints and digital repositories as a type of cloud service. The Canadians are joining the bandwagon with its Council of Prairie and Pacific University Libraries (COPPUL), a consortium of 22 university libraries in Western Canada, working with the OCLC consortium (Bird & Ashoughian, 2012). The OCLC Research, together with HathiTrust Digital library,

New York University Emer Bobst Library and ReCAP (Research Collection, Access and Preservation) Consortium has embarked on the cloud library project, funded by Andre W. Mellon Foundation. The main objective was to outsource management of low use print books held in public libraries to shared service providers. This initiative was necessary due to the emergence of mass digitized book corpus enabled by the HathiTrust digital library, which together with ReCAP repository held about 6.3 million digitized items in 2010 with 6 percent growth each month (Malpas, 2011) and projected to be 16 million by 2013. The HathiTrust and the University of California Library are Google Library project partners to create shared digital collections.

Mitchell (2010), Galvin and Sun (2012) explained about the types of cloud computing (CC) used by libraries such as, software as a service (SaaS), platform as a service (PaaS) and infrastructure as a service (IaaS). SaaS refers to using applications via a hosting service, without access to the underlying infrastructure (servers) and without having to manage the underlying software. A good example is subscription to electronic journal management systems such as Thomson Reuter's Scholar One. Another instance of software selection on the cloud is exemplified as early as 2002 when Hewlett Packard laboratories and Massachusetts Institute of Technology, hosted DSpace, an open source software platform that support more than 1,000 digital libraries all over the world. PaaS refers to using a hosted platform on which a specific application can be supported.

In this situation, the organization hosts a platform offering space and computing resources running pre-configured tools. IaaS refers to providing a service to use

servers, storage space and networking components to meet computing needs. In this context, the hosting organization initiates and manages the network access; ensure that the core server components (OS, web server and firewall) are configured correctly. This infrastructure provides scalable and affordable computing resources that run enterprise programs. This type of cloud computing is sometimes referred to as Hardware as a service (HaaS).

Amazon's Web Services, is one of the major players in providing IaaS through its Elastic Compute Cloud (EC2) (Pathy and Mahapatra, 2012). The District of Columbia public library system is using Amazon EC2 service to host their web site, to back up their integrated library system and their digital repository. OhioLink is using Amazon EC2 services to support their IaaS needs for their digital resource repository (Kroski, 2009a). Eastern Kentucky University library is using Google Docs to collect responses from their web forms and Google analytics to compile statistics about their web sites, catalogues and blogs. The library of Congress National Digital Information infrastructure and preservation program is partnering with Dura Space to fund and test Dura Cloud's effectiveness in handling their storage, searching, retrieval needs of various types of data from a collaborative network of repositories.(Kroski, 2009).

Nurnberg et al. (2012) described the cloud infrastructure at the Texas Digital Library consortium. The consortium initially comprises four institutions, namely Texas A and M University, Texas Technological University, University of Houston and University of Texas in 2005 and grew to accommodate 15 members. To cope with higher demand for services, the consortium collaborated with Amazon EC2

Cloud to backup their institutional repositories and electronic theses and dissertation digital library. In this context the main reason for using the cloud was as disaster recovery plan. The consortium faced bursting computing and storage demands at certain times such as before deadlines for theses or dissertation submissions. Although Malaysian archive information system (MyAIS) is a small repository the sudden bursts in uploads and user traffic necessitates the consideration of a more sustainable solution.

Fu and Fitzgerald (2013), through their analysis, compared traditional integrated library system (ILS) and the next generation ILS may impact system and technical services staffing models at academic libraries. The method used in their analysis was selecting two categories of ILSs. Two well established traditional ILSs and three leading next generation ILSs. To compare software architecture and workflows and functionality method was used. The results of the analysis suggested that the next generation ILS could have substantial implications for library systems and technical staffing models in particular.

To reduce costs, today's libraries not only band together in consortia for cooperative resource purchasing and sharing, but often also want to operate one "shared ILS" for managing, building, and sharing the combined collections of members (Jason & Kristen, 2011). According to Parkh and Picture (2010), libraries had never undergone retrospective conversion because the legend that the library automation is very costly affairs and they can't afford to by the costly computer hardware, software, and other resources necessary to convert their library holdings to an automation system. In their paper they suggested that

libraries should move to adapt the cloud technology. Fortunately there's a low cost, state of the art and unusually powerful library automation software based on cloud computing which can help move these library in to the 21<sup>st</sup> century with global exposure with the Internet. Based on their study library cost was minimized by half, in which investing money for purchasing new equipments, purchasing a dedicated server, and employing staffs at each center of libraries were reduced.

Sharon (2012) discussed the new generation of ILSs for the cloud has many revolutionary features that classic systems lack. The user interface or OPAC of the new generation of ILS is often a discovery tool with advanced characteristics of next generation catalog. Electronic license management is part of the unified acquisitions. There is no need for separate staff modules (Stearns & Larson, 2011).

Abrizah et al. (2010) and Zainab (2010) highlighted the growth of institutional repositories in trough time. Even though, the main constraint reported in literature in the early years was slow uptake (Van Westrieneen and Lynch, 2005; Kim, 2006; Zuber, 2008), the growth is steady, as deposition of resources has become increasingly institutionalized (Matsuura's, 2008; Kennan and Kingsley, 2009).

Marc (2012) stated Cloud Computing was the next generation of web design that allows for collaboration and web based tools defined as Web 2.0. Arguably, we are in a Web X.0, where Internet tools (cloud computing) are becoming ubiquitous. Many tools are not universally accessible, and monitors the

accessibility levels and can provide alternative processes should the need arise. Library choose not to used web 2.0 to get their message out because of security issues and lack of staffing (Rogers & Ed, 2012). However, the research underlined that libraries should be encouraged to find ways of restructuring staff and closely examining workflow to determine what can be stopped to make room for the incorporation of more online communication tools. According to survey, libraries were using social media as a “reminder of special resources available to academic community” and as a tool for “reference transactions, receiving/resolving complaints, building community.” Among the total number of respondents 75.1% of them were agreed that web 2.0 was used in the library for collaborate with other departments, introduce and show existing resources, have conversations with users and learn more about/from them, announce new releases and circulation notifications.

Kumar and Mandal (2013) discussed how service, platform and infrastructure forms of cloud computing used to serve library needs. They defined cloud computing as a use of computing resources (hardware and software) that are delivered as a service over a searching information as well as in identifying users' needs should work hand in hand with software professionals in organizing the so-called 'anarchy' of the Internet network (typically the Internet). Cloud computing entrusts remote services with a user's data, software and computation (NIST, 2012). Kumer & Mandal (2013) concluded that cloud computing offers one way for institutions to increase operational efficiency and focus scarce resources on services that are institutional differentiators. Also they argued that



Operating in a cloud environment requires IT leaders and staff to develop different skills, such as managing contracts, overseeing integration between in-house and outsourced services, and mastering a different model of IT budgets. There are many types of public cloud computing (Monaco, 2012), like Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), Storage as a service (StaaS), Security as a service (SECaaS), and Data as a service (DaaS). Cloud computing is a technology that uses the Internet and central remote servers to maintain data and applications.

Cloud computing providers offer their services according to three fundamental models: Infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) where IaaS is the most basic and each higher model abstracts from the details of the lower models (Voorsluys et al., 2011).

These services are used in integrated library management and retrieval system for cloud computing. The open source software and open standards are also used for Internet based services towards next automated library system. The most important cloud computing based services are provided for accessing journals, e-books in library OPAC as well as librarian interface and these can be achieved in different way such as information mash up, import bibliographic and authority data, reference management and web 2.0 by using twelve check lists. These important services are described in the following way.

According to Sanchati & Kulkarni, (2011) cloud based library system was a fatal solution for library operations. The ultimate goal of modern library is to offer

appropriate, comprehensive and multi-level services for its users. At present, user service models are mainly World Wide Web service model, file transfer protocol service model and E-mail service model, etc. These authors argued cloud computing is the only solution for libraries in order to advocated user centered services. Establishing a public cloud among many university libraries, it not only can conserve library resources but also can improve its user satisfaction. And it can be illustrated in Figure 2.2 bellow.

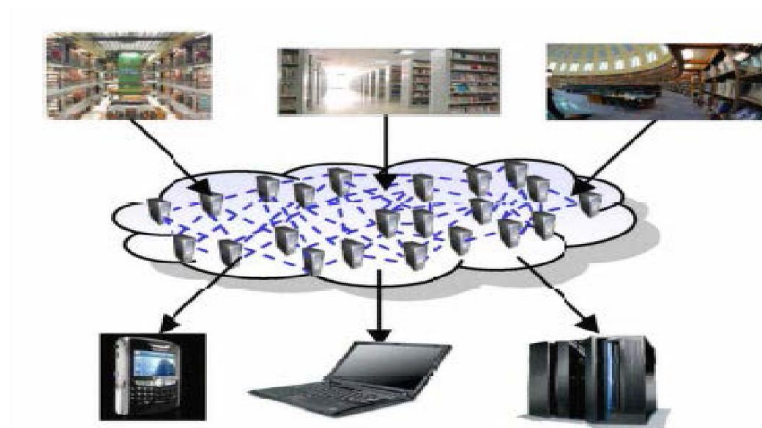


Figure 2.2: Application of cloud computing in university library (Sanchati & Kulkarni, 2011)

To date there is no study done on cloud libraries in Ethiopian higher educations. The development and growth of e-library in Ethiopian higher education is very slow, and also its usage has been stunted by poor infrastructure, high cost of running e-library and software development. Cloud library can take the library facility at the most convenient state to its stakeholders than other technical approaches. Cloud library automation solutions provide timely, efficient and effective enterprise library management services complete with easy-to-use library and knowledge management functionality. According to Ogbu & lawal

(2013) these transformative library services remove information access barriers, such as proprietary information silos, to seamlessly make information access equitable.

The end result is open access throughout the organization to information and resources sharing such as electronic journals, e-databases, e-books, newspaper and other resources or other knowledge assets. Cloud library can provide the optimum library services to the people by centralizing the resources and disk spaces of any e- library. This concept will open more doors and windows, which will let many people get their access to the library. Cloud library can provide an uninterrupted service to its stakeholders. The social impact of cloud library is also noticeable. Research and development regarding any issue will accelerate as people can get easy, efficient, faster and reliable services through cloud library. And also it is environmentally friendly, using the cloud results as at least 30% less energy consumption and carbon emissions than using on-site servers (lawal, 2013).

Libraries in public academic institutions in Ethiopia face a lot of problems in terms of costs, resource and technology. Hence the study of cloud library will highly benefit the institutions because the resources are shared by many and thus the utilization goes up. And modern developments like virtualization can make the same resources available to multiple users "simultaneously," thus reducing the need for physical resources even further.

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1. Research Design**

A survey research method was used to conduct this research. The study was concerned with investigating the use of cloud library to enhance e-library resource sharing among Ethiopian Public Higher Learning Institution (EPHLI) libraries with the view of providing a framework for effective resource sharing among libraries in EPHLI. It was specifically intended to investigate the significant value of cloud library for Ethiopian higher education in order to reduce e-library service provision differences that exist between Ethiopian Public Universities, unequal distribution of information resources and replication and superfluous procurement of information resources and technological infrastructure among university libraries. Such issues are best investigated using a survey method. Survey research method enabled the researcher to collect in depth information on views, opinions, practices, and impact of cloud library on resource sharing among EPHLI libraries from the respondents. The design generally entailed use of standardized questions to investigate selected study samples to analyze and discover occurrences. Survey design is mainly used to describe a phenomenon but it is also possible to go beyond descriptive to the interpretive, that is, to use survey method to provide explanations of the phenomena studied and the pattern of results obtained (Oso & Onen, 2005).

The general advantages of using survey design are that: it provides a relatively simple and straightforward approach to the study of attitudes, values, beliefs and

motives; and the survey design allows high amount of data standardization. However, the data collected using survey research design may be affected by the characteristics of the respondents (for example their memory, knowledge, experience, motivation, and personality) but these may be insignificant compared to its contribution to this study.

### **3.2. Description of the Study Sites**

There are 33 universities established in different parts of Ethiopia that have been authorized by the ministry of education (MoE, 2011). Those universities are classified in to 3 generations based on their establishment period. Ten were relatively older and categorized in first generation, 11 were established somewhat later and categorized in 2<sup>nd</sup> generation and 12 were newly established and categorized in third generation which is in the process of developing library services and skilled professionals. The qualities of their library services were directly proportional with development in generation. The 1<sup>st</sup> and 2<sup>nd</sup> generated libraries were somewhat experienced on developing and using e-library service and relatively advanced on the use. Therefore, in this study one university from each generation i.e 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> generation respectively Jimma University (JU), Hawassa University (HU) and Mizan Teppi University were selected purposively based on their level of having e-library services and their proximity to study sponsoring institution, which is Jimma University.

The universities listed on study site (Jimma university, Hawassa university and MizanTeppi) are part of the 33 public higher educational institutions in Ethiopia.

Jimma University was established in December 1999 by the amalgamation of Jimma college of Agriculture (found in 1952) and Jimma Institute of Health sciences (established in 1983) (JU website, 2013). Jimma University is located 352 km south west of Addis Ababa at Jimma town with an area of 409 hectares. It has four campuses, namely Jimma university main campus, Jimma University College of Agriculture and Veterinary Medicine, College of Business and Economics and Kito Furdisa (Jimma University Institute of Technology). It has not less than 6 library branches. Jimma University has more than 100 undergraduate programs, 30 master's degree programs and 3 PhD programs. These programs are offered in different disciplines including Medicine, Engineering, Agriculture, Business, Social and Natural Sciences. Hawassa University (HU) was established at Hawassa in April 2000. Since 1976 the different colleges of HU had been operational starting with the college of Agriculture. The University has been formed by merging three colleges in Southern Ethiopia: Awassa College of Agriculture (ACA), Wondogenet College of Forestry and Dilla College of Teacher Education and Health Sciences. The main Campus and several Faculties located in Hawassa city, 270 km south of the capital Addis Ababa (HU website, 2012). Mizan-Tepi University located in Mizan Teferi and Tepi towns of South Nations Nationalities People Region state of Ethiopia is one among the 13 new universities established in the country in the last decade. It is situated 565 Kilometers south west of Addis Ababa, the capital city of Ethiopia (MTU website, 2013).

### 3.3. Study Population

The respondents of the present study included library staff, academic staff, undergraduates (graduating class), post-graduate students and IT technicians working in the libraries of the selected libraries. The researcher felt that these respondents were well suited for the study and would give in-depth information and provide better and comprehensive information on cloud library. The total population of the study is presented in table 3.1.

Table 3.1.: The total population of study from academic staffs and students

No	University	Undergraduate (graduating class)	postgraduate	Academic Staff profile	Total
1	HU	3533	1275	811	5 619
2	JU	3756	1290	1210	6 256
3	MTU	1680	0	570	2 250
Total		8 969	2 565	2 591	14 125

Source: Ministry of education statistics annual abstract. November, 2013

### 3.4. Inclusion and exclusion criteria

Based on the level of use of e-resources all graduating class (undergraduates), academic staff, postgraduate students those who engaged on research and scholarly writings and all library directors, all branch library heads and IT technicians in the library who know the current challenges on e-library system development were included in the study. Administrative staffs and undergraduate students those who are not graduating class were excluded.

### 3.5. Sampling method

Purposive and simple random sampling techniques were employed to select the study sample. In this study, purposive sampling was used to select the study sites and library directors and IT technicians for interview that the researcher believed were resourceful for the study.

Simple random sampling technique was used to select samples from students, academic staffs and librarians. A simple random sample is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected. For sample which select through simple random sampling researcher were get list of department and student list from registrar and staff list from human resource management office then proportion for each department were calculated and lottery method were used to select samples from each department.

