A user-centered usability and usefulness evaluation framework of digital libraries in the context of Ethiopia

BY

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Thesis submitted in accordance with the requirements for the degree of Doctor of Philosophy in Information Systems

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DECLARATION

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I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

SIGNATURE

August 12, 2020

DATE

Dedication

Dedicated to my friend Dr. Yared Assefa, **MD, MPh, Ophtalmologist.**

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First, I would like to express my heartfelt gratitude to my supervisor Prof HH Lotriet for providing me with those constructive and priceless comments, suggestions, corrections and advices which really enabled me to realize this study. I am equally indebted to my co-supervisor Dr S Ssemugabi, whose ideas, guidance and advices have helped me a lot for the success of this work.

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Abstract

This thesis evaluates the Ethiopian higher learning institutes' digital libraries regarding their usability and usefulness. Its outcome contribute in building up of knowledge that help in propelling efforts of development; satisfying DL stakeholders; providing and filling information and its gap; serving as cross-reference for academicians and researchers in the discipline; making decisions and solving managerial issues in DLs of the developing world; and providing scientific interests and merits for the advancement of Information System.

To undertake the usability and usefulness evaluation research in DLs, there is no agreed upon established conceptual framework that guides researchers in the developing world. Therefore, the overall objective of this research is to propose a framework for DL evaluation that fits in the context of developing countries. As the study is concerned with users' internal attributes, the interpretive research paradigm was applied. The research approach employed was qualitative and the research design followed was case study. Multiple data collection techniques, namely semi-structured interviews (17 respondents), open-ended questionnaire (17 respondents), and observation (4 observations) were employed. The study encompasses four public university DLs in Ethiopia.

All attributes of usability were perceived positively by the majority of the participants. The majority of the attributes of usefulness have also been perceived positively except coverage. Major challenges encountered by participants were network accessibility, interruption and speed, and access restrictions imposed on some DL contents. DL benefits were easy access to the DL contents, enhancing teaching and research, minimizing cost and enabling easy sharing of contents. Expectations of users were ensuring resource availability and sustainability, overcoming the absence of user feedback and federated search problems and improving network infrastructure and speed.

The Interaction triptych framework, which has been used in the current study, is a well known and commonly implemented framework by several researchers. But, since it does not incorporate the contextual situation of developing countries, ITF has some limitations. Therefore, based on the output of this empirical research and considering the usability and usefulness themes of ITF and its relationships with other socio-technical and contextual themes, a contextual DL evaluation framework has been proposed. The importance of the proposed framework is that it emphasizes the social, institutional, and contextual aspects of digital libraries. The proposed framework has six DL components, named as: DL User, Content and Collection, System and Technology, Services and Support, User interface and Context. The proposed framework is named as a Digital Library Components Interaction Evaluation Framework.

KEY TERMS:
Contextual digital library evaluation, Digital library evaluation, Digital library evaluation framework, Digital library evaluation in Ethiopia, Evaluation framework for digital libraries, Framework for digital library evaluation, Information system evaluation, Usability evaluation, Usefulness evaluation, User centered evaluation.

Table of contents

List of tables

List of figures

List of abbreviations

AAU	Addis Ababa University
AGORA	Access to Global Online Research in Agriculture
BDU	Bahirdar University
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CCP	Content, Context and Process
D & M model	DeLone and McLean Information System Success Model
DLF	Digital Library Foundation
DLs	Digital Libraries
EBSCO	Elton B. Stephens Company
EHLIs	Ethiopian Higher Learning Institutes
EMERALD	Environmental Management Exchange and Resource Alliance for Local Development
FAO	Food and Agriculture Organization
FDRE	Federal Democratic Republic of Ethiopia
GU	Gondar University
HINARI	Health Inter Network Access to Research Initiative
HTML	Hyper Text Markup Language
HU	Haramaya University
ICT	Information Communication Technology
IS	Information Systems
ISO	International Organization for Standardization
IT	Information Technology
ITF	Interaction Triptych Framework
INASP	International Network for Accessibility of Scientific Publications
JESTOR	Journal Storage
MPH	Master of Public Health
NCT	Noticing, Collecting, and Thinking
OARE	Online Access to Research in the Environment
PDF	Portable Document Format

PERI	Program for the Enhancement of Research Information
PPT	Power Point Presentation
PUBMED	Public/Publisher MEDLINE (NLM journal articles database)
RTF	Rich Text Format
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model2
TAM3	Technology Acceptance Model3
UNEP	United Nations Environment Program
UNISA	University of South Africa
USA	United States of America
USD	United States Dollar
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology2
UX	User experience
WHO	World Health Organization
WWW	World Wide Web

CHAPTER ONE

1 INTRODUCTION

1.1 Introduction to the chapter

This chapter constitutes the general introduction to the research and discusses the background, problem statement, objectives, and research questions to be addressed by the study. The scope, limitations, significance of the study, ethical considerations, and the arrangement of the entire work are also parts of the chapter that are going to be discussed respectively. The chapter is important to grasp the essence of the research in terms of what problems are addressed, what questions are answered, what methodology is followed, and what the benefits of the work are.

1.2 Background of the research

The contemporary advancements in the areas of Information and Communication Technology (ICT) and in worldwide networks have changed and improved the services rendered by information systems (IS). Digital libraries (DLs) as IS are, therefore, changing the practice of resources collection and service rendering mechanisms from paper-based to digital or electronic bases **(**Vijayakumar & Vijayan 2011).

It is not simple to find a particular and totally accepted definition for the concept of 'digital libraries'. To have a broader understanding of the definitions, it becomes important to mention some of them as follows.

A working definition of DLs issued by the Digital Library Federation (1998) is as follows:

> *"Digital libraries are organizations that provide the resources, including the 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"*

In a slightly different way, Borgman (1999) defined digital libraries as,

> *"A set of electronic resources and associated technical capabilities for creating, searching and using information. In this sense, they are an extension and enhancement of information storage and retrieval systems that manipulate digital data in any medium (text, images, and sounds, static or dynamic images) and exist in distributed networks"*

The National Science Foundation (1999) defines digital libraries as follows:

> *"Digital Libraries basically store materials in electronic format and manipulate large collections of those materials effectively. Research in digital libraries is research into network information systems, concentrating on how to develop the necessary infrastructure to effectively mass-manipulate the information on the Net."*

Scrutinizing these definitions leads to the following observations: On the one hand, the definition stated by Borgman (1999) is focused and views research on DLs in terms of the information storage and retrieval field. On the other hand, the NSFs' (1999) definition is leaning towards defining only the technical aspects of the DLs. In this sense, both of these definitions are incomplete in terms of user and content elements of DLs, and the DLF (1998) definition is more complete. Therefore, the DLF definition has been adopted as the most appropriate for the purpose of this thesis.

Tsakonas and Papatheodorou (2006) describe a DL as a vast organization, covering many different types of applications. The term has been used interchangeably for systems, such as digitized library collections, electronic journals, networked databases, library portals, with one firm characteristic which is the provision of information through networked information systems. Thus, this study takes the above explanation of DLs as appropriate for the purpose of this thesis.

1.2.1 Digital library initiatives

Digital library initiatives are becoming the choice of most institutions, academics, and research institutions as DLs facilitate access to the state-of-the-art scientific knowledge and best practices available instantaneously through the Internet (INASP 2015). Most developing countries (Countries that have low living standards, undeveloped industrial base, and low Human Development Index (Nayyar 2015)) are also participating in such partnerships with publishers and funding agencies to gain relevant and up-to-date information and knowledge that would help them attain best practice for promoting growth in their communities (Rosenberg 2008). Efficient and effective utilization of resources available through DLs is dependent on the usability of the system

to the user, the usefulness of the content to the user, and the performance of the system on the content with attributes, such as aesthetics, ease-of-use, navigation, terminology, and learnability of the system and the relevance, reliability, timeliness, and format of the content (Buchanan & Salako 2009; Tsakonas & Papatheodorou 2006).

In the Ethiopian Higher Learning Institutes (EHLIs) there are a several DL initiatives; some of these are free of charge while others are offered at subsidized and discounted costs through support from funding agencies. The most significant initiatives include the Program for the Enhancement of Research Information (PERii), Access to Global Online Research in Agriculture (AGORA), Health Inter Network Access to Research Initiative (HINARI), and Online Access to Research in the Environment (OARE), which are collectively known as Research4Life (Mammo and Ngulube 2013).

Research4life is the collection name for programs (HINARY, AGORA, OARE and ARDI) that provide developing countries like Ethiopia with free or low cost access to academic and professional peer-reviewed content online. The listed programs are key sources of scientific research information in the areas of health, agriculture, and environmental sciences, for lower income countries, one of which is Ethiopia (INASP 2015, 2021). These initiatives are briefly described below.

Firstly, according to the National Academy of Science (2003), the International Network for Accessibility of Scientific Publications (INASP) is a joint association of more than 4000 partners and organizations aiming to increase global access to information and knowledge. INASP was established in 1992 by the International Council for Science as a Program of the Committee for the Dissemination of Scientific Information, with a charge to improve information flow within and among countries, mainly those experiencing challenges due to unimproved publication and dissemination systems. At the time of its establishment, it was recognized that the digital divide had significantly increased and that new ICT, especially in the form of networked information systems and technology could present enormous improvements in the dissemination of information (Walker 2011).

In this regard, it becomes important to mention the objectives of INASP as stated in the INASP newsletter (2012) as follows:

- "to improve access to scientific and scholarly information,
- to catalyze and support local publication and information exchange,
- to strengthen local capacities to manage and use information and knowledge,
- to foster in-country, regional and international cooperation and networking, and
- to advise local organizations and funding agencies on ways of utilizing information and publishing to achieve development goals."

At the end of 1990s the International Network for Accessibility of Scientific Publications (INASP) held several meetings with researchers, librarians and other information professionals from different parts of the world specifically from Southeast Asia and Africa. The participants have increasingly demanded for access to the huge amount of academic information available through the Internet, behind controlled access sites (i.e., commercially published information). To this end, these researchers, librarians, and information professionals approached INASP to assist them in the design and implementation of a program that supports the information production, access, and distribution using ICT. They also discussed the importance of training for an effective utilization of the available resources, developing their own information outputs to participate in the global research community, and maintain the sustainability of their participation. The outcome of all these meetings was the establishment of the Program for the Enhancement of Research Information (PERI) as a pilot program in six countries in 2000 (Burnett 2011).

INASP has been working with Ethiopia since 2003. It negotiates with international publishers to secure national licenses on behalf of CEARL (Consortium of Ethiopian Academic and Research Libraries), for free or discounted online access to journals and books. It also provides training in a number of areas related to digital information management and library consortium development. Additionally, it supports local research communication by providing research writing courses and active discussions between early career and more experienced researchers (INASP 2015).

PERI was INASP's flagship program devoted to working on strengthening research and knowledge systems in less developed and developing nations like Ethiopia, aiming to provide

research information important for socio-economic development through disseminating national research, improving ICT skills, and strengthening local publishing (Rosenberg 2008).

As stated in the INASP newsletter (2012), the three areas the program (PERI) focuses include:

- "strengthening, organizational performance and the capacity to design and deliver training programs that meet the changing needs of key sectors of the research information and knowledge system, and networks through resource sharing opportunities,
- clear advocacy messages, peer support, experience sharing, and continuing professional development opportunities, and
- national or regional bodies active in the research information and knowledge system."

According to Smart (2011), INASP's PERI program works with more than 50 international academic publishers to provide fair and low cost access to international literature in over 1200 institutions in more than fifty countries worldwide. PERI also provides training to help in accessing resources, in writing and publishing skills, and in developing digital libraries.