### 3.6. Sample size determination

The sample size was calculated using a single population proportional formula.

$$n = \frac{z \left( \frac{\alpha}{2} \right)^2 * P(1 - p)}{d^2} \quad (\text{Kothari,2004})$$

**Where**

- ✚ **n**= the desirable calculated sample size
- ✚ **Z** ( $\alpha/2$ )=1.96 (95% confidence level for two side)
- ✚ **p**= proportion of population and barriers (50%)
- ✚ **d**= degree of accuracy desired setting at (5%)



Therefore the value of **n** was calculated as follows

$$n_o = \frac{(1.96)^2 * 0.5(1-0.5)}{(0.05)^2} = 384$$

$$nf = \frac{no}{1+no/N} \quad \text{Where,}$$

**nf** = the desired sample size when population is less than 10000

**n** = the desired sample size when population is more than 10000

**N** = the estimate of population in each university.

**Use this formula**

$$n = \frac{nf * N_{sub}}{N_{total}} \quad \text{For } N_{sub} \text{ greater than 10000}$$

$$n = \frac{no * N_{sub}}{N_{total}}, \quad \text{For } N_{sub} \text{ less than 10000}$$

The total population identified for this study from selected universities is 14 125.

From this total number of population 8 969 are undergraduate (graduating class)

students, 2 565 are postgraduate and 2 591 are staffs. Therefore the total sample

size calculated for the study was 411. Among this total number of population 25

respondents were selected from ICT technicians and librarians, 312 samples from

students and 69 samples from staffs. Because of the population size for each

population category were less than 10000, the following formula can be used.

$$n = \frac{no * N_{sub}}{N_{total}}, \quad \text{For } N_{sub} \text{ less than 10000}$$

Accordingly the sample size formula the sample size the sample proportion is as

follow

Table 3.2 sample size from each university

$(HU \text{ gc}) = \frac{384 * 3533}{14125} = 96$		$(JU \text{ gc}) = \frac{384 * 3756}{14125} = 102$	$(MTU \text{ gc}) = \frac{384 * 1680}{14125} = 45$
$(HU \text{ pg}) = \frac{384 * 1275}{14125} = 35$		$(JU \text{ pg}) = \frac{384 * 1290}{14125} = 34$	$(MTU \text{ pg}) = \frac{384 * 0}{14125} = 0$
$(HU \text{ sf}) = \frac{384 * 811}{14125} = 22$		$(JU \text{ sf}) = \frac{384 * 1210}{14125} = 32$	$(MTU \text{ sf}) = \frac{384 * 570}{14125} = 15$
<b>Proportion</b>	<b>153</b>	<b>168</b>	<b>60</b>

### 3.7. Data Collection

The methods used to collect data for this study were questionnaire, interview and observations. From different categories of each data collection methods fixed alternative questionnaire method was used to collect data from the students, academic staffs, librarians and IT technicians in the library whereas semi-standardized face-to-face interview method was used to collect data from the library directors and computer & network service heads and also detailed observation was done for the availability of e-library services at each study site.

The questionnaires included several types of questions: nominal, dichotomous and likert type items. Among different types of interviews, the semi-standardized face-to-face interview method was used to collect data that could not be directly observed. The semi-standardized interview has some structure to it, but the wording of the questions was flexible, the level of the language may be modified, and the interview may choose to answer questions and to provide further explanation if requested. Respondents have a greater ability to express their opinions in their own words when using this type of interview structure.

### **3.8. Data Collection Procedure**

The data for this research was collected using an interview, observation and questionnaire (see appendix 5). The questionnaires were created using suitable questions modified from related research and individual questions formulated by the researcher and approved by the advisors. To collect data from the respondents the researcher got official letter from the Department of Information Science, Jimma University requesting for assistance from institutions (departments) of all study site of the study. Then the researcher submitted the letter to the academic vice presidents (AVPs) of the study site to get permission to conduct the survey. The AVP forwarded the letter to all concerned bodies by approving the study can be done. After that the researcher went to the registrar and human resource management of the study institutions to find out list of departments, students and staffs respectively. In addition class schedule was also taken from the departments to know class rooms and to get all students in class rooms.

Following, sample proportion for each department was calculated and the questionnaire was distributed to the students and staffs by using random sampling technique. Lottery system was used to pick a sample from each class. For academic staffs the researcher distributed questionnaires at 11:30-12:30 am and 4:30pm-5:30pm because this is a time to get most staffs in their office.

### **3.9. Pre-test of data collection instrument**

Prior to final data collection, a pilot study was done to test the questionnaire. It was geared towards establishing whether the questions were clear, appropriate,

and if there were other questions that could be asked. It also helped in testing the language and content of the questions, and the length and approach of the interviews.

Modifications were then made appropriately on the basis of the findings of the pre-test. 10% of the total study sample was used for the pre-test exercise. Mugenda and Mugenda (2003), argue that at least a tenth of the total population is adequate for a pre-test. Purposive sampling technique was used to identify pre-test subjects. The pre-test was done in a neutral location that was not used in the actual field work (Edwin et.al, 2011).

The chosen place for the study was Jimma Teacher Training College (JTTC) and was done by distributing questionnaire randomly for 25 teachers and interviewing library director, one acquisition librarian, and one ICT librarian. The responses were then analyzed with the view to improve the reliability and validity of the instruments.

The pre-testing exercise helped in identifying problems in the interview and the questionnaire. The major problem was found with the clarity of the questions in the interview to the library director. Modifications were made appropriately on the basis of the suggestions offered and the findings of the pre-test. These modifications included removal of questions and addition of some missing points that the researcher felt were redundant and changing the vocabulary.

### **3.10. Data Quality Control**

A brief orientation was given to the data collectors. The questionnaire was done at first time and necessary adjustments done based on the feedback. The completeness and consistency was also checked at the site by the researcher. The missing data, outliers, completeness and consistence were checked before data analysis. This increases the validity of the research.

### **3.11. Data Analysis, Presentation and Interpretation**

After the required amount of data was received from the field, it was reviewed for any inconsistencies, organized and then analyzed. Data analysis statistical software, SPSS version 20 were used, data was analyzed using both inferential and descriptive statistics. Thematic analysis was done. This involved categorizing related data into themes or topics by perusing through the collected data and identifying information that is related to the research questions and the objectives. After categorizing the data, codes were developed based on the collected data then coded materials were placed under the identified themes. After that interpretation of the data was done and a summary report developed identifying the major themes and associations between them. Direct quotations, percentages, charts, tables and One-Way-ANOVA multiple comparisons were used to present the findings.

### **3.12. Ethical consideration**

Ethical consideration were maintained and respondents consents were sort at time of data collection; through explaining and seeking their consent on the importance of study findings, which should benefit and cause no harm to them. Respondents were told that their privacy and confidentiality were maintained at all times, all findings portrayed in a confidential manner and no personal or identifiable information were to be recorded or printed in the study. No names were also to be recorded during the interviewing process. Although, the research was aware that ethical issues may arise at any point during any study regardless of the rigorous planning. However, the researcher noted and acted on the importance that possible ethical issues should be identified, prevented, and reviewed as best as possible prior to, during and after the study.

## CHAPTER FOUR

### Results and Discussions

#### 4.1. Results

##### 4.1.1. Results from students and staff

The responses for the likert scale data that was collected for this study were analyzed by using mean. According to Kenate.D and Gojeh et al., (2013) taking a decision on the respondents ranking of the variables, the mean of responses were guided by the scale 1.0-1.49 very low, 1.5-2.49 low, 2.5-3.49 medium, 3.5-4.49 high and 4.5-4.99 very high.

##### 4.1.1.1. Proportion of respondents and Response Rate

In this study a total of 411 respondents from three public universities (Jimma University, Hawassa University and Mizan-Teppi University) took part.

Table 4.1 below depicts the participation level of the respondents from these three universities. From a total of 406 (100%) questionnaires distributed, 351(85.2%) were properly filled out and returned, giving a response rate of 85.2%.

Table 4.1: Response rate of samples

<b>Librarians and ICT technicians respondents</b>		Frequency	Percentage %
Respondents University	JU	9	36%
	HU	8	32%
	MTU	6	24%
Total responded		23	92%
No response		2	8%
Total		25	100%
<b>Students and staff respondents</b>	JU	139	36.48%
	HU	131	34.38%
	MTU	53	13.9%
Total responded		323	79.6%
No response		58	15.23%
Total		381	100%

#### 4.1.1.2 Demographic Analysis for librarians, students and staff

This section of the analysis is concerned with background of the respondents to understand the respondents who participate in filling the questionnaire for this research. The profile of respondents is presented in table 4.2.

Table 4.2 Profile of respondents

Measures		Frequency	Percentage (%)
<b>Librarians and ICT technicians respondents</b>			
Work position	Head of cataloging and classification	3	13.04%
	Head of library sections	8	34.78%
	Head of computer and networking	1	4.3%
	Head of acquisition	3	13.04%
	Head of reference section	3	13.04%
	Library director	3	13.04%
	System development coordinator	1	4.3%
	Technical service team leader	2	8.6%
<b>Sub total</b>		<b>24</b>	<b>100%</b>
Computer literacy	Novice	10	43.48%
	Experienced	9	39.13%
	Advanced	5	21.74%
	Sub total	23	100%
Level of education	Certificate	0	0.0%
	Diploma	10	43.48%
	1 <sup>st</sup> degree	12	52.17%
	2 <sup>nd</sup> degree	2	8.6%
<b>Subtotal</b>		<b>23</b>	<b>100%</b>
<b>Students and staff respondents</b>			
Role	Postgraduate	58	18%
	Graduating class undergraduates	207	64%
	Academic staffs	58	18%

#### 4.1.1.3. Computer Literacy Skills of students and staff

The purpose this part was to determine the level of users' computer skills to have access to essential information and effective use of information and communication technologies. Though more than 80% of the respondents' from all universities' computer literacy skill level is good. Figure 4.1 shows the responses from the students and staff.



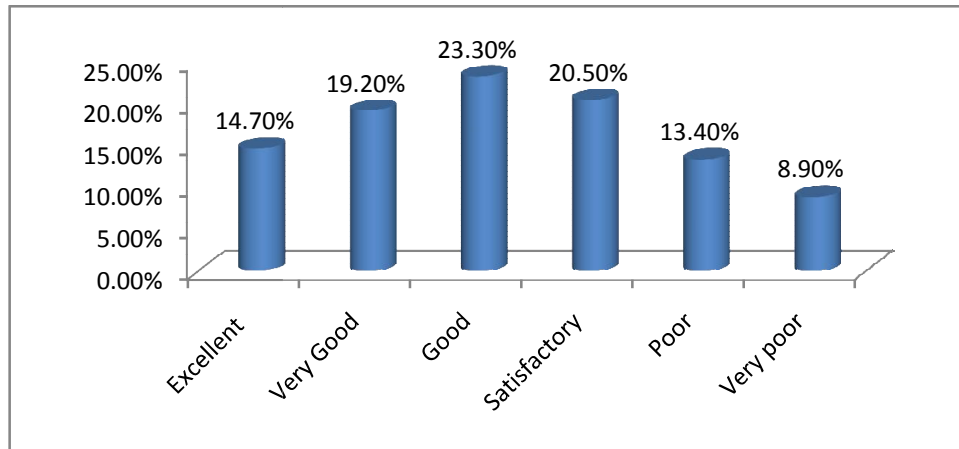


Figure 4.1: Levels of respondents' computer literacy

Figure 4.1 above depicts the level of respondents' computer literacy. The majority of the respondents' computer literacy skill is good (23.4%) followed by satisfactory (20.50%), very good (19.20%) and excellent (14.70%) computer skill. A little over 13% and about 8.9% of the respondents noted that their computer literacy level was poor and very poor respectively. The Figure illustrates that computer literacy skill of users were good. This implies that the levels of computer literacy skill of users were very capable enough to use e-library service or would not face problems in accessing cloud library services.

#### 4.1.1.4. E-library service use.

To determine whether users are using e-library services in their university, a question was asked of students and academic staff in the universities. Respondents (41.1%) from JU said that they use e-library services and respondents of HU (37.50%) indicated that they use and 11.70% of MTU responded of their use. The responses are summarized in Figure 4.2:

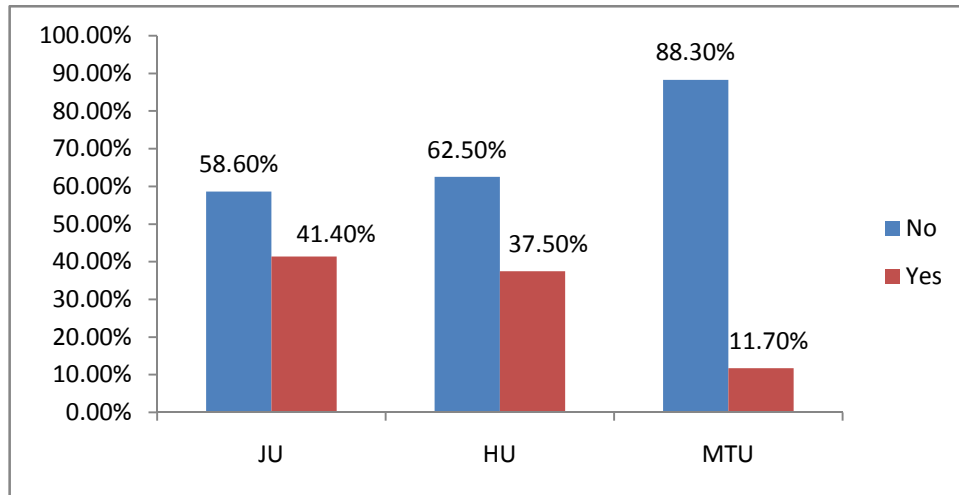


Figure 4.2: Use of university e- library services in the universities

As depicted in Figure 4.2, the result of this study revealed that 41.40%, 37.50%, and 11.70% from JU, HU and MTU respectively use e-library services in their respective university. Majority of the respondents do not use e-library services, which is 58.60%, 62.50%, and 88.30% respectively from JU, HU and MTU. MTU is a recently established university. And the service availability for e-library is at zero level compared to the other two, universities considered for this study. From the result it can be concluded that the use of e-library service in the universities were not good.

#### 4.1.1.5. E-library service provision

One of the mechanisms to determine efficiency of e-library is examining the extent of availability of services. There are different questions and issues raised to know services provided in the university. Respondents from JU and HU indicated that majority of services were provided in their universities. Whereas respondents from MTU said provision of e-library services were not available. Though comparison on the provision among the three universities with regard to different

e-library services is presented in table 4.2 and the result of ANOVA for mean differences is presented in table 4.3.

Table 4.3: Summary of provision of e-library services (see **Appendix A**)

E-library Services	JU		HU		MTU	
	Mean	SD	Mean	SD	Mean	SD
Digital library	0.44	0.5	0.34	0.48	0.07	0.25
Institutional repository	0.06	0.24	0.19	0.39	0.08	0.28
Library automation	0.66	0.48	0.72	0.45	0.07	0.25
Users database management	0.03	0.17	0.23	0.42	0.12	0.32
Open url resolver	0.27	0.45	0.28	0.45	0.10	0.30
Library web site	0.63	0.48	0.69	0.46	0.18	0.39
E-database	0.69	0.46	0.26	0.44	0.00	0.00
E-journal	0.7	0.46	0.81	0.39	0.12	0.56

From the table 4.3, we can observe that the universities which have highest mean value were good in their service availability relative to each other which is discussed under table 4.4.

Table 4.4, ANOVA table of service availability among the three universities (see appendix B)

E-library Services	Significant values between universities					
	JU		HU		MTU	
	HU	MTU	JU	MTU	JU	HU
Digital library	.142	.000*	.142	.001*	.000*	.001*
Institutional repository	.001*	.878	.001*	.083	.878	.083
Library automation	.393	.000*	.393	.000*	.000*	.000*
Users database management	.000*	.189	.000*	.064	.189	.064
Open url resolver	.975	.029*	.975	.021*	.029*	.021*
Library web site	.471	.000*	.471	.000*	.000*	.000*
E-database	.000*	.000*	.000*	.000*	.000*	.000*
E-journal	.091	.000*	.091	.000*	.000*	.000*

Level of significant at  $p \leq 0.05$

One way ANOVA was used to see whether the differences among the universities service provision. As depicted in table 4.4, variation on the availability and service provision of digital library, library automation, open url resolver, library website, e-data base and e-journals was observed among universities. Accordingly, digital library MTU (M=0.066, SD= 0.25), JU (M=0.44, SD=0.498) and HU (M=0.34, SD=0.48), library automation MTU (M=0.067, SD= 0.25), JU (M=0.657, SD=0.476) and HU (M=0.72, SD=0.45) and HU (M=0.28, SD=0.45) and e-database MTU (M=0.00, SD= 0.00), JU (M=0.686, SD=0.465) and HU (M=0.256, SD=0.438). From this it can be concluded that there were no balanced service provision between universities thus communities in less resource distributed universities were highly disadvantageous.

#### 4.1.1.6. Device used to access e-library

Question was asked to both students and staffs on which devices where they use in order to determine what library services provided that can run on the different media type. Most of the respondents use PCs and laptops. But there were also users use smart phones and mobile phones. The responses are summarized in Figure 4.3:

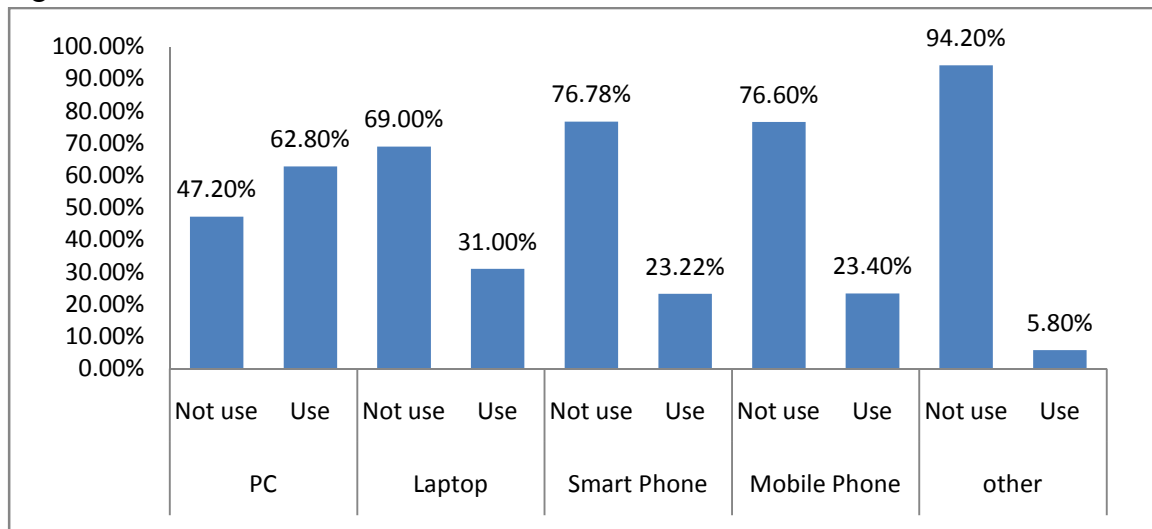


Figure 4.3: Devices used for access services

Respondents were asked which devices they use to access e-library services. Accordingly, it was found that 52.80% (201) of the respondents use PCs, 31 % (90) use laptop and 23.22% (75) use smart phones and the rest of the 23.40% (76) respondents use mobile phone. From this it can be concluded that to keep pace with technology, libraries need to provide services that can run on the media used by the library users.

#### 4.1.1.7. E-library services usage frequency

In order to observe the services were used for teaching and learning activities and usage difference among universities, question was asked the time frequency of service use. Respondents from HU more frequently use next to JU but HU were less in use. The responses are summarized in table 4.5 and 4.6 below:

Table 4.5: The Usage Frequency of e-library by the Respondents

	N	Mean	Std. Deviation
JU	139	0.49	0.45
HU	131	0.30	0.43
MTU	53	0.11	0.31
Total	323	0.42	0.48

Table 4.5 depicted that the total usage mean values of each university accordingly, it was found that the highest mean value from the e-library service use were 0.495 and 0.30, which is for the JU and HU with the standard deviation value of 0.45 and 0.43. From this we can understand that most of the JU and HU communities are interested with e-library services. Whereas, the lowest mean value is 0.11 for the use of e-library services in MTU with the standard deviation value of 0.31 that is the lowest mean value gives an understanding that users were not satisfied with the e-library services in their university.

Table 4.6, ANOVA table for service usage investigated

E-library services		Df	Mean Square	F	Sig.
Use the library's links page	Between Universities	2	19.012	20.6	.000
	Within Universities	320	.920		
	Total	322			
Use any of the e-journals	Between Universities	2	33.088	37.0	.000
	Within Universities	320	.894		
	Total	322			
Use libraries databases	Between Universities	2	25.157	30.8	.000
	Within Universities	320	.817		
	Total	322			
Use digital library	Between Universities	2	28.810	32.9	.000
	Within Universities	320	.874		
	Total	322			
Use institutional repository	Between Universities	2	23.293	41.1	.000
	Within Universities	320	.567		
	Total	322			
Use OPAC to search e-information	Between Universities	2	33.017	44.4	.000
	Within Universities	320	.744		
	Total	322			

Level of significant at  $p \leq 0.05$

Table 4.5 and table 4.6 represent the mean usage frequency scores based on a four point ranking scale from 1(Always), 2(mostly), 3(sometimes) to 4 (Never) and ANOVA table that indicate the significance difference. Further, respondents' e-library service usage among the three universities showed statistically significant differences. Accordingly, testing for variations in use of the library's links page (F=20.658;  $p < 0.000$ ), Use any of the e-journals (F=37.019;  $P < 0.000$ ), use libraries databases (F=30.785;  $p < 0.000$ ); use digital library (F=28.810;  $p < 0.000$ ); use institutional repository (F=41.116;  $p < 0.000$ ) and use OPAC to search e-information (F= 44.364;  $p < 0.000$ ) among respondents in the universities surveyed revealed that statistically significant difference and this shows that the usage of services varies among universities.

#### 4.1.1.8 E-library service quality measurements

One of the mechanisms to examine quality of services in the university library is examining the extent of services and their functionality with the satisfaction level of users from the system. There are different questions and issues raised to know availability of quality services and resources. Summary of the response of the respondents is presented in table 4.7 and 4.8.

Table 4.7: Respondents' opinion about the quality of services in the Library

Service quality indicator	Service rating scales					Central tendency		Dn
	SDA	DA	N	A	SA	X	SD	
Sufficient subscribed journals	95 (29%)	101 (31%)	60 (19%)	40 (12%)	27 (8%)	2.4	1.24	DA
Enough e-information resource	108 (33%)	91 (28%)	50 (15%)	41 (13%)	33 (10%)	2.3	1.24	DA
Sufficient purchased e-database	91 (28%)	89 (28%)	49 (15%)	52 (16%)	42 (13%)	2.1	1.19	DA
E-resources are easily accessible	89 (28%)	87 (27%)	38 (12%)	61 (19%)	48 (15%)	2.6	1.31	N
DL system satisfy your information need	78 (24%)	83 (26%)	53 (16%)	54 (17%)	55 (17%)	2.5	1.19	N
IR system satisfy your information need	124 (38%)	112 (35%)	31 (10%)	31 (10%)	25 (8%)	1.9	0.98	DA
Services are accessed from any location	77 (24%)	49 (15%)	88 (28%)	61 (19%)	48 (15%)	2.9	1.31	N
No time limitation to access	63 (19%)	56 (17%)	55 (17%)	76 (23%)	73 (23%)	1.7	1.37	DA

Scale: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree (SD)

To find out the students perceptions about the quality of services in their respective library, they were asked to give their opinion about the quality of services for the provision of quality information. The results presented in Table 4.7 show that the most of response were strongly disagreed and disagreed for the questions related with subscribed journals, e-information resource, sufficient

purchased e-database, easily accessibility of e-resource, DL system satisfy your information need, IR system satisfy your information need, and services are accessed from any location with mean values 2.35, 2.34, 2.12, 2.6, 2.5, 1.9 and 2.4 respectively. From this, we can say that current university systems were not efficient.

Respondents are asked whether there is time limitation to access the library system. About 27.6% of the respondents are neutral response with the mean value 2.97. From this, the researcher concluded that some services were accessed from any location and others were not.

For the question no time limitation to access resources in their library, 46.1% of them are strongly agree and agree. Whereas 36.6% of them respondents are disagreeing and strongly disagree, they say there is a time limitation to access resources. However, 17% of the respondents replied that neutral attitude with this issue. The mean value for this question was 1.7. From this, it can conclude that most of the time limitation is tolerable in the library.



Table 4.8: ANOVA table for service quality measurement (see Appendix 3)

E-library Services	Significant values between universities					
	JU		HU		MTU	
	HU	MTU	JU	MTU	JU	HU
Sufficient subscribed journals	.000*	.001*	.000*	.015*	.001*	.015*
Enough e-information resource	.197	.001*	.197	.037*	.001*	.037*
Sufficient purchased e-database	.010*	.000*	.010*	.000*	.000*	.000*
E-resources are easily accessible	.018*	.000*	.018*	.042*	.000*	.042*
Digital Library (DL) system satisfy your information need	.927	.005*	.927	.012*	.005*	.012*
IR system satisfy your information need	.005*	.006*	.005*	.929	.006*	.929
Services are accessed from any location	.042*	.024*	.042*	.000*	.024*	.000*
No time limitation to access	.919	.021	.919	.077	.021*	.077

Note: Level of significant at  $p \leq 0.05$

Further, respondents' perception about service quality measurement showed statistically significant differences for most of the variables. Accordingly, the e-information resources in MTU is statistically significant difference at  $p < 0.05$  when compared with Jimma and Hawassa Universities. Sufficiency of e-data base, easily accessibility of resources and service accessibility from any location were significantly different within each university. Similarly the user's information need satisfactions with IR system in JU statistically significantly different from HU & MTU ( $P < 0.05$ ). As to the currently available e-library systems there were not well organized and standardized. From table 4.8 we can conclude that there is differences among universities specially universities which were recently developed has less resource than others.

#### 4.1.1.9. Source of e-library services use

To determine where users use e-library services for their need, questions were asked to the students and staffs of the three universities. 21% of respondents use e-library services from the university library others were use from other source. Their responses are summarized in Figure 4.4 below:

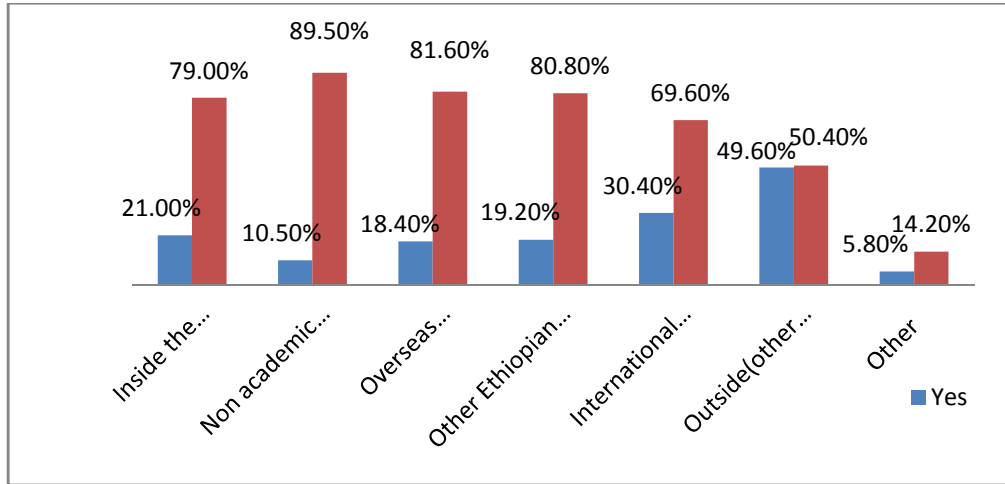


Figure 4.4: sources of e-library service

As depicted in Figure 4.4, 21% of the students said they get e-library service inside the university library. A little over 19.20% said that they access services from other Ethiopian universities. 10.50% and 18.40% of the students said that they get access from non academic libraries and over sea libraries respectively. 30.40% said that international initiative driven database were their source to access e-resources. About 49.60% of the respondents answered they use outside other universities libraries. This means that use of e-library services from other source is very high and that is why university libraries need to develop their cloud library for better service.

#### 4.1.1.10. Knowledge of cloud library

To determine the knowledge level of users about cloud library, question were asked students and staffs of three universities. Less percentage of respondents know about cloud technology. Their responses are summarized in Figure 4.5 below:

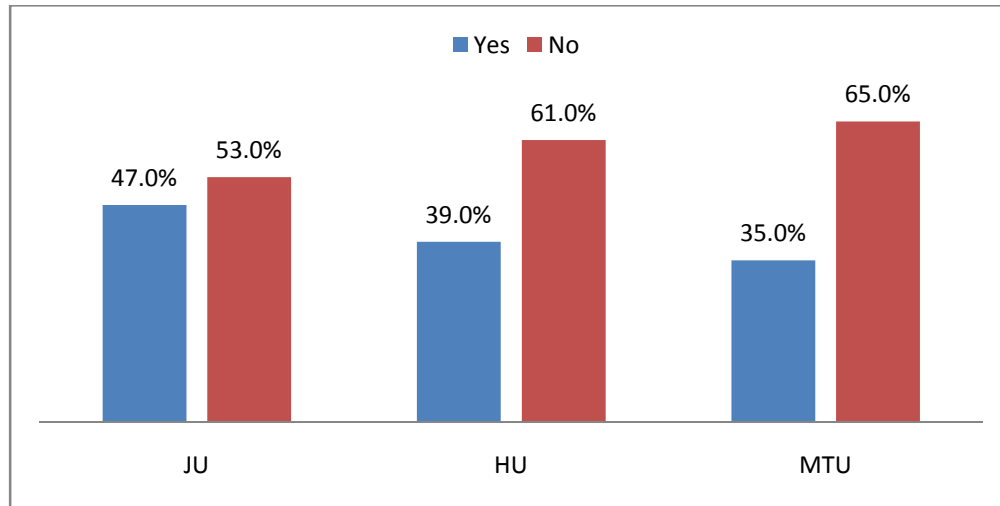


Figure 4.5: Awareness about cloud library

Majority (53%) of the respondents from JU said that they have never heard about cloud computing. And 47.0% of them said they heard about it. Similarly 61% and 65% of the respondents from HU and MTU said they have never heard about cloud library. This indicated that users were not aware of current technology in library though there is a need to provide training and awareness creation.

#### 4.1.1.11. Services used from cloud

In order to determine the user's experience of using cloud applications, questions were asked respondents. Though majority of users were use different cloud based

communication tools and some other services knowingly or unknowingly. The response is summarized in Figure 4.6 below:

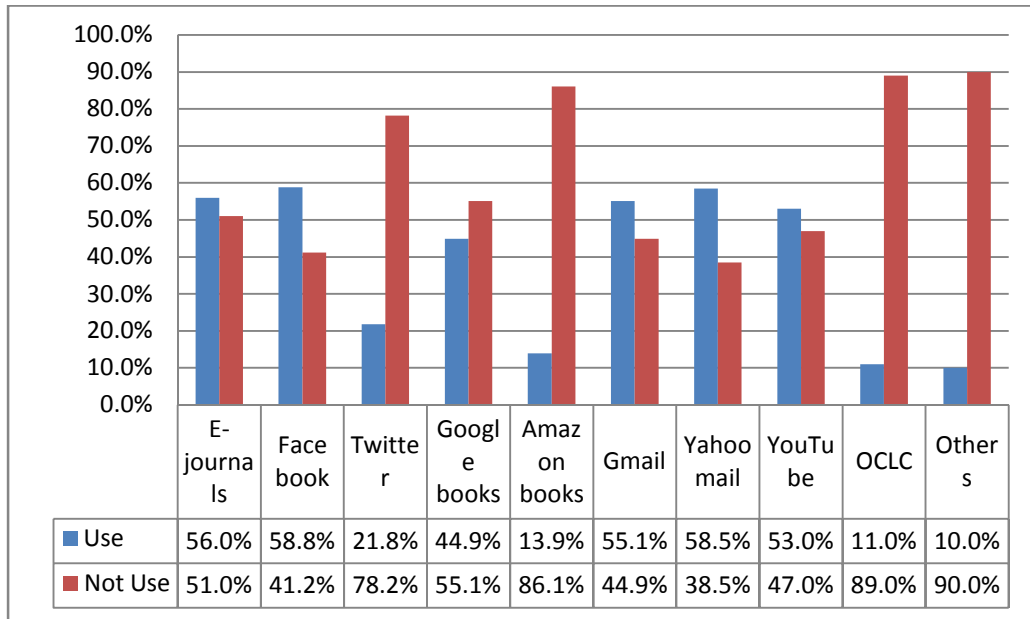


Figure 4.6: Services used from Internet

As shown in Figure 4.6, a majority of users use face books (58.8%) and 58.3 YouTube, followed by e-journals (56%), Gmail (55.1%), and YouTube (53%). This indicates that users who have had the experience of using the above services from the Internet have already experienced. So it is no difficult to use cloud libraries if established and as users were also experienced to use social communication tools, so possibilities to communicate patrons is not difficult through social medium.