Secondly, launched in 2002 under the management of the World Health Organization (WHO) and in association with Yale University (USA), the Health Internetwork Access to Research Initiative (HINARI) is a program dedicated to providing 2700 WHO accepted academic institutions in the developing world (including Ethiopia) with access to around 3700 medicine, nursing, health-related and social science journals from further 100 publishers. In addition to providing typical health science titles, such as The Lancet, access is made available to all main international diabetes journals and clinical practices (Tabachnikoff & Miller 2008).

Thirdly, Access to Global Online Research in Agriculture (AGORA) was initiated in 2003, led by the Food and Agriculture Organization (FAO) in affiliation with Cornell University (USA). It provides access to 1000 agriculture, food, fisheries, and connected biological sciences journals from 39 publishers to 1200 FAO accepted institutes in the developing world (Tabachnikoff & Miller 2008).

Finally, Online Access to Research in the Environment (OARE) was developed under the headship of the United Nations Environment Program (UNEP) and Yale University and launched in 2006.

It provides access to 1200 journals and additional resources in environmental science literature from 46 publishers to UNEP accepted institutions in the developing countries including Ethiopia (Tabachnikoff & Miller 2008).

In a nutshell, these supporting agencies launched by their mother organizations, such as INASP, WHO, FAO, and UNEP, respectively, and in collaboration with the renowned vendors and publishers, are providing a vast amount of digital resources to be used by students, faculty, and researchers of the EHLIs (Rosenberg 2008). The e-resources, facilitated and accessed through the initiatives mentioned have several benefits for the EHLIs community. As they are providing for free or low-cost access to a huge number of peer-reviewed international journals, books, and databases, they are possibly serving to overcome the problem of price crises (serial crises) and permission crises, i.e., the ever-increasing subscription and permission cost of journals and books around the world, which EHLI libraries have also faced. Without the collaboration with these initiatives, EHLI libraries would be forced to spend a significant portion of their limited budget on e-resource subscription; otherwise, they would make their users unable to access and use the available scientific information and knowledge (Mammo 2013).

A very important challenge associated with these resources is that their sustainability is questionable due to subscription issues associated with limited budget. Besides, especially in the Ethiopian context, users' awareness towards effective utilization of DLs is limited, promotion of DLs to users by the DL management is less and, frequent network and power interruptions are common. Therefore, it becomes important to hold the current evaluation research to have an understanding on how the challenges are serious and how the resources are utilized by the users in such a country where the mentioned constraints are common.

A number of DL evaluation frameworks and models have been developed by several researchers. Well known examples include: Saracevic's DL evaluation framework (Saracevic 2001), The DELOS reference model (Khoo & MacDonald 2011), Fuhr's holistic conceptual model (Fuhr et al. 2001), TAM (Hong et al. 2002), ITF (Tsakonas et al. 2004). These frameworks have been developed in accordance and fit to developed countries DLs, which have different contextual factors compared to developing countries. To undertake DL evaluation research in the context of developing

countries like Ethiopia, there is no established conceptual framework that can guide and be used by DL researchers, scholars, and developers. Therefore, undertaking this research that tries to come up with such a framework becomes essential for bridging this knowledge gap.

The main purpose of this research is to propose an evaluation framework after evaluating the usability and usefulness dimensions of EHLI digital libraries from the users' perspective in the Ethiopian context in order to get a comprehensible idea of how they are benefiting researchers and academics. This study implemented one of the well known DL evaluation frameworks called Interaction Triptych Framework (ITF) developed by Tsakonas et al. (2004) as a guide for undertaking the usability and usefulness evaluation that was ultimately used as a point of departure for the development of the proposed framework. Insight gained from such a study can provide useful knowledge for DL researchers to formulate, guided by, and undertake their evaluation research especially in resources constrained countries like Ethiopia. Besides, the output of the current study would increase the best utilization of digital resources through helping vendors and practitioners apply the acquired knowledge, improve and update services, and prioritize administration and execution decisions.

The current study employed a top-down approach on undertaking the empirical research, that is, the first step is concerned with usability and usefulness evaluation work. To do so, one of the available DL evaluation frameworks (ITF) was selected and used. Guided by ITF, the empirical study has been undertaken, which is the basis to attain the main objective of the study. Using the outcomes of the empirical study, the bottom-up approach has been followed that ultimately used as the point of departure for the development of the new conceptual contextual framework that addresses the existing knowledge gap to evaluate digital libraries in resource constrained countries.

1.3 Statement of the problem

Previously, this researcher was appointed to the position of "Director of the University Library System" at the University of Gondar, Ethiopia (2008-2010). That created an opportunity for him to communicate with users of the e-resources some of whom came to the office and asked him how to get access and search the system, because they were confused by the interfaces and password restrictions, while others, who were using the system effectively, asked for updates to the subscription of journals on their expiration. On top of that, university faculties and their respective departments, which opened Master's programs at the time, had high demands of e-resources for their students and instructors, to be utilized in the teaching-learning processes. At that moment, the majority of the students, faculty, and even the researchers were not adequately familiar with the utilization of the interfaces and the contents of the e-resources of the DL system. The magnitude of the problem urged the researcher to assume that the situation was not specific or unique to his own university DL alone, but can be common to other universities DLs in the country who share similar problems. The situation initiated the researcher to undertake an evaluation research on the EHLI digital libraries. It was on the basis of this assumption, other empirical observations, and personal encounters regarding the general utilization of DL resources that he resolved to explore the problems users face in some selected EHLIs digital libraries on the basis of their typical experiences and understand their opinions, attitudes, and perceptions toward the use of digital resources, that is, to evaluate the DL resources in EHLIs based on the usability and usefulness criteria which have not yet been explored in the Ethiopian context.

Xie and Matusiak (2014) pointed out that research on the evaluation of digital libraries is still in its infancy and researchers are still investigating who should evaluate, when to evaluate, what to evaluate, how to evaluate, and why to evaluate the DLs. Criteria for evaluating digital libraries have been suggested in prior studies, but limited research has been done to understand users' perceptions of DLs. These previous DL studies have contributed various evaluation criteria to examine different aspects of DLs, such as accessibility and usability of interface, user engagement, collection quality, and several others, but not expressed as a conceptual framework (Xie and Matusiak 2016).

To undertake the usability and usefulness evaluation research, there is no agreed upon established conceptual framework that guides researchers in the developing world, where a number of constraints are practiced, like resources (budget/fund) problems, network/Internet interruption and sluggish speed happened, frequent power interruption is common and limited user exposure to and experience with the DL use prevails. The currently available evaluation frameworks were developed in the context of and to be implemented in the developed world digital libraries and may not fit into the developing and resource constrained countries DLs like Ethiopia. Thus, this study aims to propose an evaluation framework that best suit to the context of the EHLI digital libraries and contribute knowledge in the arena of Information Systems, especially digital library evaluation in the developing world, through implementation of usability and usefulness evaluation on the EHLI digital libraries.

To the best of the researcher's knowledge, no DLs evaluation study has so far been conducted implementing the usability and usefulness approaches in the context of EHLIs, where there are poor ICT infrastructure and services, inadequate user training, experience, and skills in using the ICT, as well as where less promotion, support, and awareness creation services of the digital resources prevail (Rosenberg 2008).

This thesis places emphasis on evaluating the EHLIs DLs with regard to their usability and usefulness; giving due attention to users' experiences and opinions in the Ethiopian context (an issue which has been ignored by most DL evaluators). That is, because there is ground to believe that user opinion and attitude towards the usability and usefulness of the aforementioned DLs might have affected or influenced the utilization of digital resources accessible through the DLs with significant implications in terms of various resources (money, time, and labor). These impacts that relate to interface design, ergonomics, efficiency, and effectiveness of the system as well as to quality, trustworthiness, timeliness, format, degree of detail, applicability to work settings of the content need to be better understood.

Examining the usability and usefulness of DLs in a user-centered approach, especially in the Ethiopian context is therefore essential for improving the understanding of how users are utilizing the digital resources, what users expect from the DLs, what difficulties and stumbling blocks are

encountered by the users while using the resources, and how the DLs are operating in EHLIs. The findings have been used by the researcher as an input to develop a framework that can guide future researchers on undertaking IS and DL evaluation studies in countries like Ethiopia. It also certainly enables designers of DLs to improve the services rendered which would in turn benefit other similar studies and the academia in general. Although this study is specific to HLIs in Ethiopia, its output may be of interest to researchers of DLs in other developing and resource constrained regions of the world. The study mainly contributed knowledge to Information System evaluation and DL evaluation literature and opened many avenues for future research in the fields.

1.4 Thesis statement

As there has been no agreed upon standardized framework for DL evaluation, established user centered methods for evaluating usability and usefulness of information systems might provide sufficient tools for evaluating the DLs and on the process of developing a conceptual framework that can be implemented in the Ethiopian context.

1.5 Research objectives

The overall objective of this research is to propose a conceptual framework for user centric DL evaluation that best fits to the context of Ethiopia as a developing country, through undertaking and assessing the findings of the usability and usefulness study with regard to their implications in the Ethiopian context.

The specific objectives to fulfill the main objective are to,

1 Assess the purpose of use of digital library resources by EHLI digital library users,
2 Evaluate the usability of the digital library system from EHLI digital library users' perspective,
3 Evaluate the usefulness of the digital library system from EHLI digital library users' perspective,
4 Explore the challenges EHLI digital library users face when using the digital library system,
5 Explain the special benefits EHLI digital library users gain of using the digital libraries and,

6 Examine the contextual expectations of EHLI digital library users from their digital libraries.
7 Come-up with the components of a digital library evaluation framework.

1.6 Research questions

The main research question of the study is the following.

What is an appropriate evaluation framework for digital libraries in the context of EHLI?

To answer the main research question the following sub-questions have been set.

1 For what purpose do EHLI digital library users use the digital library resources, whose outcomes support the construction of an evaluation framework?
2 What is the composition of users' views on the usability of digital libraries, which are essential to develop an evaluation framework in EHLI context?
3 What is the composition of users' views on the usefulness of digital libraries that are essential to develop an evaluation framework in EHLI context?
4 What are the challenges users experienced while using the digital libraries and how are the challenges unique for EHLI digital library users, whose results are used as an input for coming-up with an evaluation framework?
5 What benefits do EHLI digital library users gain by using their digital libraries that are helpful for constructing the evaluation framework?
6 What are the specific and contextual expectations of EHLI digital library users from their digital libraries, whose outputs can be used as important ground for constructing an evaluation framework?
7 What are the components of a digital library evaluation framework?

1.7 Scope and limitations of the study

The study encompasses four public universities DLs in Ethiopia (Addis Ababa University, Bahirdar University, Haramaya University, and Gondar University) where the DLs are well functioning, offer DL services to their university communities, and post-graduate programs are rendered. Other public and private universities are excluded for reasons of unavailability of the service, absence of post-graduate programs, as well as time and resource constraints. Postgraduate

students, faculty, research scholars, and librarians are considered as the actual users of the DLs and potential participants of the study.

As a starting point, the Interaction Triptych Framework (see figure 2.2) of Tsakonas et al., (2004) and Fuhr et al. (2007) is the conceptual framework that was selected and used in this study. The implemented ITF (which is discussed in detail in the literature review chapter) classifies DLs into three interactive components (user, content, and system) to be used for their evaluation. But, this study is restricted to evaluating the following specific elements of the DLs: the interaction between system and user as usability evaluation, and the interaction between user and content as usefulness evaluation. The interaction between system and content as performance evaluation is left out since it requires a laboratory based research relating to information retrieval.