#### 4.1.1.12. Benefit of cloud services for users

One of the mechanisms to understand the feeling of users about the benefit they gain from the cloud application based on their previous experience, questions were asked on some general benefit of cloud based application. More numbers of

respondents said its benefit is very high except for questions about easily aware of library services and no need to have a copy of document on personal system. The response is summarized in table 4.9 below:

Table 4.9, Respondents' opinion about the benefit of cloud library use

<b>Benefit of cloud library for users</b>	<b>Mean</b>	<b>SD</b>	<b>Decision</b>
Resources are accessed any where any time	4.8	1.15	SA
All services are accessed at one point	4.7	1.2	SA
Increase users motivation to use library	3.75	1.3	A
Save users time to search information	3.63	1.3	A
Easy to get disseminated information	3.6	1.3	A
Easy to aware current library services	3.3	1.33	A
No need to have a copy of resource on personal system	2.9	1.3	N

Scale: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree(SD)

The respondents were asked different questions with respect to the benefit of using cloud applications. The result as presented in Table 4.9 shows that most of the respondents strongly agree that resources are accessed any where any time and all services are accessed at one point with Mean value of 4.8 and Mean 4.7, with standard deviation 1.15 and 1.2 respectively. The second most response scale of the benefits was cloud library increase user's motivation to use library, and save users time to search information with mean value 3.75, 3.63 and 3.6 respectively.

#### **4.1.1.13. National library system**

To determine how respondents feeling on having a central or national library system, respondents were asked. Though more than 55% of respondents from all universities were said the need their library being part of a national library system.

The response is summarized in Figure 4.7 below:

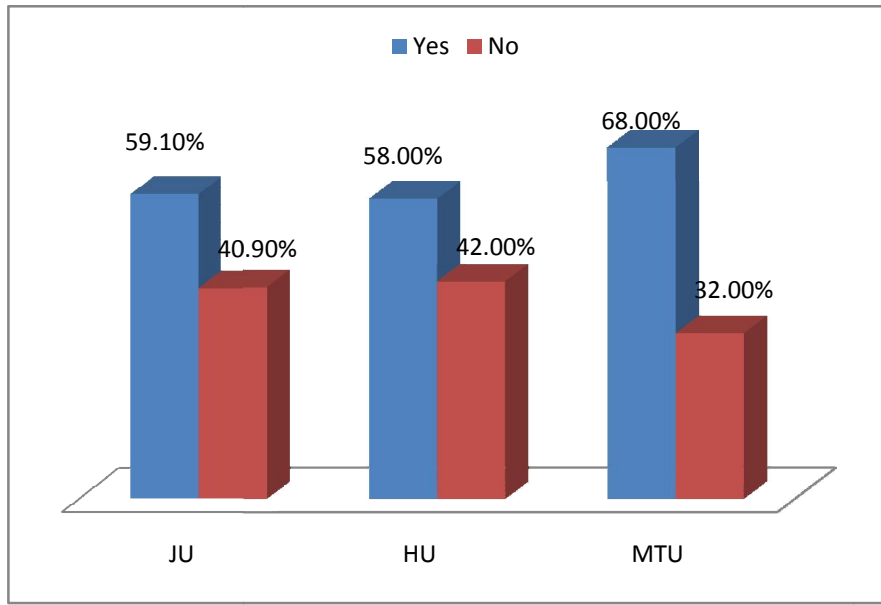


Figure 4.7: Need for library being part of national system

The respondents were asked to on the need for their library being part of national system. Accordingly, the majority (59.1%, 58%, and 68%) of the respondents from JU, HU and MTU respectively were in favor that their library be part of a national system. From the result it can be concluded that

#### 4.1.2 Responses of Librarians

One of the objectives of this part of questions was to assess the problems related with the technical aspects of library services in the various Ethiopian public higher learning institutions.

##### 4.1.2.1. Internet connectivity in the universities

One of the main activities in establishing cloud library is examining the availability and bandwidth capacity of internet connectivity in different universities. There is question raised to respondents on the status of their

university internet service. Summary of the response of the librarians of the university is presented in Figure 4.8:

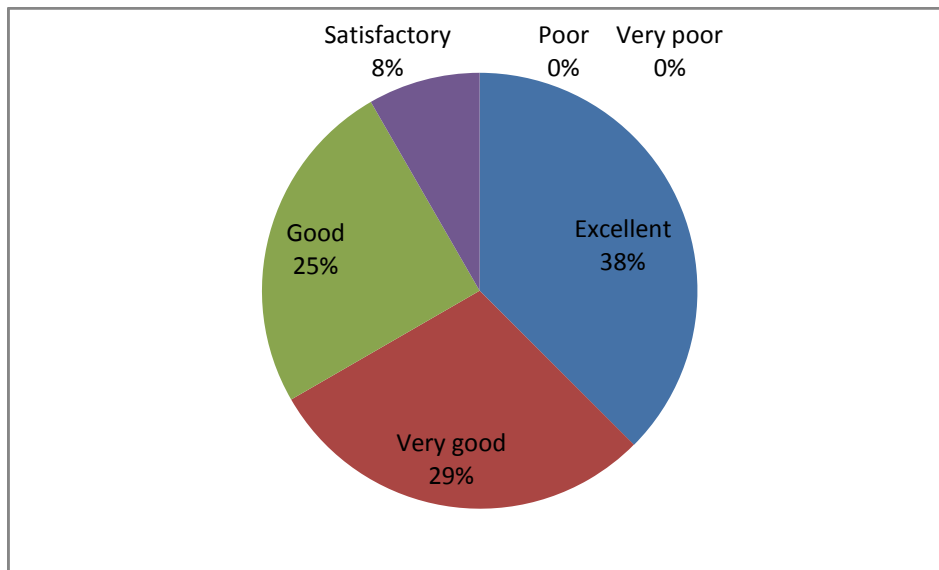


Figure 4.8: Level of Internet connectivity at universities

As the pie chart above shows, 38% of the respondents answered the level of Internet connectivity is excellent. 28% of them indicated that it is very good, 25% indicated that the level of Internet connectivity is good, 6% of respondents said that the Internet connectivity of their university is satisfactory. None of the respondents respond the level of connection is poor and very poor. This shows library services were supported by Internet connection to provide services for all users.

#### **4.1.2.2. E-library service provision**

Mechanism for understanding the e-library service provision in the universities was asking respondents, in order to identify the difference between service provisions among universities. In this phase, respondents are asked questions

regarding services provided in their universities like digital library, institutional repository, user database management-database, e-journals etc. The summary of the responses for those questions are presented in table 4.10.

Table 4.10 E-library service provision of university library

Service available	JU		HU		MTU	
	Yes	No	Yes	No	Yes	No
Digital library	53%	47%	76%	24%	12%	88%
Institutional Repository	19%	81%	25%	75%	7%	93%
User Database Management	27%	73%	35%	65%	13%	87%
E-database	42%	58%	35%	65%	11%	89%
E-journal	71%	29%	63%	37%	9%	91%
Library Automation	65%	35%	75%	25%	30%	70%
Library website	95%	5%	86%	14%	55%	45%

As shown in table 4.10 the response rate for e-library services provision in MTU was negative. 55% of respondents said there is library website but response rate for all listed services provision were less than 13% in MTU. It was found that 53% and 76% of the respondents from JU & HU answered digital library is available in their university respectively. On the other hand less percent (19% & 25%) of the respondents respond IR is available in JU &HU respectively. Regarding to the provision of user data base management services 27% and 35% of respondents said yes from JU and HU respectively. Concerning to e-data base service provision 42% and 35% of respondents answered there is e-data base service provision for both JU and HU correspondingly. Majority of respondents from JU (71%, 65% and 95%) responds that there were e-journal, library automation and library websites respectively provided in their university. Also 63%, 75% and 86% of the respondents from HU responds there are e-journals,



library automation and library website respectively. From the result it can be observed that universities e-library service provision is differ from one university to other.

#### 4.1.2.3. Respondents opinion on adequacy of resources and services

Questions to determine the adequacy of resources and services in the library were asked to the university librarians of the three universities. Accordingly all respondents from MTU indicated that adequacy of resources and services were very low. Respondents from JU and HU indicated that the adequacy of some of the resources were medium, low and very low. Table 4.11 below shows the responses from the library staff.

Table 4.11: Respondents' opinion on adequacy of resources and services

Service functionality and availability	JU		HU		MTU	
	X	SD	X	SD	X	SD
Enough human resource	2.3	0.5	2.8	0.71	1.5	0.55
Sufficient financial resources	1.8	0.6	2.3	0.89	1.3	0.52
Adequate amount of IT resources	2.9	0.9	2.1	0.64	1.3	0.52
E-database with relevant e-resource	2.3	0.7	1.9	0.53	1.2	0.41
DL with organized e-resource	2.2	0.8	2.6	0.52	1.3	0.82
IR with organized e-resource	1.2	0.6	2	0.93	1.3	0.82
Fully functional LA system	2	0.7	2	1.41	1.2	0.41
Subscribed e-journal for all discipline	1.9	1.3	1.4	0.74	1.3	0.52
Up to dated library web site with web 2.0 application	1.7	0.8	1.4	0.74	1.2	0.01
Library is integrated with other EUL	1.3	0.9	1.1	0.35	1.0	0.01
Resources shared with other university libraries	2.7	0.8	1.1	0.35	1.5	1.2

Scale: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree (SD)

The respondents were asked to give their opinion about the functionality and availability of quality service. The results presented in Table.11 shows that the responded librarians from JU were disagreed with the provision of e-database with relevant e-resource, DL with organized e-resource, and Subscribed e-journal for all discipline with mean values (M=2.3, SD=0.7), (M=2.2, SD=0.8) and (M=1.9, SD=1.3) respectively. Correspondingly they were strongly disagreed with the provision of IR with organized resources and library integrated with other university libraries (M=1.2, SD=0.6) and (M=1.2, SD=0.9) respectively.

Respondents from HU were disagreed with availability of adequate amount of IT resources, IR with organized e-resource and fully functional library automation system (M=2, SD=0.6), (M=2, SD=0.9) and (M=2, SD=1.41) respectively. Similarly they strongly in disagreement on IR with organized e-resource, and resource shared with other university libraries. But the provision of DI with organized e-resource were medium (M=2.63, SD=0.53) in HU. Whereas respondents from MTU were disagreed for resource shared with other university libraries and enough human resource (M=1.5 SD=1.2) and (M=1.5 SD=0.55) respectively. But they were strongly disagreed for the rest of services provision. From the result it can be observed that the services and resource provision in university library is not equal.

Table 4.12, ANOVA table for resource availability in the university library (see appendix D)

Dependent Variable	Significant values between universities					
	JU		HU		MTU	
	HU	MTU	JU	MTU	JU	HU
Enough HR	0.387	0.045*	0.387	0.009*	0.045*	0.009*
Sufficient financial resources	0.576	0.349	0.576	0.095	0.349	0.095
Adequate amount of IT resources	0.017	0.003*	0.179	0.044*	0.003*	0.044*
E-database with relevant e-resource	0.009*	0.003*	0.009*	0.046*	0.003*	0.046*
DL with organized e-resource	0.017*	0.177	0.017*	0.028*	0.177	0.028*
IR with organized e-resource	0.167	0.982	0.167	0.449	0.982	0.449
Fully functional library automation	1.000	0.023*	1.000	0.017*	0.023*	0.017*
Subscribed e-journal for all discipline	0.651	0.558	0.651	0.999	0.558	0.999
Up to dated library web site with web 2.0 applications	0.997	0.073	0.997	0.259	0.073	0.259
Library is integrated with other EUL	0.936	0.717	0.936	0.726	0.717	0.726

Note: level of significant difference at  $p < 0.05$

In table 4.12 above a one-way ANOVA was conducted to examine whether there were statistically significant differences among different university libraries. The results revealed statistically significant differences for provision of enough human resources between JU (M=2.3, SD=0.48), HU (M=2.5, SD=0.75) and MTU (M=1.5, SD=0.55), adequate amount of IT resources between JU (M=2.9, SD=0.99), HU (M=2.13, SD=0.64) and MTU (M=1.3, SD=0.52) and e-database with relevant e-resource JU (M=2.3, SD=0.67), HU (M=1.92, SD=0.53) and MTU (M=1.2, SD=0.41). JU and HU reported significantly better provision of services and resources compared with MTU. From the result it can be observed that the services and resource provision in university library were different.

#### 4.1.2.4. Factors affecting to develop e-library services

Respondents responded to the factors that affects the development of e-library services. The responses are summarized in table 4.13 below:

Table 4.13: Respondents' opinion factors affect to develop e-library.

Factors affecting development of e-library services	Central tendency				Dec
	X	Median	Mode	SD	
Inadequate ICT facilities	4.17	4	5	0.87	A
Inadequate skilled Digital Librarian	4.4	5	5	1.01	A
Inadequate skilled IT technician	3.7	4	5	1.2	A
Inadequate library budget	3.04	3	5	1.57	M
Level of users computer and Information literacy skills	3.02	3	2	1.41	M
Limited e-information resources & access	3.04	3	5	1.63	M
Management problem	2.9	3	2	1.42	M
Uncomfortable working environment	2.4	2	2	1.06	D
Low level of knowledge about e-library service	2.3	3	4	1.10	D
Insufficient utilization of existing service	2.17	3	3	1.09	D
Network/bandwidth problem	2.4	3	4	0.93	D
No standard used to build e-library service	2.8	3	4	1.14	M

Scale: 5=Strongly Agree (SA), 4=Agree(A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree (SDA)

The respondents were asked different questions to check out the factor which affect library development. Descriptive statistics presented in Table 4.13 show that respondents strongly agree for inadequate ICT facilities, inadequate skilled Digital Librarian and inadequate skilled IT technician with (Mean= 4.17, Mean= 4.4 and Mean =3.7 respectively). The second most response scale were inadequate library budget, level of users computer and Information literacy skills , limited e-information resources & access, management problem, and no standard used to build digital library were scaled neutral (Mean= 3.04, Mean=3, Mean=3.04, Mean=2.9 and Mean=2.8 respectively). On the other hand uncomfortable working

environment, low level of knowledge about e-library service, insufficient utilization of existing service and network/bandwidth problem were answered disagree (Mean=2.4, Mean =2.3, Mean=2.17 and Mean=2.4).

#### 4.1.2.5. Cloud Library

To determine the agreement for cloud library services, questions were asked to the librarians of the three universalities. Majority librarians from the three universities respond strongly agree. The responses are summarized in Figure 4.9 below:

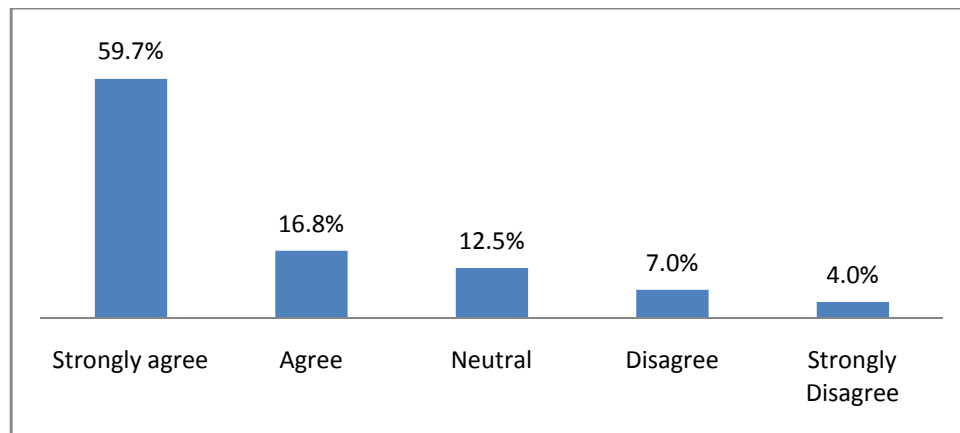


Figure 4.9: Cloud library is the best solution

From the Figure above we observed that 59.7% of respondents have a positive attitude that cloud system will change their library problems. 16.8% of them said agreed that cloud library is the best solution for changing library environment. From the Figure it can be concluded that cloud library is good for better delivery of services for users compared with traditional library. From the result it can conclude that, since librarians agreed with cloud library is the best solution for them so they easily accept/motivated the idea of establishing cloud library for their library.