Since the focus of the study is on the actual users of the system, stakeholders of DLs, such as sponsors and publishers are excluded from the study. Moreover, as the study is conducted by a single researcher, data collection methods, like focus group discussion are not employed due to time and other resource constraints.

1.8 Significance of the study

By developing and proposing a conceptual framework for DL evaluation in the developing countries, this study mainly contributes knowledge to Information System and DL evaluation literature.

This study aimed to evaluate DL systems from the users' perspectives utilizing both usability and usefulness criteria that helped the researcher to propose a digital library evaluation framework/model. Thus, it opens many avenues for future research in the fields.

The most important purpose for conducting a research is not only its final result, but also the way the researcher performed and managed the research to obtain the final result is equally important. Thus, as the research has been held in one of the developing countries (Ethiopia) and interpreted in relation to the Ethiopian context, it can be used as a reference for other scholars and researchers

in the field, who wish to design or evaluate DLs especially in the context of developing countries like Ethiopia.

Finally, one of the purposes of evaluating an IS is to provide helpful information for decision making. The study helps to construct a firm knowledge about the users' perceptions, needs, expectations, and behaviors on EHLI digital libraries. From the output of this study users and librarians can generate different decisions on using the resources, and improving the services rendered.

1.10 Ethical considerations

With regard to ethical considerations, this study complies with the UNISA research ethics policy (2007). Prior to starting the data collection process, ethical clearance has been obtained from UNISA, College of Science, Engineering and Technology, School of Computing. Furthermore, an informed consent was also obtained from participants who have volunteered to take part in the study. The participants were told about the importance and benefits of undertaking the research and their right to withdraw from the study any time they wish. Finally, data collected for the study has been treated as private and confidential, and the identity of participants is not going to be revealed through the analysis and dissemination of the study output.

1.11 Organization of the research

This thesis work consists of six broad chapters, which are described as follows:
Chapter one constitutes the general introduction and background to the research and also includes the problem statement, objectives, and questions to be addressed by the study. The scope, limitations, significance, ethical considerations, and the arrangement of the entire work are also parts of the chapter.

In Chapter two, relevant literature was reviewed. The chapter starts by discussing and reviewing related literature categorized into sub-chapters or sections as Information system evaluation, Digital library evaluation, and user centered evaluation and Usability and usefulness evaluation. Next qualitative research works in digital library evaluation and finally different conceptual

frameworks used for digital library evaluation and the one employed in the current work have discussed in detail.

Chapter three is devoted to explaining the research design and methodology. The research paradigm, research design, the methodology employed, data collection techniques, sampling strategies, analysis methods and trustworthiness of the study were discussed in detail in this chapter.

The next chapter, i.e., Chapter four covers the analysis and interpretation part. Using the qualitative data analysis software (Atlas ti V.7), the collected data were transcribed, coded, categorized, and interpreted. All the analysis and interpretation processes were discussed in detail in the chapter.

Chapter five is a discussion chapter. It is concerned with a discussion of the findings of the study in relation to other related studies and their findings. Besides, the chapter discusses and illustrates the construction of contextual evaluation framework with regard to its components, attributes of the components and interactions/relationships among them.

The last Chapter is the conclusion and recommendation part that provides conclusion of the whole work, contribution and limitation of the work and recommend actions to be taken for further improvement of the DL services, suggestions and directions for research to be undertaken in the future.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Introduction to the literature review

A literature review can be viewed as the utilization of ideas in the literature for the purpose of justifying the particular approach to the study, selected methodology, the contribution of the research for the advancement of existing knowledge, and finding areas where further research is needed (Levy & Ellis 2006).

This chapter is arranged in the following manner.
To answer the main research question of the study (proposing a conceptual framework), the first step is to undertake the empirical work. Therefore, the first part of the literature review is devoted to discussing IS evaluation. As DLs are one type of IS, different methods, techniques, and approaches that have been so far used to evaluate ISs can potentially also be used to evaluate DLs. After a thorough discussion on the various IS evaluation methods, techniques, and approaches, the ones which are appropriate for undertaking the current empirical research and implemented in this study are argued for and justified in comparison with others.

Next, several DL evaluation studies relevant to this study with regard to their similarity and differences are reviewed. The review is based on evaluation studies, i.e. in terms of their aims and objectives, research methodology implemented, criteria and techniques employed to collect data, especially usability and usefulness criteria and their attributes. Then, as the current study follows a qualitative research methodology, DL studies that vastly use qualitative research methodology as well are reviewed intensively.

After a detailed discussion and understanding of the IS evaluation techniques and tools, and describing several types of DL evaluations, especially concerned with usability and usefulness; the second part of the literature review discusses some well known and frequently employed frameworks and models used as a roadmap in undertaking IS specifically DL evaluation research

and the one that is selected and used in the current research are discussed, critically argued for, compared, and justified. Finally, the need for and the importance of constructing a framework for DL evaluation in resource constrained countries like Ethiopia that answers the main research question of this study was discussed in detail with its justifications.

2.2 Information system evaluation

Al-adaileh (2009, 227) defines an information system (IS) as:

"A set of interrelated and interacted elements or components that collect, store, process and report data and information that can be used to enhance the process of decision."

Paul (2007, 194) defines IS as follows: *"Information system is what emerges from the usage that is made of the IT delivery system by the users."*

Emphasizing the human dimension of IS, Paul (2007, 194) further discusses the concept of IS by classifying it into two parts as:

> *"First the formal processes, which are assumed to be pre-determinable with respect to the decisions about what IT to use… and second the informal processes, which are what the human beings who use the IT and the formal processes create or invent in order to ensure that useful work is done."*

ISs enable organizations to be efficient and effective in their business through providing a conducive environment for their competitive advantage (Gunasekaran et al. in Irani & Love 2008). On this point, Lu et al. (2012) argues that IS has developed into a strategic aspect that enables an organization to face challenges in global competitiveness. However, in practical and academic fields, IS is broadly recognized as an enabler for organizational competitive advantage (Lagsten 2011). Therefore, having understood the importance of IS and implementing them as not an issue of preference, organizations are spending massive amounts of money to build modern IS these days. Since the implementation of IS is a expensive investment, its failure is considered as an costly practice and remains a most important concern for organizations (Al-adaileh 2009; Irani and Love 2008).

It is likely to consider IS as successful when it meets criteria, such as satisfying user requirements and organizational objectives. However, ISs are developed for different purposes based on different technologies, and their ways of functioning differ from one context to another. Further, a variety of factors may influence ISs throughout their development and implementation. As a result, their evaluation in terms of success is a complex effort (Bokhari 2005; Cronholm & Goldkuhl 2003; Palmquist & Kim 1998). This is due to the fact that measuring the success of an IS can be described in a variety of terms, such as system performance, effectiveness, quality, use, and user satisfaction. As users are the most direct, articulate, and verbal providers of remarks on the IS they use, their participation in measuring success is imperative (Bokhari 2005). Thus, how to evaluate the effectiveness of IS has turn into an important research topic in recent decades (Lu et al. 2012). It is on this ground that evaluation becomes a method intended for generating knowledge about IS for the purpose of decision making.

In this respect, Saracevic and Covi (2000, 5) define evaluation as *"an appraisal of the performance or functioning of a system or part thereof, in relation to some objective(s)."* According to these writers, performance can be evaluated in terms of effectiveness, efficiency, and cost-effectiveness.

A more general definition of evaluation by Farbey et al. (1999, 205) is as follows:

"Evaluation is a process that takes place at different points in time or continuously, for searching for and making explicit, quantitatively or qualitatively, all impacts of an IS project."

As far as IS evaluation is concerned, Cronholm and Goldkuhl (2003), and Irani and Love, (2008) discussed the investment of enormous amounts of money for IS development around the world and the significance of evaluating the IS for the return on the investment. But, as stated above, evaluation appears a complex duty; consequently, there are abundant of proposals on how to evaluate information systems. A large amount of the literature on evaluation takes a formal-rational position and sees it as a mostly quantitative method of calculating the possible cost/benefit on the basis of defined criteria (Cronholm & Goldkuhl 2003; Irani & Love 2008). Other evaluation approaches, such as the interpretative approaches (the approach that is followed in this research) often view information systems as social systems that have IT embedded into them. In this line of thought, interpretive evaluations of IS are concerned with the context in which the evaluation takes place, assuming that IS evaluation being inductive, engages multiple stakeholders in the

process to understand their subjective assumptions and views, and that the process is recognized as a social and political process (Jones & Hughes 2001; Walsham 2006).

With regard to IS evaluation in developing countries, Kebede (1999) mentioned a number of features and constraints of IS in developing countries, unlike the developed ones as: poverty, lack of information literacy, digital divide, poor image of IS, and increasing cost of information materials.

2.2.1 Approaches and techniques for IS evaluation

In this section, different IS evaluation approaches and techniques described by several authors like cost and benefit evaluation, content, context, and process (CCP) approach, predictive or prescriptive evaluation, mechanistic and interpretive evaluation, socio-technical IS evaluation, and interpretive IS evaluation will be discussed. Then after, the approaches which are preferred and implemented in the current empirical work and why they are selected and used are argued for.

2.2.1.1 Cost and benefit approach

The techniques and tools that have been used for IS evaluation discussed by Gunasekaran et al. (2008) in Irani & Love (2008) focused on its cost and benefit evaluation. These techniques and tools are classified into different approaches, like economic, strategic, and analytic. For Gunasekaran et al. (op. cit), economic approaches are concerned with cost/benefit analysis from the financial performance perspectives. The strategic approach involves the measurement of IS investment in terms of their long term implications. It includes technical significance, competitive advantage and research and development (Irani 2002). The analytical approaches include non-numeric models, computer based techniques, risk analysis and value analysis expert systems (Gunasekaran et al. 2008).

2.2.1.2 Content, context and process approach

Irani (2002) has also argued for the importance of following the content, context, and process (CCP) approach in evaluating IS. Content evaluation concerns, particularly "what" is being measured or evaluated, which is significantly influenced by the stakeholders and the context of the organization. Context evaluation is focused on the socio-technical entities within the organization and the environment. Here, context will determine and answer the "why" and "who" of the evaluation questions (Stockdale & Standing 2006; Stockdale et al. 2006). Finally, "how" and "when" the evaluation is undertaken is answered by process evaluation, which is concerned with the methodologies and instruments implemented, in addition to the actions, reactions, and interactions of the stakeholders involved in the IS evaluation (Irani 2002; Song & Letch 2012; Stockdale et al. 2006).

2.2.1.3 Predictive and prescriptive approach

Thomas et al. (2008) further argue that IS evaluation can include predictive or prescriptive evaluation. This is due to the fact that IS evaluation can possibly be conducted before the IS investment, during project delivery, or after the compilation of the project. Predictive evaluations are used to predict or forecast the feasibility, cost, and impact of an IS investment, while prescriptive evaluations are conducted for assessing the performance and impact of the IS, and are used to learn lessons for further improvement. They are usually conducted after the IS project has been finalized.

With regard to prescriptive or post-implementation evaluation of IS, Al-Yaseen et al., (2008) argue about the importance of IS evaluation that takes place after the compilation of the project. The post-implementation evaluation according to Al-Yaseen et al. draws on real and available data unlike predicted and projected data and is useful to justify system adoption, to estimate the system's direct cost and tangible benefits, to ensure whether the system meets the requirements, and to measure the efficiency and effectiveness of the IS (Al-Yaseen et al. 2008; Irani 2002; Irani & Love 2001).

2.2.1.4 Mechanistic and interpretive approach

Again, with regard to IS evaluation approaches, Jones (2008) argues for further classifying IS evaluation into two approaches, called mechanistic and interpretive. According to Jones, mechanistic IS evaluation approaches are those formal evaluation methods concerned with costs and benefits. They are based on quantifiable, financial, technical, static accounting, and economic measurement criteria. Due to their nature, the mechanistic approaches have ignored the human, organizational, contextual, and social dimensions of IS evaluation, which has become their major defect in IS evaluation, especially in public sector organizations (Jones 2008). Jones (2008) further contends in favor of the idea that holds IS as a predominantly social systems and that their social aspects be significant in their evaluation.

2.2.1.5 Socio-technical approach

Here, it becomes important to mention the importance of a socio-technical IS evaluation approach. The socio-technical approach with regard to IS evaluation can be seen as a consideration of the mutual constitution of people and digital technologies in the context of individuals, organizations, or institutions and their environment (Morris 2009; Sawyer & Jarrahi 2013). The approach works on the premises that there are interdependent and mutual relationships among technology or system and the social norms, values, and the participation of different human stakeholders (technology creators, sponsors, users). In general, the aim of the socio-technical approach in IS evaluation is to investigate the two parts of the system, i.e. the social (organizational) and the technological (software and hardware) network in relation to the context under study. In other words, the emphasis on socio-technical evaluation is to study the multidimensional impact of technology on people, organizations, and task**s** as well as the impact of social and people issues on technology design, adoption and use (Creswell 2013). Thus, a socio-technical approach emphasizes an understanding that the very existence of technology is a part of the social system and mediated by organizational considerations. These features have made it an important and essential approach and a tool for IS evaluation (Morris 2009; Sarker, et al. 2013; Sawyer & Jarrahi 2013). The use of this socio-technical approach in undertaking DL evaluation research is not mentioned and missed in the DL evaluation literature that is going to be addressed by the current work.

Socio-technical research approach is premised on the interdependent and inextricably linked relationships among the features of any technological object or system and the social norms, rules

of use, and participation by a broad range of human stakeholders. This mutual constitution of social and technological is the basis of the term socio-technical. Besides, the socio-technical premise is that all technologies are socially situated. Any IS is embedded into a social context which both adapts to, and helps to reshape, social worlds through the course of their design, development, deployment and uses (Morris 2009; Sarker et al. 2013; Sawyer & Jarrahi 2013).
Because, it is vital to have an extensive evaluation and analysis of the DL systems with a theoretically informed lens, the socio-technical theory has been implemented as the DL evaluation approach in the process of developing a context based new conceptual framework in the current work.

The interpretive IS evaluation approach that is based on interpreting and understanding the social organizational aspects of IS becomes essential to improve the IS evaluation. This approach states that IS evaluation is a socially embedded process. Thus, the views and opinions of the social actors using the IS are vital. The social actors can be individuals, or organizational IS situations, who can assess the IS and offer their opinions and advices on the usefulness and success of the IS (Jones in Irani & Love 2008; Walsham 2006). In this respect the interpretive IS evaluation approach is concerned with understanding the opinions of social actors in the IS organizational setting and emphasizes the important value of contextual and subjective data for the IS evaluation purpose (Jones 2008; Lagsten 2011; Irani & Love 2001; Walsham 2006). According Walsham (2006) most of the current IS evaluation research adopted the interpretive approach. He further discussed an interpretive evaluation study as specifically aims to access the interpretations of stakeholders and other research participants, and to bring out the authors' own interpretations. The aim is then to write up the evaluation research in ways which facilitate the readers' interpretations, certainly different in slight ways at least to those of the authors.

In information systems, interpretive evaluation research is aimed at producing an understanding of the context of the information system and the process whereby the information system influences and is influenced by its context (Walsham 1993). Interpretive evaluation research, usually involves using qualitative methods from which to understand the data collected and analyzed during the research process. A key task in interpretive evaluation research is seeking meaning in context; the subject matter must be set in its social and historical context so the reader

can see how the current situation emerged. Interpretive evaluation research can help IS researchers to realize human thought and action in social and organizational contexts; it has the potential to produce deep insights into IS including the management of information systems and information systems development.

In spite of all its potential advantages discussed above, there does not seem to be much evidence of extensive use of interpretive evaluation approaches in practice. One reason for the non-use, in the field of IS, could be the lack of practical methodology ready at hand for evaluators and assigners of evaluations (Walsham 1993). Again the interpretive evaluation approach has been reported as a capable evaluation approach with important implications for practice (Walsham 2006). There is a growing body of work on interpretive IS evaluation, but most of the interpretive work on IS evaluation is an interpretive evaluation of empirical studies, but more limited when it comes to describing IS evaluation as interpretation. Walsham (2006) suggests that the limited use might be explained by a lack of knowledge in the IS field of the interpretive approach or that such evaluations bring into light problems that are normally hidden leading to anxiety and fear. The limited use might also be due to organizational political motives. According Lagsten and Goldkuhl (2011) one reason for the low use is due to poor understanding of the results and uses of interpretive evaluations.

Interpretivists use meaning (versus measurement) oriented methodologies, such as interviewing or participant observation, that rely on a subjective relationship between the researcher and participants. Interpretive research does not predefine dependent and independent variables, but focuses on the full complexity of human sense making as the situation emerges (Kaplan & Maxwell 1994). This approach aims to explain the subjective reasons and meanings that lie behind social action.

In light of the above discussion of the approaches and techniques so far implemented in IS evaluation, it becomes important to examine those techniques and approaches against the ones preferred in the current research. To undertake the empirical work of this study, an analytic evaluation approach that involves non-numeric value analysis, rather than the economic approach that deals with cost/benefit and financial performance analysis was employed. Unlike the

mechanistic approach that provides managers or decision-makers with direct cost analysis, cash flow projections, and financial figures, choosing the IS evaluation approach that goes beyond these traditional financial evaluation boundaries becomes increasingly important as it considers the political and social factors during the IS evaluation (Irani & Love 2008). It also follows the content, context, and process (CCP) approach in order to understand and answer the "what", "why", "who", "when", and "how" questions on the IS evaluation process, which these days, becomes a central issue for managers and the academic community (Irani & Love 2008). Rather than being predictive that depends on predicted data, the first part of this work is considered to be prescriptive or post-implementation evaluation that deals with real and available data, which is conducted after project finalization. Thus, the second part of this study (developing a contextual framework) can be classified under the interpretive IS evaluation approach since it is fully concerned with understanding and interpreting ISs in relation to their social and organizational aspects based on the social actors or stakeholders' views and opinions, emphasizing the importance of subjective and contextual data extracted from the social actors themselves (Walsham 2006).

2.2.2 Strategies for IS evaluation

In the previous section different approaches and techniques used for IS evaluation have been discussed. Hereafter, a number of IS evaluation strategies are going to be discussed and argued for their strengths and weaknesses indicating which of them are appropriate for and implemented in the first section of this study (empirical study).

Several IS scholars and researchers (for example, Chen et al. 2011; Cronholm 2004; Cronholm & Goldkuhl 2003; Vasilecas et al. 2006) had distinguished three main types of IS evaluation strategies, namely the goal-based evaluation, the goal-free evaluation, and the criteria-based evaluation. Their findings relate to how the evaluator performs the evaluation, and the delineation is made in relation to what drives the evaluation. Each of these strategies are briefly discussed and contextualized in terms of this thesis, and also which of them are appropriate and implemented in undertaking the empirical part of the current work are argued in the following paragraphs.

2.2.2.1 Goal-based evaluation

Generally, goal-based evaluation means that specified goals from the organizational context force the evaluation of the IS. The evaluation, then serves to assess if predefined goals are satisfied or not, and to what degree and in what ways. Its emphasis is placed on how objectives are to be measured. This approach is deductive in its nature, and what is measured depends on the nature of the goals which means that a quantitative or qualitative approach could be used (Chen et al. 2011; Cronholm 2004; Cronholm & Goldkuhl 2003; Vasilecas et al. 2006). In this approach, results are assessed only in relation to the predetermined goals. The evaluator closely scrutinizes the object of evaluation in relation to its goals. The key strength of this approach is the determination of whether results align with goals. The degree of alignment between goals and results is important to know from accountability and improvement perspectives (Calidoni-Lundberg 2006).

Calidoni-Lundberg (2006) argues that using the goal-based approach is only possible and useful if the goals of the evaluated object are clear, if there is consensus about them, and if they are time-bound and measurable. Quantitative data collection methods are traditionally adopted in goal-based evaluation (Cronholm and Goldkuhl 2003; Patton 1990). Nonetheless, it has been extensively criticized (Cronholm and Goldkuhl 2003; Hirschheim and Smithson 1988) since if only quantitative methods are used; goal-based evaluation often mainly focuses on technical and economical aspects, rather than on human and social dimensions. As a consequence, the result of the evaluation may over-emphasize on the quantitative value of the innovation (e.g. a newly implemented IS), but neglect important social, organizational and human effects (Hirschheim & Smithson 1988). Therefore, Cronholm and Goldkuhl (2003) suggest that when quantitative methods can be used to assess hard, measurable goals, qualitative methods should actually also be adopted in goal-based evaluation in order to examine the goals of more social or human nature.

2.2.2.2 Goal free-evaluation

A goal-free evaluation is a process in which no such specified goals are used, as it is a situation-driven strategy with a further interpretive approach. The aim of goal-free evaluation is to avoid risk of narrowly studying stated program objectives and thereby missing important unanticipated outcomes (Patton 1990). This approach suggests that evaluation should not be based

on goals in order to enable the evaluator to remain unbiased. The evaluator must search for all outcomes, including unintended positive or negative side effects. Thus, the evaluator does not base the evaluation on reaching goals and remains unaware of the program goals. The objective of the interpretive evaluation is to achieve a deeper understanding of the nature of what is to be evaluated and to create inspiration and commitment. Being an inductive evaluation, it aims at discovering the qualities of the object of the study and the evaluator makes an account of likely problems where the knowledge of the object of the study emerges throughout the improvement of the evaluation (Chen et al 2011; Cronholm 2004; Cronholm & Goldkuhl 2003; Vasilecas et al. 2006).

Youker and Ingraham (2013) argued and criticize goal-free evaluation as pure, rhetoric and imply that it lacks practical application. Although evaluators know about goal-free evaluation in theory, they have little knowledge of it in practice. Without knowledge of goal-free evaluation's use, evaluators are less likely to believe it can be used. Also Calidoni-Lundberg (2006) criticized goal-free evaluation approach being not often used in evaluation since it is difficult for evaluators to determine what to evaluate when program objectives are not to be used. The concern is that evaluators will substitute their own goals, since there is a lack of clear methodology as to how to proceed.

2.2.2.3 Criteria-based evaluation

Criteria-based evaluation means that some specific general criteria are used as an evaluation measure. There may be important criteria to be addressed such as the criteria of user interaction with the IS. It means that the evaluation is conducted according to predefined checklists, heuristics, or principles. These criteria mainly stem from some specific theories as well as sets of guidelines, standards or even legal requirements. The selected criteria for evaluation indicate that evaluators emphasize and focus on certain characteristics more than others. Therefore the criteria used for evaluation determine the types of outcomes that can be acquired (Cronholm 2004).

The difference between criteria-based evaluation and goal-based evaluation is that the criteria are broad and not limited to a specific organizational context and therefore are more generally applicable. What becomes distinctive in these approaches is that the IS interface and/or the

communication between users and IS uses are a basis for the evaluation jointly with a set of predefined criteria. (Chen et al 2011; Cronholm 2004; Cronholm & Goldkuhl 2003; Vasilecas et al. 2006).