#### 4.1.2.6. Cloud library development model

To understand the establishment of cloud library in Ethiopian public higher education, it is essential to know respondents interest. There is question raised to know which model is the interest of respondents. In this regard, respondents are asked to select model which interest them. For any organizations to adopt cloud library, first there should be an understanding on the models of cloud technology.

Summaries of the respondents response is presented in Figure 4.10 below:

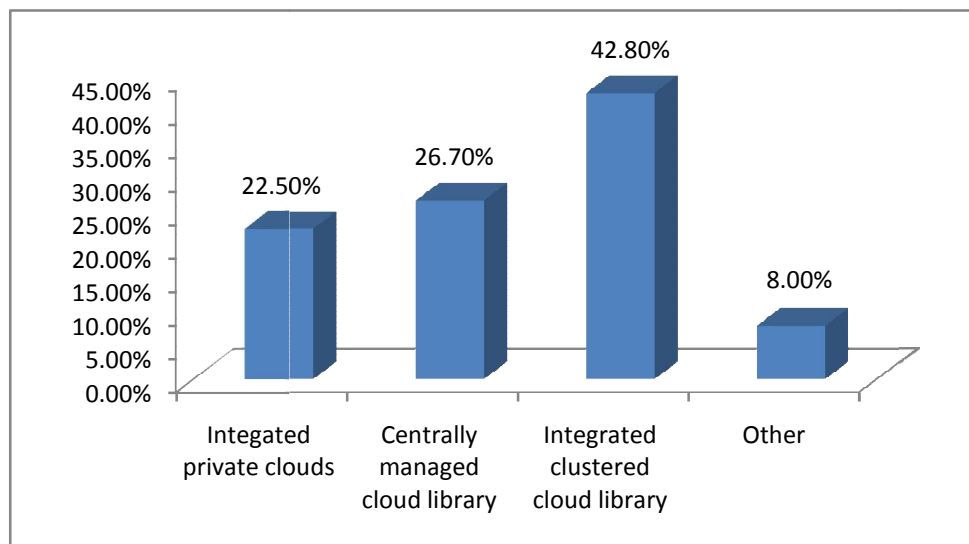


Figure 4.10: Cloud Computing Deployment models in libraries

We can see from Figure above that the majority of the respondents (42.80%) choose integrated clustered cloud computing library model. The second groups of respondents (26.70%) were said centrally managed cloud library. About 22.50% of the respondents said that integrated private cloud. 6% of the students said that other. Library services rests on various data & information.

#### 4.1.2.7 Level of cloud computing

In order to identify the level of using cloud library in the universities, respondents were asked their library status of cloud implementation. All the respondents from the three universities indicated that: cloud library not in use. Summaries of the respondents response is presented in Figure 4.11 below:

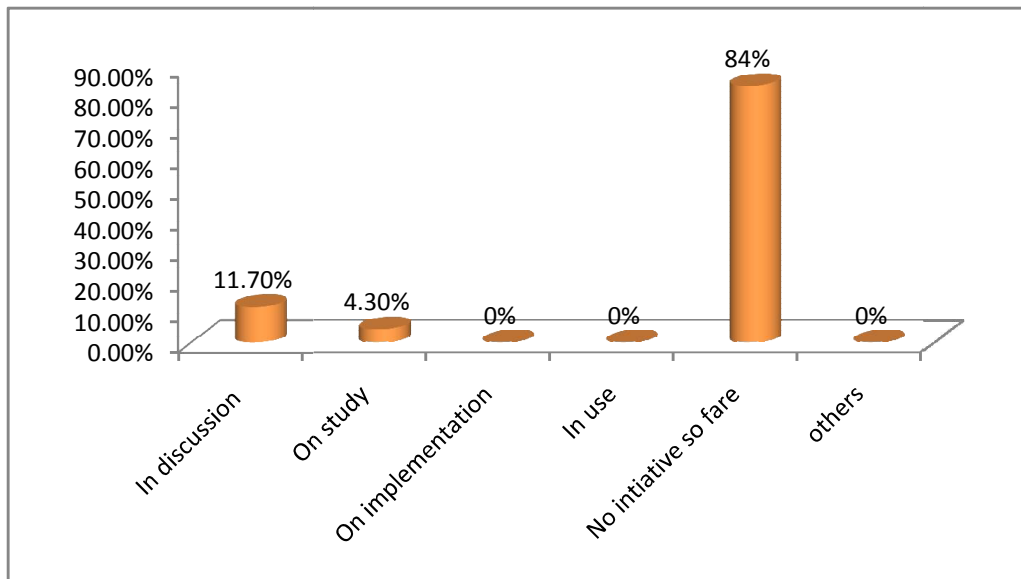


Figure 4.11: Level of cloud computing in libraries

In Figure above we see that about 84% of the respondents indicated that there are no initiatives so far for applying cloud library. 11.70% respondents said that cloud library use is under discussion. 4.3% said that the use of cloud computing is on study and none of the respondents said it is in use on implementation.

#### 4.1.2.8 Reason to have cloud library

In order to understand the drivers for using cloud library for universities, respondents are asked questions to scale their level of interest on the benefits of cloud library. The purpose was to find out that how development of cloud library benefits university libraries in order to efficient delivery of services. Respondents were highly agreed on the benefit cloud library benefits. Summaries of the respondents response is presented in table 4.14 below:

Table 4.14: Drivers for librarian’s interest in cloud library system

Reasons for using cloud technology in libraries	Mean	Median	Mode	SD	Decis
Need for physical storage space can be reduced	4.2	5	5	1.14	A
Minimized maintenance cost among libraries	4.12	4.5	5	1.22	A
Resource purchasing cost can be reduced	4.20	4.5	5	1.14	A
High Scalability	3.29	3	3	1.16	N
Increased computing ability/power	3.45	4	4	0.99	N
Minimized duplication of e-library projects	3.75	4	5	1.28	A
Enhanced ability to integrate libraries	3.79	4	5	1.28	A
Increased resource sharing among libraries	4.25	5	5	1.15	A
Minimized resource difference among libraries	3.95	4	4	1.12	A
Minimized duplication of resource	3.87	4	5	1.33	A
Increased interoperability	3.3	4	4	1.096	N

Scale: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree (SDA)

Table 4.14 shows that respondents scale of measurement values reasons to use cloud technology in library. Accordingly respondents were agree for cloud can reduce storage space, minimize maintenance cost, infrastructure and resource purchasing cost, minimized duplication of e-library projects, enhance ability to integrate libraries, increase resource sharing, minimized resource difference, and minimized duplication of resource (Mean= 4.2, Mean= 4.12, Mean=4.20,



Mean=3.75, Mean=3.79, Mean=4.25, Mean=3.95 and Mean =3.87 respectively).

The second most response scale were High Scalability, increase computing ability/power and increased interoperability were scaled neutral (Mean= 3.29, Mean=3.45 and Mean=3.3 respectively).

#### 4.1.2.9. Expectation of library service on cloud

To determine what services on cloud library is more needed by librarian to their university libraries, questions were asked to the three universities respondents. Majority of responses were access to library collection, CAS and SDI services through cloud communication tools, management of scholarly documents, and library software's, were the main services needed to have on cloud. The summary of the responses are presented in Figure 4.12.

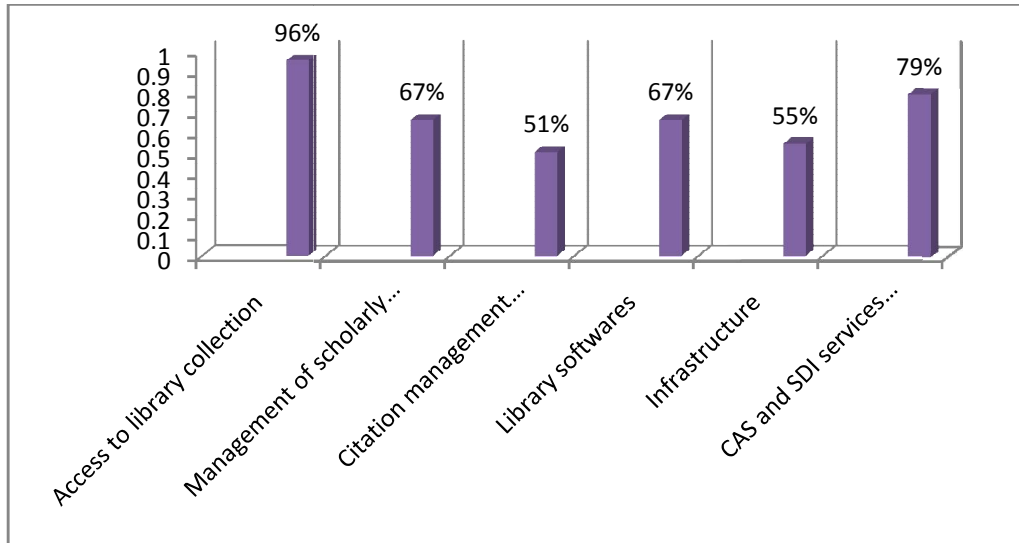


Figure 4.12: Expectations of library services through cloud library

In Figure 4.12 we observed that librarians interest on possibility of services under cloud library. Accordingly the majority of the respondents (95%) said access to library collection.51% of them indicated that citation management software. A

little over 67% said that management of scholarly documents, 79% of respondents said CAS and SDI services through cloud based communication tools. 67% and 55% of respondents were said library software and infrastructure are their expectation on cloud library.

#### 4.1.2.10. Challenges and constraints to development of cloud library

To determine implementation of cloud library services in public university libraries may have an impediment to efficient and effective development process, questions were asked to university librarians and technical services libraries about the challenges and constraints that block them to have cloud library services. The responses given by the respondents are given in table 4.15 and Figure 4.13 below:

Table 4.15: summary of factors affecting cloud library implementation

Central tendency	Poor ICT strategy/ policy	No shared collection development policy	No resource sharing consortium	Poor current library structure
Mean	4.25	4.25	4.16	2.79
Median	4.5	4.0	4.0	3.0
Mode	5	4.13	5	2
Std. Deviation	0.98	1.07	0.91	1.21
Decision	Agree	Agree	Agree	Medium

Scale: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (DA), 1=Strongly Disagree (SD)

The above table indicates that majority of respondents were agreed on factors that keep silent to use cloud technology in the Ethiopian public higher education libraries. Accordingly respondents were strongly agreed for poor ICT strategy and policy and no resource sharing consortium (mean values 4.25, 4.25) and agreed for no shared collection development policy (mean values 4.16) but for poor current library structures respondents were respond disagreed (mean values 2.79).

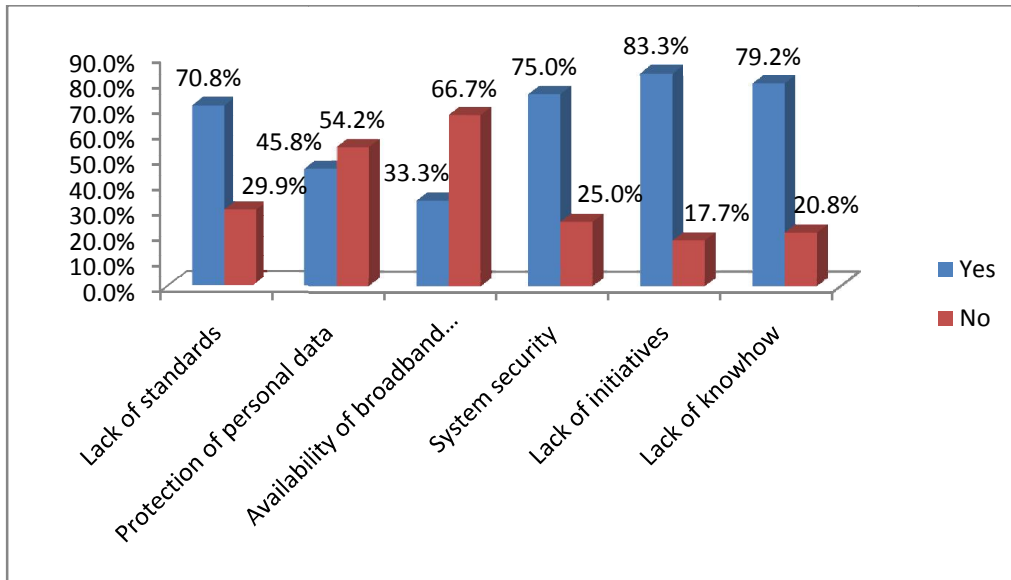


Figure 4.13: Reason to not have cloud library

However, there are more than enough opportunities of library services in cloud computing yet there are various perceptions that hinder its implications in the libraries. Figure 4.13 presents a snapshot of the obstacles of cloud library establishment. Accordingly we observed that 75.0% of respondents fear for implementing cloud library was security problem. The results show that 70.8% of respondents respond lacks of standards were problem to implement cloud library. Moreover, 79.2% working library professionals reacts lack of know how an issue was. Further, a majority of library professionals 83.3% answers lack of initiatives among universities were other issues to implement cloud technology in the library system. But 45.8% and 33.3% of respondent's answers protection of personal data and availability of broad band internet respectively were a concern to establish cloud library.

#### 4.1.2.11 Responsible bodies to cloud library implementation

To determine the involvement of stake holders on implementation of cloud library in EPHIE, questions were asked respondents who they think responsible persons. Accordingly majority of respondents said university library, ministry of education and university ICT office and close to 58% were also said university officials. The summary of the responses are presented in Figure 4.14.

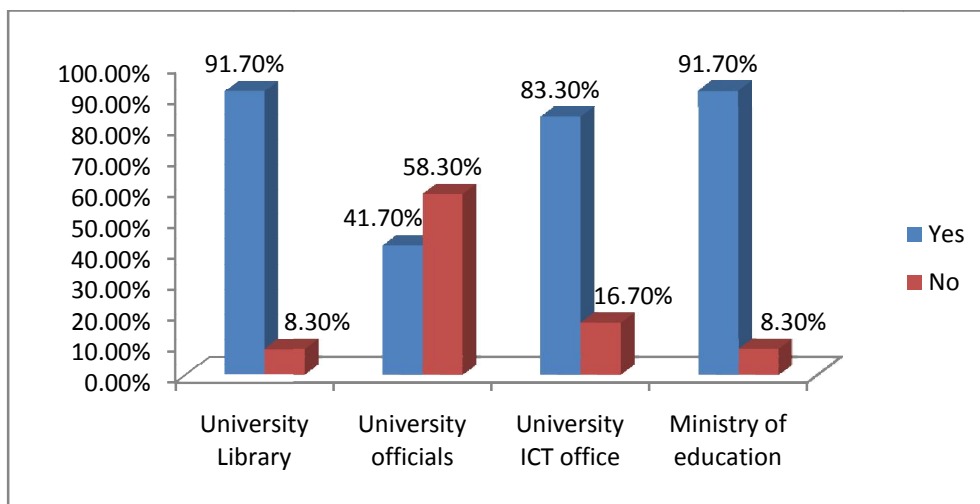


Figure 4.14: Responsible bodies for establishing Cloud Library

In Figure 4.14 Close to 92% of the respondents indicated that ministry of education and university library has responsible bodies. About 83.3% said that university ICT offices. Over 42% of them said that university officials. Since higher education institutions are at the center of the government's policies.

#### **4.1.3. Qualitative data result**

The researcher also carried out interviews with the three university library directors and two IT technicians in the library from the three universities. It was clear that the entire library were used internet service for providing services for their users. Respondents from JU and HU indicated that the computers available in the library were sufficient. In addition the respondents from JU said the university library had wireless network. So the students no need to come inside the library. They were used from anywhere inside the university. Respondents from the HU even they have the internet connection its speed and the number of computers in the library were very less. Both JU and HU universities were use digital library, e-database, and subscribed journals with less numbers of collections that helps the users to access e-information. However the respondents from MTU indicated that the library had no any ICT services/ e-library system.

ICT were also used in bibliographic description of resources in the two universities except MTU. Both JU and HU had automated library system that only performs a cataloging function. JU used ABCD and HU used KOHA library automation software. Both respondents indicated that this library automation system was functioned only locally which is not possible to use it outside the university. Due to power and some technical familiarity the system was not always function. In case of MTU there is no library automation. However the automation system was not work now.

In order to cooperate with publishers universities were do not have their own communication system rather than using web mails like Gmail and yahoo. All universities indicated that they do not subscribe to e-journals by themselves due to

high cost of subscription. They were subscribed through the help of other overseas supporters like UNSCO, World Bank and WHO.

One challenge faced by university libraries in application of IT based services respondents gave several challenges that impeded successful application of e-library services. All respondents cited less library budget, high cost of IT equipments, less skilled digital librarian, lack of IT infrastructures and less support from high officials were the major problems.

On the extent of developing e-library all respondents from the three universities indicated that cost budget was very high. Even due to the high cost of e-journals subscription universities were not going for it. The cost approximated for one journal subscription was not less than 10-25 thousand dollars. Universities were investing a lot of budget for power and internet bandwidth consumption by the library users. Also maintenance, IT equipment and human labor costs were the major areas libraries invest their budget.

University librarians were also asked to determine ways in which cloud library can be used to enhance resource sharing among universities. All the respondents indicated that it will enhance collection size, balance have and have not of information, enhance cooperation, make the process more efficient and effective. Communication with users and librarians were easier and it made possible to know the availability information resources within universities. They also indicated that the cost invested for the same resources were minimized and collaborative subscription for journals may ease the process and cost invested.

In fact universities from all universities were investigated that they have no plan to deploy the cloud technology. But they informed the interviewer that there was national consortium initiated for the sake sharing resources. so far how and what methods used were not identified yet. It was observed during the interview that most librarians believed that cloud library is the best solution for the current problem they encountered. They also indicated that the application used for assisting their service process. So they were highly motivated to involve in the process of establishment. Generally they were indicated that all university officials, MOE, librarians and ICT professionals should have take a high responsibility from the beginning of policy making and establishment. Respondent's needs for services available on clouds were digital library, institutional repository; integrated library automation system and bibliographic database management were their major choice of service on the cloud. Respondents from MTU and HU recommends since the system was belongs to all universities it is better to decide the service to be available together.

For question about policies needed respondents from JU indicated that collection development, acquisition and resource sharing policies were required. MTU and HU respondents point to use policy, ownership issues and weeding policies were needed. The respondents were not care for security they said security is not a problem because libraries first job were providing information for users thus as Ranganatans law of library, library resources were for use and all users have their resource. No information kept secret form users unless it is for office use.

## **4.2. Discussion**

The disproportionate distribution of resource and services with in public universities in Ethiopia needs to have necessitated change in the way libraries operate. Libraries are now required to embrace these changes and manage the resources and services in the best way that satisfies the users that they serve.

### **4.2.1. E-library service delivery strategies and efficiency in Ethiopian higher learning institutions**

On the basis of analysis and interpretation of collected data of respondents, it is clear that most of the respondents from all universities possess excellent computer literacy as per their own assessment. Regarding provision and availability of various e-library services, the opinion of users (students and academic staffs) and librarian response of individual universities differ. Services on digital libraries, library automation, open url resolver, library website and e-journal provided in Hawassa university and Jimma university seems similar. Institutional repository and e-database distribution among all universities were varied. However the responses for provision of services in Mizan-teppi University were quite less than services in JU and MTU. The comparison of availability of services at each university was explained under table 4.4. The use of e-library services and frequency usage of service difference in libraries among respondents from each university was different as explained under table 4.5 and table 4.6. Main source of using e-library services by respondents is outside other oversea libraries and international initiatives database, which may be due to ineffective service, less information resources and quality of services of their university



library. It is quite interesting to note that the majority of respondent's satisfaction level on sufficiency of subscribed journals, e-databases, e-information resources and easily accessibility of services were low and the existing digital libraries and institutional repositories don't satisfy their information needs in general.

Thus the researcher concluded for a service delivery strategy among universities was independent of each other which needs cloud system to bring discrete parts together. This finding is in agreement to Nandkishor et.al. (2013) who stated that Cloud library systems are all service oriented i.e. the systems are such that they are created out of other discrete services. Many such discrete services which are independent of each other are combined together to form this service. There were no networked system among universities service accessibility were location dependent (locally served systems) that keeps users were no get resource at any time. Since no resource sharing mechanisms among libraries it is common to face problems like flexibility associated with the digital data, lower levels of efficiency, skilled human resource and huge cost involved in managing the entire IT infrastructure. If all electronic data resources of each university put together in a single place (cloud library) which may be accessed by a group of libraries, the whole electronic data base will become huge. This finding is in agreement to Sanchati & Kulkarni, (2011), who stated that using cloud technology can help to bring all service in one place which realizes the resource sharing and obtains a greater efficiency among libraries.

#### **4.2.2. Potential benefit of cloud libraries for user and library**

The study found that cloud library development in Ethiopia potentially benefit EPHLI. The research result indicated that users have no knowledge about cloud technologies but it is seen that majority of them had the experience of using cloud applications like face book, Gmail, yahoo mail etc services from the internet have already experienced “cloud computing”, unknowingly. Since cloud library paradigm is independent of location and can be accessed on any media having network connectivity. The research finding indicated that users use different devices to access information from cloud which tells us cloud applications are not stranded on individual machines. This finding is in agreement to Hamm, (2009) said that it is combined into one digital cloud available at the touch of a finger from many devices. (Lowry et.al, 2009) libraries need to deliver services and resources to the virtual environments used by students, staffs & researchers. In order to keep pace with technology libraries need to provide services that can run on the media used by the library users. Majority of respondents indicated that cloud library benefit them in many ways such as access to information any where any time, access all services at one point, increase motivation and save time to search information, easy to get disseminated information and easily aware of the available resources in their library environment. Thus the research indicated that the users need for being their university library part of a national system (cloud library) was highly supported.

Majority of the respondents identified that cloud library is the best solution to solve their library service provision and it they responds that it helps them by

reducing storage space, minimize maintenance cost, infrastructure and resource purchasing cost, increase computing ability, minimize duplication of projects and increase resource sharing among libraries. In fact different literatures argued that cloud library is a best solution for sharing resources and services among organizations. This finding is in agreement to Fox, (2009) and Kueukshetra and Haryana, (2012) said that libraries are in a good position to opt for centralized cloud solution because they handle huge data but with limited finances to afford continuous upgrades of their own computing facilities. cloud computing allows libraries to avoid locally hosting multiple servers and equipment and constantly deals with hardware failure, software installs, upgrades and compatibility issues and this is possible because processes get simplified and libraries save time and money. ICT related headaches of libraries get reduced by the introduction of this technology. This study is in agreement to Faiz.A and Hasan.J (2012) said that cloud library is the one point solution to get all updated software, Applications with low cost and less maintain and without about data, document scattering.

The respondents indicated overwhelmingly that they were completely agreed computing will help the integration of libraries in a painless easy manner. This finding is in agreement to Suresh Chandra. P and Mahapatra, (2013) said that libraries will be able to share their electronic data resources which shall lead to reduction of duplicate data resulting in cutting down the overall budget of libraries.

#### **4.2.3. Factors affecting e-library services development**

Finding from the research indicated that e-library service development was highly dependent on knowledgeable digital librarians and skilled IT professionals who have merit of developing standardized library systems with better resources that satisfy the need of all users. The study depicted that libraries in Ethiopian Public Higher Learning Institutions were experiencing several challenges like lack of skilled professionals, insufficient resource utilization, and unbalanced resource with users need, digital divide problems, and inadequate library budget. This finding is in agreement to Suresh.C and Mahapatra (2012) said that cloud technology brings opportunities for libraries to leverage their combined efforts into large-scale systems with more end-user impact and organizational efficiencies. The study reveals that the development of the system also influenced by the computer literacy skill of librarians as well as their level of education. The result of the research indicated that there is require of computer literacy skilled librarian in the academic libraries. It is high time when the librarians should take it as part of their worry. This finding is in agreement to Lamont, (2009) and Mavodza, (2013) who stated that since technology has become very important for the libraries in the current days that librarians may increase more advanced computing skills to address a lack of technical support, to develop new services, or for professional or personal interest. Further “with the current irregular IT revolution libraries have become one of the places which are using cloud and therefore librarian’s desires to enlarge their skill set & think more openly”.

#### **4.2.4. Impediments and the challenges to adapt cloud library**

It was found that the major obstacles to the development of cloud library also highly affected by lack of initiatives, lack of knowhow, system security and lack of standards so far among libraries. Beside this the second impediments factors indicated in the research were poor ICT strategy, No shared collection development policy and No resource sharing consortium. Hence, cloud library chains all higher education institutions common collection development policy is mandatory that define plans for the continuing development of resources, identifies collection strengths, and outlines the relationship between selection philosophy and the institution's goals. This finding is in agreement to Gbaje, (2007), that who declared the process of developing electronic information resources in cloud environment includes "acquisitions of electronic resources such as databases, e-books and journals through license and access to quality free web based resources". This process requires that strong ICT policy for how infrastructures such as a reliable internet connectivity and web site to provide users with access to relevant information for research, learning, and teaching. Many libraries are coming together to form consortia for electronic resource sharing and technology support. Respondents present a snapshot of the obstacles of cloud library establishment. "Cloud computing raises a range of important policy issues, which include issues of reliability and liability, security, privacy, access and usage restrictions" (Arbabioon & Pilaveri, 2011).

#### **4.2.5. Technological solution to make the digital divide even between EPHLI**

The research finding indicated that cloud development in Ethiopian higher education were in at infant stage. There are many issues to consider when moving an enterprise application to the cloud environment which are divided into different types of clouds, each with its benefits & drawbacks (Zhang, Cheng & Boutaba, 2010). Finding from the research indicated that librarians had high expectation to access library collection, management of scholarly documents, citation management software, CAS and SID services, library software and infrastructure to move to cloud. This finding is in agreement to Goldner & Birch, (2012) state that “Cloud-based systems are not new in resource sharing as many countries have a national cloud based resource sharing tool, accessed via a web browser”. Thus the researcher was developed a framework on how to balance the technological divide between academic libraries in Ethiopia.

### **4.3. Proposed Framework for Cloud Library**

#### **4.3.1. Components of cloud Library**

Due to different factors, it is known that e-library system in Ethiopian Higher Education is currently not well developed and it can be said that it is at very early stage, as revealed by the findings of this study and well discussed in previous sections. Harnessing the Cloud based library technology for delivering different services such as online e-resource sharing system, integrated library management system, digital repositories, open url resolver, citation management, web

communication tools, database management system, and similar services will give more flexibilities and efficient resource utilization.

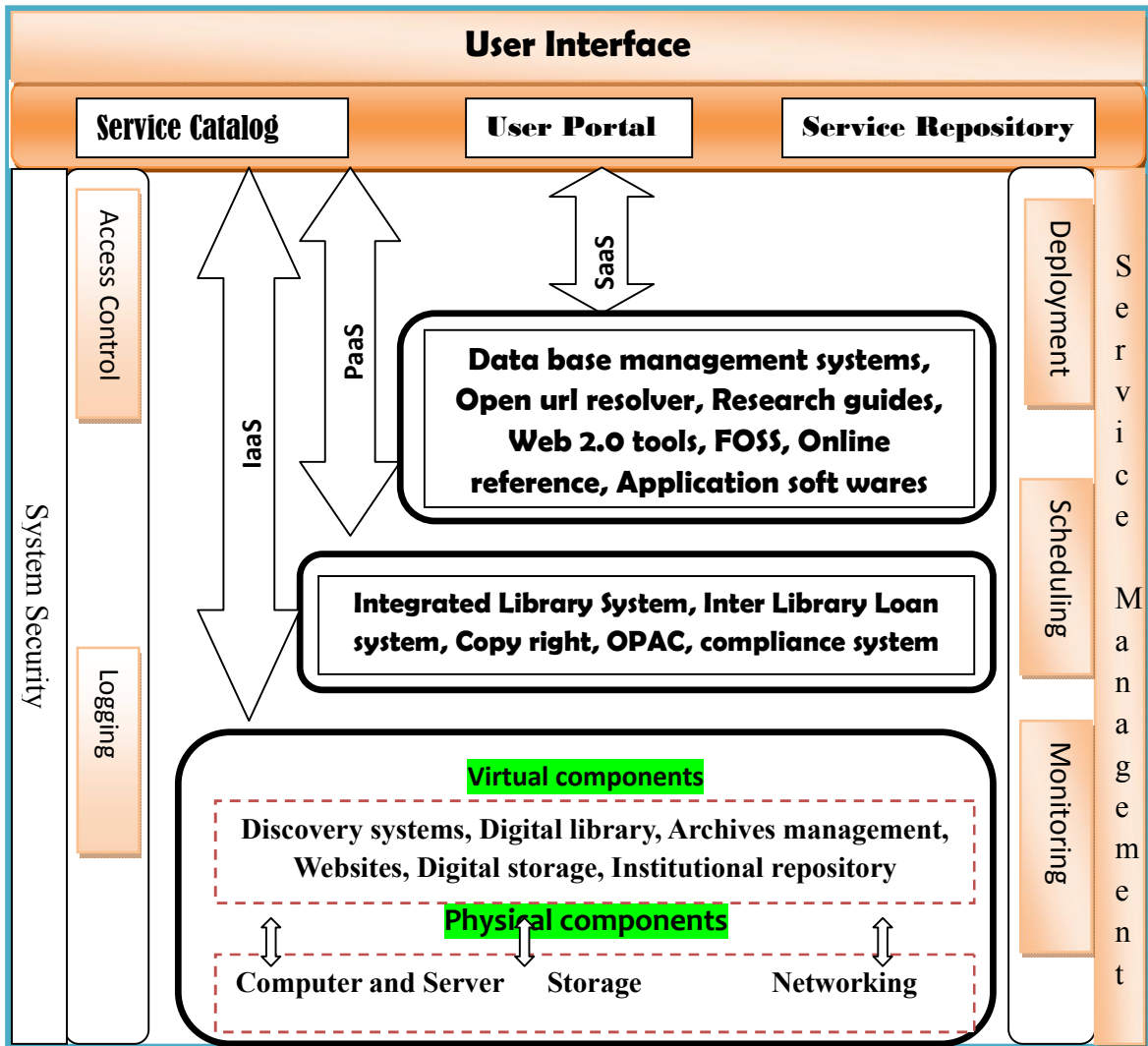


Figure 4.3.1.2: Cloud library service model modified from Kanungo et.al, (2012)

The presented framework contains four layers (User Interface, software as a service (SaaS), Platform as a service (PaaS), and Infrastructure as a service (IaaS) and three modules (User log database, system security, and service management):

**User Interface Layer:** A user Interface represents system interaction Management System since it acts as an interface between the user and the Cloud

content. The User Interface layer contains three important components which are as follows:

- User Portals: provide an access path to specific web applications or services since everything is located on the web and can be accessed using a network connection
- Service Catalog: contains different types of services with detailed information about the additional access information, such as what layer the service is located and who can access this specific service
- Service Repository: composed of different services like software's, e-resources etc. categorized and arranged depending on the service name and access level which may be in one of the three other layers, namely SaaS, PaaS, or IaaS.

**SaaS Layer:** This layer provides access to hosted programs, applications or tools on the Cloud. Data base management systems, library circulation Management Systems and other Application Soft ware's can be hosted at this layer.