Criteria-based evaluation emerges as one of the most frequently used evaluation approaches in the field of IS, namely in usability, accessibility and standard verification studies (Bertot et al. 2006). In connection with these criteria, it is vital to underscore that usability and usefulness with their attributes are employed in this research based on the interaction of users with the concerned DLs. The results of the research were the bases for the development of the interaction evaluation framework.

A major disadvantage and potential controversy that often surrounds criteria-based evaluation is related to the fact that evaluators with different backgrounds, specializations or even knowledge may differ in their opinion on the criteria. This makes the acceptance of the results of criteria-based evaluation more difficult (Chen et al. 2011).

Broadly speaking, goal-based evaluation is focused on the relative degree to which a given system effectively meets a previously specified goal, while goal-free evaluation measures the effectiveness of a given system exclusively in terms of its actual effects i.e., the goals and motivations of the system are ignored. Each approach has relative advantages and disadvantages. On the one hand, goal-based evaluation is ordinarily more cost-effective than goal-free evaluation; on the other hand, measuring effectiveness entirely in terms of the degree to which stated goals are met can have at least two undesirable consequences: since effectiveness is inversely proportional to expectations, effectiveness can be raised simply by lowering expectations, and unwanted effects, if any, are left out of account, while unintended benefits, if any, go unnoticed (Calidoni-Lundberg 2006).

What to evaluate

In order to undertake IS evaluation, first it becomes vital to decide on what and how to evaluate. In addition to how to evaluate, it is also important to make a decision on what to evaluate. In this regard Cronholm (2004) and Vasilecas et al. (2006) identify two different situations for evaluating

IS: the evaluation of IS "as such" and the evaluation of IS "in use". The following discussion aims at briefly exploring these two evaluation approaches.

Evaluation of IS "as such"

Evaluating IS "as such" simply refers to evaluating IS without the participation of users. In this circumstance only the evaluator and the IS are involved in the evaluation process. The data source that could be used for this strategy is the IS itself and a possible records of the IS. How the evaluation is performed depends on the how-to-evaluate-strategy preferred. The evaluator could use a goal-based, a goal-free, or a criteria-based strategy. This strategy can implement different usability evaluation techniques that does not participate IS users, such as usability inspection, which further follows two common approaches as examples of it: the heuristic evaluation and the cognitive walk-through are highlighted next.

Heuristic usability evaluation consists of a small set of expert evaluators, such as the human-computer interface design specialists, DL designers, or graphic artists. The experts independently inspect the IS and judge its compliance using a set of heuristic principles which have been defined preceding the evaluation (Reevs et al. 2005). The experts determine whether a system conforms to a set of usability principles and discover specific usability problems in the system. Heuristic evaluation is the most widely used usability evaluation model for computer system interfaces (Kadir et al. 2011).

In a cognitive walk-through, a group of expert assessors (composed of graphical user interface specialists, software developers) work through a paper mock-up, prototype, or full version of the IS with the goal of carrying out a set of practical tasks while evaluating the IS ease of learning, user-friendliness, and understandability (Reevs et al. 2005).

From this it follows that with both the heuristic evaluation and the cognitive walk-through usability inspection, the real users of the system do not participate in the evaluation process. These types of evaluation approaches do not consider the social and organizational context of the IS evaluation

and are not suitable for this kind of research that implement an interpretive research. Therefore, they can be understood as typical examples of Cronholm's (2004) "IS as such" approach.

Evaluation of IS "in use"

On the other extreme, evaluating IS "in use" means to study a use condition where a user interacts with an IS. This analysis condition is more difficult than the "IS as such" situation since it includes users; however, there is the potential for the provision of richer information (Vasilecas et al. 2006). The data sources for this type of evaluation could be usability and usefulness inquiry evaluation methods, such as field observations of users interacting with IS, focus groups, and individual interviews with the system users and their perceptions and understanding of the IS quality, and both open-ended and closed questionnaires are the widely used strategies that directly involve system users (Reevs et al. 2005). Compared with the "IS as such", this approach engages with more potential data sources. Therefore, this approach is the appropriate one for the current research whose objective is proposing an interaction evaluation framework based on the opinions of users and interactions of users with the digital library.

Finally, from how to evaluate and what to evaluate, Cronholm (2004) derives six different evaluation types, namely goal-free IS as such, goal-free IS in use, goal-based IS as such, goal-based IS in use, criteria-based IS as such, and criteria based IS in use. All of these can be summarized and presented in a two dimensional table as follows.

Table 2.1: Six generic types of information systems evaluation. Adapted from Cronholm (2004).

How / What	Goal-free	Goal-based	Criteria-based
IS as such	Goal-free IS as such	Goal-based IS as such	Criteria-based IS as such
IS in use	Goal-free IS in use	Goal-based IS in use	Criteria-based IS in use

When to evaluate

Similarly, Chen et al. (2011) and Vasilecas et al. (2006) discussed the use of the three "how to evaluate IS strategies" described by Cronholm (2004). But instead of using the "what to evaluate"

(IS as such and IS in use) strategies, Chen et al. (2011) and Looney (2011) try to use an additional "when to evaluate" strategy, called formative and summative evaluation. In line with Cronholm (2004), Chen et al. (2011) as well have developed six evaluation strategies known as goal-free formative, goal-free summative, goal-based formative, goal-based summative, criteria-based formative, and criteria based summative. In short, the six strategies can be organized and presented in the following two dimensional tables. At this juncture, it appears quite significant to observe the main difference of the when to evaluate from Cronholm's (2004) strategy that it considers when to evaluate instead of what to evaluate strategy.

Table 2.2: Chen's et al. (2011) six information system evaluation strategies

How / When	Goal-free	Goal-based	Criteria-based
Formative	Goal-free formative	Goal-based formative	Criteria-based formative
Summative	Goal-free summative	Goal-based summative	Criteria-based summative

Formative evaluation (also known as process or progress evaluation) refers to a type of evaluation activity that aims to acquire feedback from the user of the IS during the process of development and implementation (Looney 2011; WHO 2013). The main objective of formative evaluation is to suggest ways of improvement and help in the development of the change, innovation, or intervention. On the other hand, summative evaluation (also known as outcome or impact evaluation) refers to a type of evaluation that is carried out after the process of development and implementation of the IS has been finished. This evaluation aims mainly to gather information and feedback from the system users so as to assess the effects, effectiveness, impacts and outcomes of the developed IS (Chen et al. 2011; Jose 2007; Looney 2011; WHO 2013). Specifically, and in light of the discussion above, formative evaluation is typically used throughout the IS design, development and implementation process, with the aim to provide systematic feedback and suggestions to system designers and implementers during the project (Cronholm & Goldkuhl 2003; Hamilton & Chervany 1981). In contrast, summative evaluation is normally carried out at the end of the IS project or at the post-implementation stage, in order to inform IS stakeholders about the quality, adequacy and impact of the implemented IS and the overall effectiveness and outcomes of the project (Cronholm & Goldkuhl 2003; Hamilton & Chervany 1981; Kumar 1990). Except

the different time frame they are employed, both formative and summative evaluation types involve system users in the evaluation process and can similarly be understood with that of Cronholm's (2004) "IS in use" strategy.

In general, Cronholm (2004), and Chen et al. (2011) share the view that clearly accepts that the different evaluation types can in a realistic evaluation condition be utilized together in a combined way. Put simply, they can be used in diverse stages, where evaluation results collected from earlier stages would directly apply to inform the later ones. Besides, it is interesting to indicate here that it might also be feasible to combine some of these types of evaluation in an integrative way (Looney 2011).

Owing to the aforementioned discussions on IS evaluation, this researcher has chosen to employ a combination of the above evaluation strategies for how to evaluate, i.e., criteria-based and goal-free strategies. This is because the current work is interpretive and involves a goal-free and criteria-based evaluation. Using the general usability and usefulness criteria with their attributes for the evaluation certainly justifies the preference for adopting systematically combined strategies.

As long as the research follows a user-centered approach, regarding what to evaluate as underscored from the outset, it is obvious that "IS in use" is the proper strategy as it deals with the interaction of users with the system and the involvement of users in the entire research process. Compared with the "IS as such", this approach engages with more potential data sources. Therefore, this approach becomes the appropriate one for the current research.

Finally, based upon the "when to evaluate" strategies discussed above, since all the evaluated DLs have been established and already functional during the study, the summative evaluation strategy would best suit the objectives set for the DL evaluation study that can be discussed next.

2.3 Digital library evaluation

This section discusses the complex nature of DLs and their evaluation research in general and in relation to the developing countries context in particular as stated by several researchers of the field. It also compares a number of DL evaluation practices in developed and developing countries,

and finally points out the importance of the current work's knowledge contribution in solving the DL evaluation constraints especially in the developing countries, and more specifically in Ethiopia.

2.3.1 Difficulty of digital library evaluation

There are several different types of DLs, like Academic, Public, or Music, DLs all with their own sets of goals and objectives. DLs maintain precise activities in specific contexts. They need to be evaluated in order to verify how useful, usable, and effective they are. This is due to the fact that since the final goal of DLs evaluation is to study how they renovate research, education, learning, and life (Fuhr, et al. 2007; Saracevic & Covi 2000). However, owing to their complex nature, along with their richness and diversity of uses and users, the evaluation of DLs becomes a difficult, challenging activity, and difficult undertaking, and the methods used for evaluating them may likewise be different, as they are complex, dynamic and synchronic entities which need flexible approaches (Vullo 2010).

Also, for Khoo and Giersch (2009), digital libraries are complex systems and their evaluation is a complex activity. They are composed of a wide range of social, technological, organizational and other phenomena, embedded in a variety of external contexts (e.g., social, political, economic, and organizational). They can be modeled as socio-technical systems, comprised of many components linked in complex and mutually constitutive ways (Bishop et al. 2003), and their evaluation is further complicated by a plethora of data gathering tools (e.g., surveys, interviews, focus groups, transaction logs, and observation), channels (e.g., in person, online, mail, e-mail), and their settings. Add to this, the very nature of the setting, and the challenges are even more distinct (Schwartz 2000). The design and evaluation of digital libraries are also further complicated by the newness of the systems, their ability to integrate a range of functions that were previously designed and evaluated separately, the heterogeneity of their user population, the physically distributed nature of usage, the ability to fragment and rearrange previously integrated documents and images, and the rapid versioning of digital objects (Schwartz 2000).

In the same tone, Borgman et al. (2000) state the difficulty of digital library evaluation due to their richness, complexity, and variety of uses and users. Chowdhury and Chowdhury (2003) emphasized that a new set of parameters is required for the evaluation of digital libraries in order

to reflect their diversity since a digital library is a complex construct and its success will depend on a number of factors. They suggest that, in addition to content, information retrieval and usability, several other factors such as, hardware, software and networking, data formats, access and transfer times, failure rates, and development and maintenance costs should also be used on the evaluation.

According to Saracevic (2000) the ultimate goal of digital library evaluation is to study how they transform research, education, learning and life. This goal leads to a set of associated questions such as: what is to be evaluated, by which criteria, within which boundaries, from which perspectives? These questions are rooted in the nature and development of digital libraries as well as to the perspectives of different categories of digital library researchers. Marchionini (2000) advocates that the ultimate goal of digital library evaluation is to assess the impact of digital libraries on their patrons' lives, and the larger society. He suggests that in order to assess how good a digital library is, one has to study how it influences the day-to-day activities of the target users, and thus society as a whole.

The academic community is possibly the largest and the most important user group of digital libraries. User requirements from a digital library are influenced by their nature of work, affiliation, educational background, accessibility to technology, and so on. Apart from the various information resources that are currently managed, provided, and accessed by digital libraries, there is a variety of other information that is needed by users in an academic community. However, currently such information is either not available at all or is partially available to only a certain section of the user community (Meyyappan et al. 2004).

Xie, Joo and Matusiak (2014) pointed out that research on the evaluation of digital libraries is still in its infancy and researchers are still investigating who should evaluate, when to evaluate, what to evaluate, how to evaluate, and why to evaluate the DLs. As Saracevic and Covi (2000) articulated, the evaluation of digital libraries is a complex undertaking that is conceptually and pragmatically challenging. Borgman et al (2001) further suggest that technical complexity, variety of content, uses and users, and the lack of evaluation methods contribute to the problem. Any

evaluation is based on the conceptual model of the evaluators: their understanding of the goals of the system and of users' needs and behaviors. (Van House, Butler, Ogle & Schiff 1996).

Saracevic and Covi, (2000) emphasized on DL evaluation research as a great many things are being done, but evaluation is striking by its absence in the enormous majority of published work on digital libraries be it research or practice. According to them, so far, evaluation has not kept pace with efforts in digital libraries or with digital libraries themselves, has not become a part of their integral activity, and has not been even specified as to what it means and how to do it. They also try to speculate possible reasons for the above problems as: perhaps it is too early in the evolution of digital libraries to attempt an evaluation in any formal way; maybe evaluation is taken to be adequate on a very basic technical level; the interest in evaluation might be concealed; and perhaps the performance is apparent in the use and popularity. On the other hand, perhaps in the pressure of the rapid pace of evolution, the rush to do something now and then, does not leave time and room for evaluation; and maybe evaluation of digital libraries is so complex that even when desired, it cannot be accomplished with what is presently known about evaluation. In other words, it might be concluded that the conceptual state-of-the-art of digital library evaluation is not adequately developed. While all these speculations may be true to some extent, Saracevic and Covi (2000) believe that the last, the one about the underdeveloped conceptual nature of evaluation, is actually true. Chowdhury (2006) supports this idea by stating that more efforts have been made in the last decade to evaluate digital libraries and to build global evaluation models, even if an accepted methodology that encompasses all the approaches does not exist. Research and professional communities have specific viewpoints on what digital libraries are, and they use different approaches to evaluate them. Therefore, it is logical to consider the importance of a novel set of parameters for DL evaluation that reflects the multiplicity (Chowdhury 2006).

2.3.2 Purpose of digital library evaluation

Evidently, it is necessary to state the key purposes of carrying out a DL evaluation research. Many works in the area place due emphasis on the requirement of identifying the major components (objects) characterizing the magnitude of DL environments and their interactions with each other. Following this idea, as clearly explained in the conceptual framework part of this work under Section 2.5.6, three major components characterizing the dimensions of a DL environment are

identified by several scholars in the field (Buchanan & Salako 2009; Fuhr et al. 2007; Matusiak 2012, 136; Tsakonas et al. 2004) These three main components in the DL domain are user, content, and system. Also Jose (2007) precisely describes the DL components as being user, content, and technology, while keeping intact that the mentioned technology component remains similar to the system component.

Considering their evaluation as a complex and complicated task, Saracevic and Covi (2000) have recommended a conceptual framework for DL evaluation. Focused on the IS approach, they state that at least three general questions should be answered while engaging on any DL evaluation. These are, "Why should the system be evaluated"? "What should be evaluated"? and "How should the system be evaluated"? Taken together in the IS context, they define evaluation as an assessment of the performance or functionality of a system or its part in relation to some objectives. The performance has to be assessed in terms of effectiveness, efficiency, and a blend of the two (cost-effectiveness). Based on this idea, they stated five elements, namely construct for evaluation, context of evaluation, criteria, measures, and methodology for doing evaluation, which are related to that of Jose's user, content, and system components.

Still in different terms Zhang (2010) has proposed the following six evaluation criteria that might be used to do research, to develop a holistic model for different levels of DL evaluation.

- "Content- Accuracy, authority, clarity, cost, ease of understanding, informativeness, readability, timeliness, usefulness,
- Technology- Effectiveness, display quality, robustness of digital information, reliability, cost, response time,
- Interface- Learnability, efficiency, memorability, errors, satisfaction,
- Service- Accessibility, courtesy, empathy, reliability, difference before and after service intervention, gaps between expectation and perception,
- User- Session time, accuracy of task completion, acceptance, use/intent to use, satisfaction,
- Context- Copyright compliance, preservation, and spreading of culture, sustainability."

Although Zhang (2010) tries to discuss the six components, it is obvious and simply understood that the three main DL components mentioned earlier (user, content, and system) have similarly remained unaltered. He further tries to classify the criteria and sub-criteria used to understand the interaction between the main components (usefulness and interface) as simply main components. Similarly, Tsakonas and Papatheodorou (2006) and Fuhr et al. (2007) identify a conceptual model for DL evaluation known as Interaction Triptych Model (see Section 2.5.6 of this study for detailed discussion), which divides DLs into three cospects such as, user, content, and system. The framework of Saracevic and Covi which includes construct, context, criteria, and methodology is also used by Fuhr et al. (op. cit.). They try to base their evaluation on DL component relations like usability, usefulness, and performance. They describe the interaction between system and user as usability; between user and content as usefulness, and between system and content as performance evaluation. Except performance, both the usability and usefulness criteria are also used to evaluate the interactions between DL components in the current study, which is a vital precondition to come up with an interaction evaluation framework.

2.3.3 User- centered evaluation

As the final aim of a DL system is to enable people to access human knowledge at anytime and anywhere, by overcoming barriers of distance, language and culture, and by using multiple network connected devices, the quality of DLs needs to be judged by their users (Xie and Matusiak 2016). DLs are intended to serve users; if these systems are not used, they fall into oblivion and terminate their operation. Therefore, one of the main aspects to be considered in DL evaluation is the user's perspective, determining the extent to which the DL addresses the real needs of its users (Heradio et al. 2012).

The user-centered evaluation of digital libraries means that the outcomes of this type of evaluations are mainly based on users' opinions, actions, feelings and perceptions. It means that users become the center of attention and reveal the extent to which a digital library supports their needs and demands, their roles and practices. If analyzed in a proper and creative way, the feedback of users

can lead to the implementation of user-centered systems (Tsakonas & Papatheodorou 2008). The final output of a user-centered evaluation concept can be used for the implementation of systems focusing on users' necessities, perceptions, mental models and information-processing structures (Fuhr et al. 2007).

Although research on the quality evaluation of DLs based on users' perceptions seems to be in an early stage, the importance of evaluating the quality of DLs from the user's perspective is well recognized by the DL community. User-centered evaluation of DLs has drawn considerable attention during recent years. Research in this area has produced a set of varied criteria by which to judge DLs from the user's perspective, measuring instruments to extract users' opinions, and approaches to analyze the elicited data to conclude an evaluation (Heradio et al. 2012).

User- centered DL evaluation requires the definition and study of interaction events and the deep exploration of the physical and digital environments. The main conclusion drawn by the user-centered study is the need of joint examination of usability and usefulness. In regard to these systems, usability evaluators are encouraged to investigate aspects of usefulness in parallel to acquire a holistic view of DL interaction (Tsakonas & Papatheodorou 2011).

An evaluation of DL collections and contents and services and support must consider the characteristics of the user community. User-centered evaluations are recognized and have been applied in several studies. The evaluation of a DL can serve many purposes, including understanding phenomena such as human information seeking behavior and information handling and refinement (Huang 2014).

According to Fuhr et al. (2007) user-centered evaluation involves many stakeholders, both individual end-users and librarians, as well as various groups from the community or society in general. Fuhr et al. (2007) also stated criteria used in the evaluation of user–system interaction include:

- "Types of users and their characteristics, such as different levels of knowledge and experience.
- The information needs of the users.

- Different satisfaction factors (e.g.: functionalities and task accomplishment).
- Types of information handling strategies.
- Tasks and task procedures.
- Representation of work domains and environment.
- Collaboration between users and groups of users."

The term 'user' has different meanings in the DL context. For instance, the DELOS Digital Library Reference Model (DELOS 2007) identifies the following types of actors that interact with DLs:

1. "DL end-users exploit the DL functionality for the purpose of providing, consuming and managing the DL content and some of its other constituents. DL end-users may be further divided into:
   a. Content consumers are the purchasers of the DL content.
   b. Content creators are the producers of the DL content; they feed it with the resources, mainly information objects, to which other users of the DL will have access.
   c. Librarians are end-users in charge of curating the DL content. In fact, these actors have to curate all the resources forming the DL, e.g. establish the policies.
2. DL designers exploit their knowledge of the application semantic domain in order to define, customize and maintain the DL so that it is aligned with the information and functional needs of its potential DL end-users.
3 DL system administrators select the software components needed to construct the DL system. Their choice of elements reflects the expectations that DL end-users and DL designers have for the DL, as well as the requirements the available resources impose on the definition of the DL.
4 DL application developers develop the software components that will be used as constituents of the DL systems, to ensure that the appropriate levels and types of functionality are available."

Evaluation of interactive information systems like DLs has been performed so far either in a system–based or a user–centered fashion. In the system based evaluation, the evaluation emphasizes on measuring a set of properties of the system and very little focus is on the person

who is the actual driver of the system. In the user- centered evaluation, the user is a central actor and his/her behavior determines the outcome of the evaluation (Huang 2014).

According Kautonen (2018), the user–centered approach was initiated in the 1970s as an alternative to the traditional system oriented approach. At this time it appeared necessary to extend the focus of the research concentrating on the individual actors of the information search and use processes, in the social, practical and cultural contexts. This approach focuses mainly on the user's problems and his/her production of meaning, stressing that the recovery of information is efficient depending on the integration of the results with the user's life, and more specially on how the user evaluate the utility of the information provided to solve his/her problems. In contrast to the user–centered approach, the system-centered approach is concerned with information environment external to the individual user that said, the user being not involved in the process. However, the user-centered approach examines the individual psychological and cognitive necessities and preferences, and the way these aspects influence the standards of search and use of information (Kautonen 2018).

Digital libraries can be regarded as powerful tools if they are usable, useful and users benefit from using them. This shows that user-centered evaluation for digital libraries is essential in understanding how well the system serves and fulfills its targeted users. Tsakonas et al. (2011) admitted that the common reason for evaluation was to identify users and their information needs. This includes knowing which resources users wanted most, what data format are mostly useful and other kinds of users' needs. In having worldwide digital libraries, the use of efficient digital information system is crucial in order to handle large number of concurrent users and information transactions (Kautonen 2018). Furthermore, there are different type of users using digital libraries (like students, academicians and researchers) with different level of computer skills/knowledge (like novice, intermediate or expert), and with different needs/purposes of using digital libraries. Users should be at the center of any digital library evaluation and their characteristics, information needs and information behavior should be given priority when designing any usability study (Kadir et al. 2008; Tsakonas et al. 2011).

Thus, a user centered perspective tries to optimize the user interface around how people can, want, or need to work, rather than forcing the users to change how they work to accommodate the system or function. In other words, evaluation with a user-centered perspective is an evaluation based on the needs of the user and, for that, we need to know the users, their goals and their tasks (Huang 2014).

2.3.4 Usability and usefulness evaluation research

A number of definitions exist in a literature for the term usability that indicates its multidimensional nature (Matusiak 2012). ISO defines usability as 'The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use' (ISO 9241-11 1998). Usability involves effectiveness, efficiency, and satisfaction where users can complete certain tasks as easy as possible. Effectiveness is the degree to which users can perform specific tasks successfully; efficiency is the amount of time and resources spent on performing a task; and satisfaction is the measure of users' feelings and impressions of a system. These three factors form the basis of usability evaluation (Pant 2015).