**PaaS Layer:** This layer provides access to different platforms- OPAC, Integrated library system, Inter library loan system and similar platforms.

**The IaaS:** level gives more flexibility when dealing with the Hardware layer but through the system virtualization. Now, we have reached the point where we have to build the servers and set up their configurations. Additionally, the user can deal with the fine details of the virtualization with some limitation which makes the



virtualization step set in this level. Additionally the proposed framework will have a system security module for maintaining the security of the cloud, a Service management module for monitoring, scheduling and deployment of services and users log database module for tracking user's access to the cloud.

Based on the identified services and selected Clouds, the researcher suggests a Cloud library framework for EHLI.

Considering the presented issues of e-library services development in EHLI, and a focus on library resource sharing, different solutions can be provided. However the researcher suggests that by using an integrated clustered community cloud library system for intermediate sharing of resource, supported by adequate strategies and policies, it would provide solution for existing problems today at our academic libraries, like lack of resource sharing, poor e-resource management, lack of good preservation, inefficient utilization of resources and duplications of resources and poor library projects collaborations among each universities. Centralized cluster libraries should be established as an e-library resource center being a specially designed or constructed location for low cost storage, maintenance, and easily sharing of resource between clustered clouds. That individual cluster in a given location is considered as a community cloud for universities supported under the clouds. Instead of having an e-library system in each academic institution, which requires very high price, modern technology and fast Internet connections enable a centralized location for storage, sharing of resource and access. According to Vaquero, et al (2008), cloud is understood as “a large pool of easily usable and accessible virtualized resources that can be

dynamically reconfigured to adjust to a variable load (scale), allowing also for optimum resource utilization”, while a community cloud is a cloud where the cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and agreement considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises (National Institute of Standards and Technology, 2011).

According to Bearman (2007), the transfer would be from “private library management environment” to “a community library cloud environment”. Such solutions would be available as Infrastructure as a Service (IaaS), which reduce underutilized IT hardware, and as Software as a Service SaaS, which reduce current application complexity. The centralized location would enable all the academic institutions to use a secure network transfer and store and manage resources in a remote location the cloud. Since such centralized library should be built and managed with the cooperation of the universities with the support of MOE, the costs of setup and management should be shared among all stakeholders according to their use of the system, as is common for the concept of cloud computing (Armbrust et al., 2009).

By using the suggested cloud-oriented library for resource sharing, the public academic institutions would derive many benefits. The cost of setting up such a repository would be mainly on the side of the MOE or shared among academic institutions, but still lower than individual solutions within each institution due to

the economies of scale (Jaeger et al., 2008; Armbrust et al., 2009). Services and storage would be used free for all based on the policy but for extra services and storage as a pay-as-you-go for and savings on energy consumption, and expenses arising from IT management are expected at the same time. The reduction of duplicated resources would also reduce storage needs and therefore the cost per resource since only one copy would be stored in the cloud accessible to certain users based on their rights, regardless of their institutions. But while the infrastructure costs would be reduced, the cost of data communication would rise (Dillon et al., 2010), so the institutions should use their own communication networks as much as possible.

The development and implementation of such solution would not be a burden on the participating institutions and the knowledge to manage such a project and its solution would not be needed in the individual institutions. Management of such a system would be shifted to the selected institutions with trained IT professionals, digital librarians, and other experts who are selected from each university or hired some were else. The central cloud would have a uniform solution that could be managed by fewer IT and digital librarian employees. Upgrades of the system hardware and software would be simpler and more transparent for individual institutions and the costs shared among all of them.

Moreover, access to the repository would be available from anywhere and anytime, enabling working with documents using mobile devices in the field. Using an adequate web based application interface, could be accessed using computers, smart phones, tablets, and other devices.

The risks that would have to be addressed in such a way therefore include security issues, dependency on network connections for access to resources, dependency on the availability and quality of services provided in the cloud, bandwidth problems, problems of regulatory and standards compliance, etc. Consequently, a risk management program focused on cloud computing should be an essential part of the institutions IT environment (Paquette et al., 2010). For this model, some of the usual cloud computing risks are less hazardous, since the researcher suggests a community type of cloud, although Wyld (2009) warns that budget pressures will continue to drive more and more institution IT to hybrid and even public clouds. The suggested community cloud would be managed by the selected institution and not subject to open market rules or cloud providers. Consequently a vendor lock-in, caused when each cloud has its own method for cloud clients/applications/users to interact with the cloud (Dillon et al., 2010), is not a high risk since the institutions would build their own single cloud to be used by all communities in the cloud.

Security risks and personal data privacy issues for self administered documents are stressed as two of the main issues of clouds (Marinos and Briscoe, 2009). Even within a community cloud and central clouds, institutions are shifting their documents over the network to remote storage, leaving them with less control over their documents thereafter. But since a central cloud would be established in a community cloud as a trusted system it would be a part of a closed environment, strictly subordinated to different acts and regulations. A trusted cloud would therefore enable implementation of the idea of moving beyond solutions

dependent on policy alone, to those which implement systems-based control (Bearman, 2007).

When orienting towards the cloud, institutions would have to focus on the redesign or adaptation of some business activities or processes. Existing information systems or applications would have to be adapted to integrate or at least exchange information and resources with the central cloud and enable the primary goal of interoperability, i.e. to realize a seamless flow of data across and between cloud and local applications (Dillon et al., 2010). At the same time, institutions could make good use of all the other services that would also be available within such a cloud. As suggested by Paquette et al. (2010), the scope of implementation and the level of integration would be determined by whole institutions.

The question of what happens if cloud providers (selected institutions) stop to exist is more a question of a national disaster than of the capabilities of services in the system. For this case, the researcher proposed four communities cloud which is connected one with each other (Figure 4.3.1.3). The service and application might be the same which means one system should have a copy of others. In addition if one system fails the rest work because the network structure will be mesh topology. However, system continuity should be guaranteed by the commitment of responsible institutions at each cloud, and should be supported by disaster recovery plans and testing. Care should be taken to ensure the reputation and sustainability of the service within the communities in the cloud and externally.

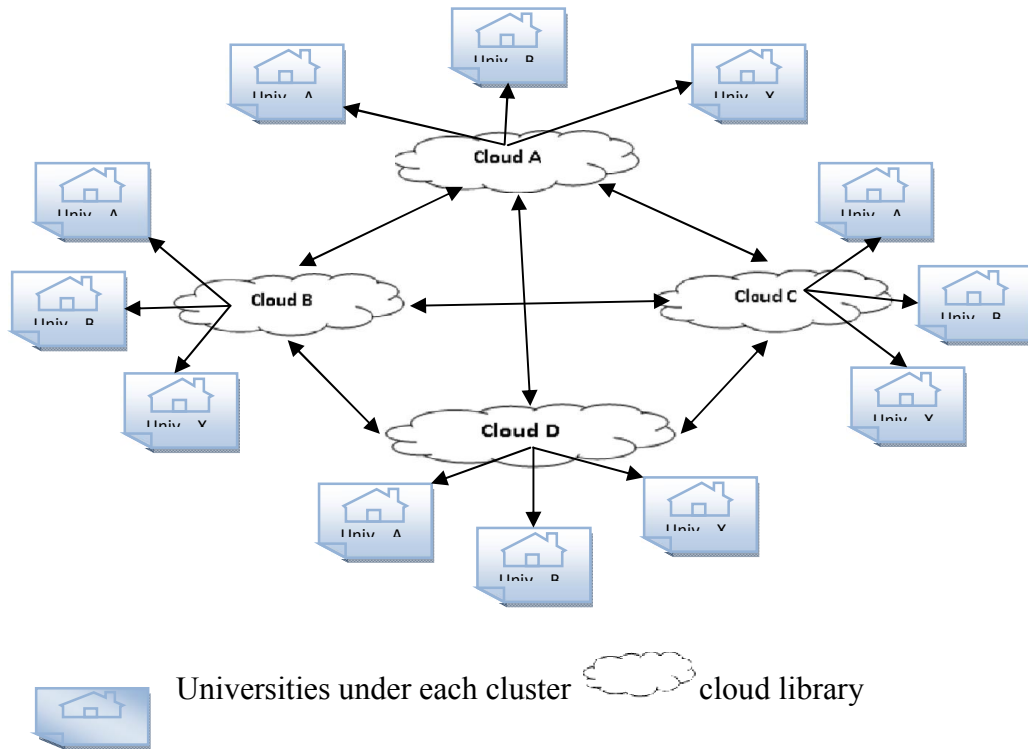


Figure 4.3.1.3. Proposed cloud library framework for EPHLI

Hence, based on Figure 4.3.1.3, if university libraries in the near geographical location collaborate and preserve their resources under a single place, it forms a collaborative system. It may be defined as “a means through which multiple institutions work together and pool resources to manage significant portion of their holdings”. They offer a shared space in which collection deposited by different libraries are maintained under a common rule. They are included in a common control system, subjected to common standards. Their service and resource delivery is managed by a single organization.

The institutions with common objective regarding their less used resources and services can join hands to form a collaborative clouds library, it should be noted

that for success of collaborative system there is a need for unwavering commitment by the participating libraries.

In a successful collaborative system, the participating libraries will not only share the resource, service and the cost involved but also should share the approach to the collection in terms of growth, management and access. Collaborative effort definitely provides more efficient use of resources.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATION**

#### **5.1 Summary of findings**

According to the result of the study depicted e-library services delivery strategy and efficiency in higher education is at low level. The mechanisms in which services were delivered between universities are varied. Thus frequency usage of e-library services at each university were indicated poor. The available resource and services in different universities in Ethiopia were similar in feature, purpose and objectives but differently operated in different academic institutions which lead to redundancy and wastage of resources. Generally it is quite interesting to note that at the study sites the availability of e-library services, respondents' satisfaction level with their university service and sufficiency of e-database, e-journal, institutional repository and digital library services in universities were very low.

The respondents indicated that using of cloud library approach may result a significant benefits to the library in order to increase visibility and accessibility of collections; reduce duplications of developing similar projects in the library, resources and collection management.

Since cloud library is more economical and cost effective than the traditional computing methods, librarians were highly supportive on the idea of cloud library establishment and are wishing to have various services that can be implemented on the cloud platform.



## **5.2. Conclusion and Recommendation**

### **5.2.1. Conclusion**

This research found out the serious need for cloud library in Ethiopian public universities. Both the librarians and patrons agreed on the enormous importance of cloud library and the finding of this study is in line with other researches that have been conducted on related titles. Most of the study participants attested to the assumption that, as opposed to current system, cloud library makes resource sharing very easier and faster, thus, it can be concluded that Ethiopian university libraries develop a cloud library. If so, libraries have the opportunity to improve their services and relevance in today's information society. Cloud library is one avenue for such a move. It can bring several benefits for libraries and give them a different future.

Libraries have the opportunity to improve their services and relevance in today's information society. Cloud library is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future.

The cooperative effect of libraries using the same, shared hardware, services and data rather than hosting hardware and software on behalf of individual libraries can result in lowering the total costs of managing library collections and enhancing the both library user's experience and library staff workflows.

The vision is to use cloud library to deliver library resources, services and expertise at the point of need, within user workflows and in a manner that users want and understand. It should free libraries from managing technology so they

can focus on collection building, improved services and innovation. The cloud library model will encourage libraries and their users to participate in a network and community of libraries by enabling them to reuse information and socialize around information. The dependency of libraries on external agencies for matters on pertaining IT is also expected to reduce considerably. Capital expenditure on hardware resources will be converted to operational expenditure.

### **5.2.2. Recommendation**

Although the technologies underlying cloud computing have existed for nearly sixty years, cloud computing as a computing paradigm has existed for just a few years. As a result the scope for further research is broad. This section recommends some actions to be taken and also provides future research work in this area.

Since the proposed clustered community cloud library managed by one university with supportive of others appropriate policies would certainly have to be defined by the EPHLI together with MOE, especially since policy issues related to cloud library, such as collection development, shared acquisition policy, terms of use, privacy, authority need to be seriously considered. There should individual institutions facilitate their own IT staff to focus on specific tasks within the organization, improve efficiency, and even create solutions that were not technically or economically feasible without the cloud.

All EHLI come together and develop a library resource sharing consortium as a national level and discuss on what resource they share and how it can be managed. Once it is determined a cloud solution does accomplish this for the library then who owns the data stored in the system and what rights does the library have to

extract their data for other uses or even to leave the service entirely should also be discussed .

Ministry of education takes a responsibility to facilitate the work and clustering of universities according to their proximity should do appropriately. Since cloud library implementation depends on high Internet bandwidth each universities work hardly to enhance their internet bandwidth.

There is a need for more discussion with ICT professionals, Librarians, and policy makers to evaluate the proposed framework for cloud library development in EPHLI to improve the framework.

Research in this area should seek to answer questions such as: how does migrating to cloud affect the current work practices? Will system affordances change and how will they change?

Meta search user interface which have a function to search information resources from all clustered cloud databases should designed properly.

The prototype cloud library should be developed according to the proposed framework and implemented at a two university library and tested with iterative feedback reflection from the users so that the proposed framework will be modified based on the feedback before the framework's full implementation for all university libraries.

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## Appendixes

### Appendix A: Provision of e-library services

E-library Services		N	Mean	Std. Deviation	Std. Error
Digital library	JU	139	.4438	.49831	.03833
	HU	131	.3421	.47598	.03861
	MTU	53	.0667	.25155	.03247
	Total	323	.3438	.47561	.02437
Institutional repository	JU	139	.0592	.23665	.01820
	HU	131	.1908	.39422	.03198
	MTU	53	.0833	.27872	.03598
	Total	323	.1155	.32003	.01640
Library automation	JU	139	.6568	.47619	.03663
	HU	131	.7237	.44865	.03639
	MTU	53	.0667	.25155	.03247
	Total	323	.5906	.49238	.02523
Users database management	JU	139	.0296	.16995	.01307
	HU	131	.2303	.42239	.03426
	MTU	53	.1167	.32373	.04179
	Total	323	.1234	.32928	.01687
Open url resolver	JU	139	.2722	.44641	.03434
	HU	131	.2829	.45189	.03665
	MTU	53	.1000	.30253	.03906
	Total	323	.2493	.43320	.02219
Library web site	JU	139	.6272	.48498	.03731
	HU	131	.6908	.46370	.03761
	MTU	53	.1833	.39020	.05038
	Total	323	.5827	.49377	.02530
E-database	JU	139	.6864	.46534	.03580
	HU	131	.2566	.43819	.03554
	MTU	53	.0000	.00000	.00000
	Total	323	.4068	.49189	.02520
E-journal	JU	139	.6982	.46039	.03541
	HU	131	.8092	.39422	.03198
	MTU	53	.1167	.55515	.07167
	Total	323	.6509	.50931	.02609

**Appendix B:** ANOVA table of differences in service availability among the three universities

E-library Services	(I)University of respondents	(J)University of respondents	X-Difference (I-J)	Std. Error	Sig.
Digital library	JU	HU	.10168	.05132	.142
		MTU	.37712	.06899	.000*
	HU	JU	-.10168	.05132	.142
		MTU	.27544	.06999	.001*
	MTU	JU	-.37712	.06899	.000*
		HU	-.27544	.06999	.001*
Institutional repository	JU	HU	-.13162	.03519	.001*
		MTU	-.02416	.04731	.878
	HU	JU	.13162	.03519	.001*
		MTU	.10746	.04800	.083
	MTU	JU	.02416	.04731	.878
		HU	-.10746	.04800	.083
Library automation	JU	HU	-.06688	.04886	.393
		MTU	.59014	.06569	.000*
	HU	JU	.06688	.04886	.393
		MTU	.65702	.06664	.000*
	MTU	JU	-.59014	.06569	.000*
		HU	-.65702	.06664	.000*
Users database management	JU	HU	-.20068	.03543	.000*
		MTU	-.08708	.04763	.189
	HU	JU	.20068	.03543	.000*
		MTU	.11360	.04833	.064
	MTU	JU	.08708	.04763	.189
		HU	-.11360	.04833	.064
Library web site	JU	HU	-.06357	.05174	.471
		MTU	.44389	.06955	.000*
	HU	JU	.06357	.05174	.471
		MTU	.50746	.07056	.000*
	MTU	JU	-.44389	.06955	.000*
		HU	-.50746	.07056	.000*
E-database	JU	HU	.42981	.04649	.000*
		MTU	.68639	.06250	.000*
	HU	JU	-.42981	.04649	.000*
		MTU	.25658	.06340	.000*
	MTU	JU	-.68639	.06250	.000*
		HU	-.25658	.06340	.000*
E-journal	JU	HU	-.11099	.05054	.091
		MTU	.58156	.06794	.000*
	HU	JU	.11099	.05054	.091
		MTU	.69254	.06893	.000*
	MTU	JU	-.58156	.06794	.000*
		HU	-.69254	.06893	.000*

Appendix C: ANOVA table for differences of service quality measurement surveyed in the study.