Usability is a quality attribute that assesses how easy user interfaces are to use. The word "usability" also refers to methods for improving ease-of-use during the design process (Nelson 2012). When users cannot handle an online service intuitively, they will potentially classify it as useless and avoid using it again. Therefore, usability is a key factor for the success of digital library services (Nelson 2012).

According to Issa and Isaias, (2015) usability refers to the "quality of the interaction in terms of parameters such as time taken to perform tasks, number of errors made and the time to become a competent user". Alternatively, Usability "is a quality attribute that assesses how easy user interfaces are to use. The word 'usability' also refers to methods for improving ease-of-use during the design process" (Nelson 2003). Furthermore, Shackel (2009) indicates that usability is the "capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and user support, to fulfill the specified range of tasks, within the specified range of environmental scenarios".

Usability of a digital resource refers to the following:

1 “how the resource supports the user’s needs” (Matusiak 2012);
2 “how easy the user perceives the resource is to use, the quality of the user experience” (Kelly 2014);
3 “how useful the resource is to the information needs of the user” (Dalkıran et al. 2014; Zha et al. 2015); and
4 “How well the user perceives the resource to meet the user’s needs and evaluation of the usability of a digital library can be conceived as an interplay of four components: users, task, tool, and environment” (Jeng 2009).

Usability is an important quality indicator for interactive systems. It refers to the degree to which products are effective, easy to use, easy to learn, efficient, fewer errors and satisfying to users. It is mainly about the functional part of the product (Matusiak 2012). The usability of a product can be defined operationally as “the degree to which specific users can achieve specified goals in a particular environment, effectively, efficiently, comfortably and in an acceptable manner" (ISO TC159/SC4/WG5 1989). Also, according to Chowdhury (2006) usability of a digital library relates primarily to its accessibility. In other words, it relates to how easily users can interact with the interface, how easily they can find useful Information and how easily they can use the retrieved information to accomplish their specific tasks (Chowdhury 2012; Silva and Wijayaratne 2015).

It can be pointed out that usability, as part of the crucial subject matter of IS evaluation, necessarily encountered in the process of implementation certainly attracts its own specific attention. Broadly speaking, usability often functions as the major parameter to define the level of the qualities of interaction that do exist between the “user” and the “system”. Also usability in specific IS evaluation terms can be used in at least two well known manners. On the one hand, it helps the user to use a system effectively in an efficient and pleasant way. On the other hand, usability allows the user to make use of all the existing functionalities within a given system. In other words, it appears central that a usable system in its basic feature not only is easy to learn, but also flexible as well as adaptable to user preferences and skills (Fuhr et al. 2007; Silva and Wijayaratne 2015).

Usability evaluation is about observing users to see what can be improved, what new products can be developed (McGovern 2003; Issa and Isaias 2015). It is based on human psychology and user research (Silva and Wijayaratne 2015).
On the contrary, the other aspect of IS evaluation called usefulness is concerned with the "user" and "content" components. The usefulness of the content and its significance to the user's tasks and needs can be mentioned as the reasons behind the selection and usage of a DL. (Fuhr et al. 2007).

Usefulness is the degree to which a specific information item will serve the information needs of the user. The concept of usefulness defines whether DLs constitute valuable tools for the completion of users' tasks. Usefulness answers the questions if DLs support users' information needs and work completion. In general, usefulness refers to the quality of being useful or to what extent something is useful. We can also say that it is the quality that makes a thing useful or suitable for a given purpose, advantage, usefulness, worth, and utility. It is actually the act of using or the state of being used (Tsakonas & Papatheodorou 2011).

According to Heradio et al. (2012), Usefulness is in the field of HCI generally considered together with usability as an integral part of a holistic approach. However, regarding digital library services it has to be interpreted slightly different. In this context, usefulness refers mainly to the provided content and its relevance for fulfilling the users' information needs.

Usefulness, thus defines whether DLs found important tools for the completion of users' tasks. Meaning, being on the user-content relation, it answers questions whether or not DLs support users' information needs. In sharp contrast as mentioned above, usability stands on the user-system relation, especially the user interface, and focuses on the effective, efficient, and satisfactory task accomplishment (Buchanan & Salako 2009; Matusiak 2012).

Usability and usefulness are interrelated aspects of applications and information systems that are necessary to ensure a system's functionality, to support user needs and tasks, and to provide a satisfactory user experience (Matusiak 2012). Thus, it is observed that, being interrelated properties of system interaction and originating from the fields of information behavior and human

computer interaction (HCI), respectively, usefulness and usability are amongst the most important research issues in the field of DL evaluation. In addition, both hold a significant role in the understanding of user satisfaction and system usage, as they basically study users' interactions with IS and information contents (Buchanan & Salako 2009; Tsakonas & Papatheodorou 2008). Thus, owing to these broader contexts, it has significantly led several scholars in the IS so far that they have targeted their studies on employing usability and usefulness criteria like the current research.

2.3.5 Usability and user-experience (UX)

As previously stated under Section 2.3.2, ISO defined usability as 'The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use (ISO 9241-210 1998)'. In the same document, user experience has been defined as 'A person's perceptions and responses that result from the use or anticipated use of a product, system or service (ISO 9241-210 1998)'. Bevan (2009) argues that although this definition can be interpreted as satisfaction in usability, differences exist between usability and UX by their objective. Usability tests focus on improving human performance, while UX evaluation methods try to enhance not only performance, but also overall experience, such as how users feel. Therefore, user experience is concerned with all aspects of the end-user's interaction with the company, its services, and its products (Nielson 2014). It is not only about facilitating the user in achieving goals, but to give the users a meaningful and pleasant experience before, during and after use.

In many cases, the terms usability and user experience, have been used commonly without carrying specific meanings. But, UX takes a holistic view of products and services, not only addressing their functionality, but also exploring the emotions of users as they use them and the value users place in them. UX attempts to move the design of products and services out of the organizational context and into the user context. In a nutshell, it is not enough to design the product; we also must design the experience the user has in using the product (Pennington 2015).

The concept of UX tends to focus on the emotional factors that influence, and sometimes supersede usability as a determinant of system quality. While there is no consensus on a precise operational

definition of the term, there is broad agreement that UX research 'highlights non-utilitarian aspects of interactions, shifting the focus to user affect, sensation, and the meaning as well as the value of such interactions in everyday life' (Law et al. 2009). Thus, UX research takes a much broader perspective than usability research because it 'encompasses all aspects of interacting with a product' (Hassenzahl & Tractinsky 2006) and UX researchers attempt to understand and assess all stages of the interaction in order to fully capture how users interact with a system (Forlizzi & Battarbee 2004; Hassenzahl & Tractinsky 2006; Law et al. 2009). Rather than the narrow, task-based focus of usability, UX researchers take a holistic view of the entire user-system interaction by going beyond the tasks users perform with technology and focusing on the provision of positive emotional outcomes from using technology (Frandsen-Thorlacius et al. 2009; Hassenzahl & Tractinsky 2006; Lindgaard & Parush, 2008). As a result, UX is subjective, varies between individuals and between situations, and changes over time. To put it simply, the UX perspective forces designers to focus on creating a positive experience for users rather than on preventing usability problems, or 'designing for pleasure rather than for absence of pain' (Hassenzahl & Tractinsky 2006).

Therefore, usability is related to how easy it is for the user to complete the task while using the site; the user experience focuses on the user's perception of how the site interacts with him.
Usability plays important role in making good UX. Good usability products make users feel more conveniently, quickly and comfortably after using the product, also reduces wrong operations made by users. Obviously, it will arouse a good emotional experience and make the user feel happy and enjoyable, then it will improve the user experience design of the product.
Usability involves effectiveness, efficiency, and satisfaction where users can complete certain tasks as easy as possible. On the other hand, user experience covers a wider aspect of the user's interaction with the system (ISO TC159/SC4/WG5 1989).

Having the above description of usability, usefulness and UX in mind, hereafter, it becomes vital to describe the works of scholars and researchers in the field classifying them into five different categories based on the similarity of the criteria they used, the methodology they employed, and the data collection methods they implemented.

Jung (2005) and Joo et al. (2011) conducted a usability study on academic DLs. In view of both studies, it can be said that their main goal was developing a model to be used as a measurement tool for usability evaluation of academic DLs. In so doing, they applied a survey questionnaire as a data collection tool on actual DL users, besides designing their own models in which their tests carried out upon different academic DLs proved successful. It is vital to underscore here that Jung (2005) especially brought up findings with regard to the availability of an interlocking criterion among usability attributes, such as effectiveness, efficiency, satisfaction, and learn-ability.

Despite the fact that in both studies the evaluations of DLs were done from the users' perspectives, they concentrated merely on the usability dimensions and did not give due attention to the other evaluation criteria, like usefulness. Evidently, while usability remains an important criterion in DL evaluation, it is also true that a usable system may not be at all times useful for the user, i.e., systems could confirm to be usable, but functionally useless (Greenberg & Buxton 2008).

Xie (2008) tried to examine users' use of DLs, their evaluation criteria, and the evaluation of two selected DLs. In doing so, chosen participants were instructed to keep a record for their use of DLs, rate the importance of the DL evaluation criteria, and evaluate the two DLs by applying their perceived essential criteria. The results of the study revealed the patterns of users' use of DLs, their perceived vital evaluation criteria, and the positive and negative aspects of DLs. The perceived evaluation criteria that were in use were the interface usability, collection quality, service quality, system performance, and user satisfaction which corresponded to the usability, usefulness, and performance criteria.

Tsakonas and Papatheodorou (2006) conducted a study to analyze and evaluate usefulness and usability in electronic information services. Their study was based on an ITF and employed a questionnaire survey for data collection. The intent was to verify usability and usefulness as being two associated properties of interaction and examine which features of the system and content were most important in the compilation of information work and task. The three main components of the interaction process are the user, the content, and the system which are described in detail in the conceptual framework section (Section 2.5.6) of this work.

At Tsakonas and Papatheodorou's (2006) work, usefulness attributes were listed as relevance, form, reliability, level of information, and timeliness. Here, according to their findings, relevance and level of information detail were considered as important features. Whereas, when it came to the usability attributes, they incorporated the ease of use, aesthetics, navigation, terms, and learn ability. Here, it is also important to observe that ease of use has been taken as a characteristic with critical value for users.

Buchanan and Salako (2009) also aimed to evaluate a health DL using usability and usefulness criteria. A pilot study was conducted on DL, using a questionnaire and observation. The study indicated that usability and usefulness could possibly be combined in DL evaluation. It also yielded that while effectiveness, efficiency, aesthetic appearance, terminology, navigation, and learn-ability were the key properties of system usability, relevance, reliability, and timeliness became key properties of system usefulness.

The studies discussed above used usability and usefulness not only as the main criteria, but also as similar attributes for DL evaluation. However, it is important to point out that the studies employed a survey questionnaire as the main tool to gather evaluation data from users while qualitative data was also important to realize how users perceive and evaluate the system, appreciate how the social and organizational context influences the systems' use, examine causal processes, and enhance the utilization of evaluation results (Kaplan & Duchon 1998).

Matusiak (2012) investigated the use of DL resources in two undergraduate classes and explored faculty and students' perceptions of educational DLs. This study, unlike the above discussed works, employed a qualitative methodology and several data collection techniques, such as field observation, document analysis, and interviews which were used so as to overcome researcher bias through triangulation. In so doing, the result indicated, among other things, that user perception of usability and usefulness, especially perceived ease of use, would play an important role in user intentions on adopting and using academic DL collections.