Dependent Variable	(I)Univ of respondent	(J)Univ of respondent	X-Difference (I-J)	Std. Error	Sig.
Sufficient subscribed journals	JU	HU	-.19363	.14137	.432
		MTU	.30286	.16659	.200
	HU	JU	.19363	.14137	.000*
		MTU	.49649	.17342	.015*
	MTU	JU	-.30286	.16659	.001*
		HU	-.49649	.17342	.015*
Enough e-information resource	JU	HU	.24833	.13690	.197
		MTU	.69438	.18183	.001*
	HU	JU	-.24833	.13690	.197
		MTU	.44605	.17515	.037*
	MTU	JU	-.69438	.18183	.001*
		HU	-.44605	.17515	.037*
Sufficient purchased e-database	JU	HU	.39116	.13266	.010*
		MTU	1.06045	.13105	.000*
	HU	JU	-.39116	.13266	.010*
		MTU	.66930	.11383	.000*
	MTU	JU	-1.06045	.13105	.000*
		HU	-.66930	.11383	.000*
E-resources are easily accessible	JU	HU	.40926	.14846	.018*
		MTU	.81233	.16185	.000*
	HU	JU	-.40926	.14846	.018*
		MTU	.40307	.16266	.042*
	MTU	JU	-.81233	.16185	.000*
		HU	-.40307	.16266	.042*
Digital Library (DL) system satisfy your information need	JU	HU	.07276	.13205	.927
		MTU	.54162	.16949	.005*
	HU	JU	-.07276	.13205	.927
		MTU	.46886	.15936	.012*
	MTU	JU	-.54162	.16949	.005*
		HU	-.46886	.15936	.012*
IR system satisfy your information need	JU	HU	.35254	.11038	.005*
		MTU	.42535	.13493	.006*
	HU	JU	-.35254	.11038	.005*
		MTU	.07281	.13345	.929
	MTU	JU	-.42535	.13493	.006*
	No time limitation to access	JU	HU	.08825	.15390
MTU			.54132	.19741	.021
HU		JU	-.08825	.15390	.919
		MTU	.45307	.20159	.077
MTU		JU	-.54132	.19741	.021*
		HU	-.45307	.20159	.077

Appendix D: ANOVA table for differences of resource availability in the university library

Dependent Variable	(I) Respondents University	(J) Respondents University	Mean Difference (I-J)	Std. Error	Sig.
Enough HR	JU	HU	-.45000	.29297	.387
		MTU	.80000	.27080	.045*
	HU	JU	.45000	.29297	.387
		MTU	1.25000	.33541	.009*
	MTU	JU	-.80000	.27080	.045*
		HU	-1.25000	.33541	.009*
Sufficient financial resources	JU	HU	-.45000	.37177	.576
		MTU	.46667	.29059	.349
	HU	JU	.45000	.37177	.576
		MTU	.91667	.37770	.095
	MTU	JU	-.46667	.29059	.349
		HU	-.91667	.37770	.095
Adequate amount of IT resources	JU	HU	.77500	.38759	.179
		MTU	1.56667	.37859	.003*
	HU	JU	-.77500	.38759	.179
		MTU	.79167	.30949	.074
	MTU	JU	-1.56667	.37859	.003*
		HU	-.79167	.30949	.074
E-database with relevant e-resource	JU	HU	.30000	.34203	.779
		MTU	1.13333	.27080	.003*
	HU	JU	-.30000	.34203	.779
		MTU	.83333	.31497	.066
	MTU	JU	-1.13333	.27080	.003*
		HU	-.83333	.31497	.066
DL with organized e-resource	JU	HU	-.42500	.30936	.467
		MTU	.86667	.41633	.177
	HU	JU	.42500	.30936	.467
		MTU	1.29167	.38025	.028*
	MTU	JU	-.86667	.41633	.177
		HU	-1.29167	.38025	.028*
IR with organized e-resource	JU	HU	-.80000	.38359	.167
		MTU	-.13333	.38873	.982
	HU	JU	.80000	.38359	.167
		MTU	.66667	.46718	.449
	MTU	JU	.13333	.38873	.982
		HU	-.66667	.46718	.449
Fully functional library automation	JU	HU	.00000	.54263	1.000
		MTU	.83333	.26874	.023*
	HU	JU	.00000	.54263	1.000
		MTU	.83333	.52705	.387

	MTU	JU	-.83333	.26874	.023*
		HU	-.83333	.52705	.387
Subscribed e-journal for all discipline	JU	HU	.52500	.48451	.651
		MTU	.56667	.45826	.558
	HU	JU	-.52500	.48451	.651
		MTU	.04167	.33711	.999
	MTU	JU	-.56667	.45826	.558
		HU	-.04167	.33711	.999
Up to dated library web site with web 2.0 aplns	JU	HU	.07500	.41556	.997
		MTU	.70000	.26034	.073
	HU	JU	-.07500	.41556	.997
		MTU	.62500	.32390	.259
	MTU	JU	-.70000	.26034	.073
		HU	-.62500	.32390	.259
Library is integrated with other EUL	JU	HU	.17500	.32500	.936
		MTU	.30000	.30000	.717
	HU	JU	-.17500	.32500	.936
		MTU	.12500	.12500	.726
	MTU	JU	-.30000	.30000	.717
		HU	-.12500	.12500	.726
Resources shared with other university libraries	JU	HU	1.57500	.28880	.000*
		MTU	1.20000	.56372	.188
	HU	JU	-1.57500	.28880	.000*
		MTU	-.37500	.51539	.872
	MTU	JU	-1.20000	.56372	.188
		HU	.37500	.51539	.872

## Appendix E

### Introduction

**Cloud computing** refers to applications and services that run on a distributed network using virtualized resources and accessed by common Internet protocols and networking standards. The research intends to develop a cloud based library model for Ethiopian higher education in order to reduce technological divide that exists between Ethiopian Public Universities, dissimilar distribution of information resources and replication and superfluous procurement of information resources and technological infrastructure among university libraries. Moreover, information poverty is what these universities are epitomized.

So, to achieve the goal of the research, getting genuine information on the current situation of the library is vital. Hence you are kindly requested to give genuine answer for the questions presented below. Please tick (√) in the appropriate box:

**I. General information**

1. University of respondents
  - JU                       HU                       MTU
2. Educational status
  - Certificate    BSc/BA
  - Diploma    MSc/MA and above
3. What is your position/role in the library?
  - Head of Cataloging & Classification    Library Director  
Department
  - Head of Library Section                       System Development Coordinator
  - Head of Network services                       Technical Service Team Leader
  - Head of Acquisition
  - Head of Department of Reference and Information Services

**II. Main information**

1. What is the level of your computer literacy?
  - Novice                       Experienced                       Advanced
2. What is the level of Internet connectivity for patrons to use in the university library?
  - Excellent                       Good                       Poor
  - Very good                       Satisfactory                       Very poor
3. Which IT based services are being provided by your library? (You may tick '√' one or more answers)
  - Digital library                       Users database management    E-database
  - Institutional repository    Open url resolver                       E-journal
  - Library automation                       Library web site
4. Please rate the extent to which you agree or disagree with resource and service provision of your library by putting a tick (√) mark in the appropriate box?

**Strongly agree=5, Agree=4, Neutral=3, Disagree=2 and strongly disagree=1**

S/N	Statements about Resources	5	4	3	2	1
1	Enough human resource in library					
2	Sufficient financial resources					
3	Adequate amount of IT resources					
4	Sufficient e-database with relevant e-resource					
5	Digital library with organized e-resource					
6	Institutional repository with organized e-resource					
7	Fully functional library automation system					
8	Subscribed e-journal for all discipline					
9	Up to dated library web site with web 2.0 applications					
10	Library is integrated with Ethiopian university library					
11	Resources are shared with other university libraries					

5. Please indicate the extent to which you agree or disagree with the following factors affecting e library service development by putting a tick (✓) mark in the appropriate box.

Strongly agree=5, Agree=4, Neutral=3, Disagree=2 and strongly disagree=1

S/N	Factors affect IT based library service development	5	4	3	2	1
1.	Inadequate ICT facilities (server, computer & software)					
2.	Inadequate skilled digital librarian					
3.	Inadequate skilled IT technician					
4.	Inadequate library budget					
5.	Level of users computer and information literacy skills					
6.	Limited electronic information resources and access					
7.	Management problem					
8.	Uncomfortable working environment					
9.	Low level of knowledge about e-library service					
10.	Insufficient utilization of existing service					
11.	Network/bandwidth problem					
12.	No standard used to build digital library					
13.	If any other _____					

6. Do you agree cloud library i.e using applications and services that run on a distributed network that can be accessed by a common internet protocols is best solution to solve all the above library problems?
- Strongly agree       Neutral       Strongly disagree  
 Agree       Disagree       Not sure
7. In your opinion which one of the following can be used as a best solution to face the challenges?
- Having private clouds and integrating them i.e all libraries have their individual system then integrating with each other  
 Having centrally managed cloud library system i.e one library for all then individual libraries access resources through internet  
 Having integrated clustered cloud library system i.e grouping university libraries according to their proximity and establishing library accordingly then integrating the clusters.  
 Other, please specify \_\_\_\_\_
8. What is the plan of your library in terms of implementing cloud library?
- In discussion       On implementation       No initiative so far  
 On study       In use       Others , specify \_\_\_\_\_



9. Please indicate the extent to which you agree on the benefit of cloud library by putting a tick (√) mark in the appropriate box.  
Strongly agree=5, Agree=4, Neutral=3, Disagree=2 and strongly disagree=1

S/ N	Benefits of cloud library	5	4	3	2	1
1.	Need for physical storage space can be reduced					
2.	Minimized maintenance cost among libraries					
3.	Infrastructure and resource purchasing cost can be reduced					
4.	High Scalability					
5.	Increased computing ability/power					
6.	Minimized duplication of e library projects					
7.	Enhanced ability to integrate libraries					
8.	Increased resource sharing among libraries					
9.	Minimized resource difference among libraries					
10.	Minimized duplication of resource					
11.	Increased interoperability					
12.	If any other, specify_____					

10. Which one of the following library operations is a prime concern in a cloud setting among your library services? (You may tick (√) one or more answers)
- Cloud based access to library collection       Cloud based software  
 Management of scholarly communication       Cloud based infrastructure  
 Cloud based citation management software       Cloud based library applications
11. What do you think the challenges of cloud library applications in Ethiopia?
- Lack of standards       System security  
 Protection of personal data       Lack of initiatives  
 Availability of broadband network       Lack of knowhow  
 Others please specify\_\_\_\_\_
12. Who do you think who is responsible to establish cloud library? (You may tick (√) one or more answers)
- University Library       University ICT office  
 University officials       Ministry of education

## Questionnaire for Academic Staffs and Students

### Introduction

**Cloud computing** refers to applications and services that run on a distributed network using virtualized resources and accessed by common Internet protocols and networking standards. The research intends to develop a cloud based library model for Ethiopian higher education in order to reduce technological divide that exists between Ethiopian Public Universities, dissimilar distribution of information resources and replication and superfluous procurement of information resources and technological infrastructure among university libraries. Moreover, information poverty is what these universities are epitomized.

So, to achieve the goal of the research, getting genuine information on the current situation of the library is vital. Hence you are kindly requested to give genuine answer for the questions presented below. Please tick (√) in the appropriate box:

#### I. General Information

1. University of respondents  
 JU       HU       MTU
2. What is your role/position?  
 Undergraduate graduating class student       Postgraduate student       Academic staff

#### II. Main information

1. What is the level of your computer literacy?  
 Excellent       Good       Poor  
 Very good       Satisfactory       Very poor
2. Do you have an experience to use e-library services in side your university?  
 Yes  
 No
3. If you are using the e-library service, please specify the source? (You may tick '√' one or more answers)  
 Inside the university library       From others Ethiopian university libraries  
 From other non Academic libraries       From international initiative driven database  
 From the overseas libraries       From outside (other universities) library  
 Other, specify \_\_\_\_\_
4. Which devices do you use? (You may tick '√' one or more answers)  
 PC       Mobiles phones  
 Laptop       Other, specify -----  
 Smart phones

5. Please indicate the extent to which you agree on the efficiency and effectiveness library services by putting a tick (√) mark in the appropriate box.

**Strongly agree=5, Agree=4, Neutral=3, Disagree=2 and strongly disagree=1**

sn	System quality indicators	5	4	3	2	1
1.	Library has sufficient subscribed journals					
2.	Library has enough e-information resource					
3.	Library has sufficient purchased e-database					
4.	E-resource are easily accessible from the system					
5.	The available digital library system satisfy your information need					
6.	The available institutional repository system satisfy your information need					
7.	Services are accessed from any location					
8.	There is no time limitation to access the resource					
9.	If any other _____					

6. Have you ever heard of cloud computing before?

Yes  No

7. Indicate the extent of your agreement on the benefits of using shared e resources using IT based applications among Ethiopian Universities. Please, put a tick (√) mark in the appropriate boxes.

**Strongly agree=5, Agree=4, Neutral=3, Disagree=2 and strongly disagree=1**

S/N	Benefits of cloud library	5	4	3	2	1
1.	Resources are accessed any where any time					
2.	No need to have a copy of resource on personal system					
3.	Increase resource sharing among libraries					
4.	Minimize resource difference among libraries					
5.	Minimize duplication of resource among libraries					
6.	Increase users motivation to use library					
7.	Save users time to search information					
8.	All services are accessed at one point					
10.	Easy to aware current library services					
11.	Easy to get disseminated information					

8. Do you feel happy if your university library service is part of the national system that would address all universities in the country?

Yes  No

## Appendix 6

### **Interview Questions for Library Directors & Computer & Network Service Heads**

1. What are the ICT services and supports that are provided to the university library :
  - A. For accessing electronic information?
  - B. For library automation like, circulation service, book loan system, OPAC, develop e-library system and related offices in the library?
  - C. For cooperating with publishers and e-resource subscription?
2. Do you think these services are enough to achieve your mission and vision, supporting quality service, and creating well organized e- library system?
3. What are the limitations in providing the above discussed services?
4. How much do you think your library invest for the following services?
5. What do you think about cloud library to provide e-library services for Higher education libraries all over the country to support with e-database sharing?
6. Do you have any plan to deploy cloud technology for common use among Ethiopian Universities?
7. If a cloud library infrastructure is to be built that could be used by all higher education institutions of the country including your university to provide e-library services,
  - A. What will be your reaction to this strategy? Who should be responsible?
  - B. What kind of services your university need from the cloud?
8. What kind of policy is need for having cloud library?
9. Do you think security is a matter for establishing cloud library system? How?
10. Do you have any other idea/experience for future to have the best library service in Ethiopia Higher Education?

### Observation Check List

No	Services	yes	No	Remark
1	Mechanism for resource sharing b/n libraries			
2	Availability and usability of Internet connection			
3	Availability of e-library system			
4	Library resource provision			
5	Availability of e-journal subscribed			
6	Accessibility/ Availability of digital library			
7	Accessibility/ Availability of institutional repository			
8	Availability of web tools (face book, library 2.0, web blogs, web tagging RSS feeds and streaming media)			
9	Availability of e-database			
10	Availability desktop computer and internet connectivity for students in the library			
11	Availability of library server			
12	Integrated library system			
13	Availability of social networks such as of e-mail, web social media			
15	Enough ICT infrastructure			
16	System is fully functional			
17	Status of Intranet/portals			
18	Skill and manpower			
19	Resource organization on the system			
20	Standard applied			