Generally, one way or the other, the different properties of usability and usefulness criteria mentioned in the above studies revealed certain common or similar things aspects. Accordingly,

because of their importance in DL evaluation research and coming up with the proposed interaction evaluation framework, they are implemented in the current work. Even though the usability and usefulness criteria are implemented in the current study, their evaluation properties may not be enough and not consider the context of DLs where the research is implemented, i.e., the context of developing and resource constrained countries which differ from developed countries. Therefore, it was tried to come up with a knowledge that contextualize the DL evaluation criteria that fits to developing countries like Ethiopia. Additionally, all of the studies advocate a further study that involves different DL users, implement a number of data collection techniques, and consider several factors that affect users' evaluation of DLs. Thus, it is on the basis of the reasons mentioned above that the empirical part of this study choose usability and usefulness as the criteria for DL evaluation.

2.4 Qualitative approaches to DL evaluation

As far as a user-centered DL evaluation is concerned, the need for moving towards more qualitative based evaluation research either as an alternative or as a complement to quantitative based methods has been accepted. Among others, the change is reasonably justified based on the existing change of research from examining information sources and services used by information users, considerably to exploring the role of information in the user's day to day activity, in his/her work, organization or social setting, as well as to understanding individual users' needs and information-seeking behavior. This has been strengthened by being able to design a more effective IS. It is also observed in the course of the development of the field of IS that firstly the purpose of research was to shape humans to adapt to the technology, which recently proved that it is to shape the technology itself to suit human requirements and capabilities (Branner 2006; Chowdhury et al. 2006). Therefore, it has already become essential to shift research towards understanding as to why the user behaves this or that way as he/she does (Palmquist & Kim 1999). Moreover, qualitative research is believed to be appropriate for discovering new knowledge in a field where very little is known.

Likewise, the considerations placed upon the perceived ease of use and perceived usefulness are users' opinions, assumptions, perceptions, and feelings of the system and do not essentially reflect the objective reality. Instead, they are considered to be to a large extent subjective (Buchanan & Sakalo 2009; Matusiak 2012). So long as interviews and observations are employed for collecting subjective user data through direct links between the evaluator and the participant, it could potentially aid the evaluator to clarify behavior and to check user concepts (Fuhr et al. 2007).

On the basis of the aforementioned assumptions and assertions, so far a number of DL evaluation studies that specifically employ qualitative data collection methods have been done. This involves studies, such as surveys, interviews, focus groups, course work assessments, observations, and document analysis (McNicol 2004). Hereafter, works of scholars which have been conducted using the qualitative methodology will be briefly explained by classifying them into two categories. The first category concerned with studies that implement only semi-structured interview for their data collection and the second category employ observation field notes, questionnaires and interviews.

First, Papachristopoulos et al. (2008) can be cited for their attempts to collect users' opinions about the usage, usefulness, and usability of DL value added services through a qualitative approach. The research technique was interview and eleven doctoral students were interviewed. Vezzois (2008) also mentioned in his work an account to explore and examine the information behavior of a group of biology doctoral students for understanding their needs and obtaining suggestions for service improvement of a library. An in-depth semi-structured interview was employed to discover the type of information sources, research strategies, information seeking processes adopted by the students, and the students' attitude towards library services. Likewise, Haines et al. (2010) aimed to study the information-seeking behaviors of basic science researchers at the University of Vermont to update the development of customized library services. Here, the researchers used semi-structured interviews to gather data from nine basic science faculty members, and explanations from the interviews and audio tapes were then used to recognize such major themes as, information sources, search techniques, work environment, current and potential library services. Wu and Chen (2011) also conducted a study at a University in Taiwan. The main aim of their study was to investigate graduate students' perception of digital resources, their searching behavior, and patterns of use. Interviews were employed as data collection instruments.

As we can observe from the above four studies, the data collection technique employed to collect the necessary qualitative data was only a semi-structured interview. It is obvious that interview is one of the main and frequently used methods to collect qualitative data from users' opinions and perceptions. However, one of the drawbacks of qualitative research, usually mentioned by positivists is its trustworthiness. That is to say that the validity and reliability of the method in question (Shenton 2004) is mainly due to the researcher's bias and inclination to his/her understanding of the reality. Hence, using different data collection methods is one of the methods used to overcome this problem through implementing multiple approaches in the data collection process in order to enhance confidence by improving the quality of findings (Bryman 2003). In this connection, it can be recognized that all the above discussed works may be subject to the problem of trustworthiness (validity and reliability) because of implementing the interview as the only tool for data collection.

Second, Makri's (2007) work aims to support users to understand how to use and know the appropriate situation to use specific DL and other electronic resources. A series of semi-structured interviews and naturalistic observations were conducted on 21 law students, ranging from first year undergraduate to final year doctoral students looking for electronic legal information. Apedoe (2007) described the findings of a qualitative research intended to examine the available opportunities and obstacles of DL on the process of supporting teaching and learning activities in an inquiry-based undergraduate geology course. The data were collected through classroom observations and field-notes of classroom practices, questionnaires, audiotapes, and transcripts of interviews with student and instructor participants.

The above two works employed more than two techniques for collecting user data and were able to overcome the problem of trustworthiness as stated earlier. Owing to the general and specific considerations at hand, and as will be discussed in detail under the research design and methodology parts, in this research, multiple qualitative data collection techniques (semi-structured interview, open-ended questionnaire, and field observation) were implemented to ensure the validity and reliability of findings besides having detailed and thick data on sayings of DL users, which are very important to contextualize the findings with Ethiopian individual and social contexts.

2.5 Conceptual frameworks and models for digital library evaluation

A conceptual framework can be seen as an attempt to define the nature and purpose of the research. Lester (2005) describes a conceptual framework as a skeletal structure of rationalization. For Lester (2005), a conceptual framework is an argument which includes different points of views culminating in a series of reasons for adopting or not adopting some points or concepts. It is considered as an argument on the concepts selected for exploration, and the expected relationships among them will be suitable and useful for the research problem under inquiry.

On the other hand, Jabareen (2009) defines a conceptual framework as, "a network or a plan of interlinked concepts that together provide a comprehensive understanding of a phenomenon. The concepts that constitute a conceptual framework support one another, articulate their respective phenomena, and establish a framework-specific philosophy."

Jabareen (2009) further clarifies the features of conceptual framework which can be summarized as not only a collection of concepts, rather a construct in which each concept plays an essential or vital role; provides not a causal/analytical setting, but an interpretive approach to social reality; rather than providing theoretical explanation, provides understanding, and provides not "hard fact" knowledge, rather provides "soft interpretation of intentions".

In this section, different frameworks and models used by several researchers on undertaking IS, especially DL evaluation research were discussed with regard to their strengths and weaknesses. Thereafter, the framework that is selected and implemented in the current empirical study that guides the researcher on the proper handling of the current work and used as a basis for proposing a new interaction framework for DL evaluation in the developing world context has been discussed in detail. Further, the importance of proposing a context based conceptual framework for Ethiopian higher learning institutes' DL evaluation is justified.

2.5.1 Technology Acceptance Model (TAM).

The Technology Acceptance Model (TAM) is a well-established theory explaining user behavior in adopting new technology. Even though many models have been proposed to clarify and forecast the use of a system, TAM captured the most attention of the IS community (Chuttur 2009). It

theorizes that a person's intent to adopt a particular IT is guided and determined by two distinct beliefs, perceived ease of use (usability) and perceived usefulness. Perceived ease of use is defined as the degree to which a potential IT/IS user perceives or believes that the use of that IT/IS will be free of effort. Perceived usefulness in turn, is defined as the degree to which a potential IS user believes that the use of that IS will improve that user's job performance (Matusiak 2012; Thong et al. 2002). The key benefit of using TAM to understand system usage behavior is that it provides a framework to examine the effects of external attributes on system usage in order to achieve a successful execution of a new IS (Vaidyanathan et al. 2005) i. e., a DL in this research.

TAM is different from other frameworks and models as it does not intend to measure the success of the IS/IT, but it is used to study and predict the user's intention to use IS. In specific terms, TAM uses the ideas of perceived usefulness and perceived ease of use as predicting indicators of users' intentions and actual usage of the IS. However, user centered DL evaluation requires the definition and study of interaction events among DL components and the deep exploration of its physical and digital environments (Hong et al. 2002). For instance, it was found that perceived usefulness depends primarily on the relevance of the content to the user rather than other system attributes (Fuhr et al. 2007; Tsakonas et al. 2004). Moreover, as being a predictive model, TAM investigates the impact of external variables on the formation of perceptions on ease of use and usefulness, and the prediction of usage is based on the profile of the user (Shuraida and Barki 2007). Therefore, it concentrates only on one dimension (user) and doesn't investigate the effect of specific attributes in the interaction between the user and content and also between user and system (Hong et al. 2002; Shuraida & Barki 2007). Despite TAM having substantial explanatory power, its major weakness is having a low descriptive richness that would allow researchers to draw conclusion upon. Additionally, TAM relationships exhibits imperfection; there exists large deviation in the predicted outcomes in some research with divers examples and systems (Nyoro et al. 2015).

Venkatesh & Davis (2000) developed TAM2 by adding two determinants to the original TAM: social influences and cognitive instrumental processes. The social influences include subjective norms and images. On the other hand, the cognitive instrumental processes include job relevance, output quality, result demonstrability and perceived ease of use. TAM2 keeps the concept of perceived ease of use from the original TAM as a direct determinant of perceived usefulness. All

of these additional elements are believed to influence the acceptance of technology. There are two moderating variables in this model, which Unified Theory of Acceptance and Use of Technology (UTAUT) (2003). Combining the different theories and models of technology acceptance, Venkatesh et al. (2003) developed a unification theory in which they incorporated the components of eight technology acceptance models and theories.

The UTAUT model used four main determinants of usage and intention; these are performance expectancy, effort expectancy, social influence and facilitating conditions. These stand alongside four moderators of gender, age, experience and voluntariness of use. This theory has been criticized for having too many independent variables for predicting intentions and behavior (Bogozzi, 2007). However, it is considered to be more robust than other technology acceptance models in evaluating and predicting technology acceptance (Venkatesh et al., 2003).

TAM3 is constructed on a theoretical framework of four classifications which Venkatesh and Bala claim is a mixture of all prior TAM research (2008). These four classifications are individual differences, system characteristics, social influence and facilitating conditions (Howard et al., 2010). According to this model, the perceived ease of use is determined by computer self-efficacy, computer playfulness, computer anxiety, perception of external control, perceived enjoyment and objective usability. The perceived usefulness is determined by subjective norms, job relevance, result demonstrability and image. However, one of the criticisms of the model is that there are too many variables and too many relationships between the variables.

UTAUT2 is the extension of the unified theory of acceptance and use of technology developed by Venkatesh et al. (2012) to pay particular attention to the consumer use context. This model included the independent variables of UTAUT but added three more which are hedonic motivation, price value and habit. They have integrated these three independent variables into UTAUT in order to fit it to the consumer technology use context.

2.5.2 DeLone and McLean's Information System Success Model (D & M model).

Another dominant and frequently cited framework in IS success measurement is the DeLone and McLean IS Success Model (DeLone & McLean 1992). DeLone and McLean's proposed model reflects the systematic combination of previously reported individual measures. The model provides a categorization of IS success that originally consisted of six variables, namely system quality, information quality, use, user satisfaction, individual impact, and organizational impact. In their updated work, the authors revised the original model and added service quality as a construct and replaced individual and organizational impact with net benefits (Christian et al. 2013; DeLone & McLean 2003).

Despite its important contribution towards the improved understanding of IS evaluation and its application in many IS success research, several issues remain in the D & M model. To mention some, one of the main limitations of the D & M model is that it does not present any appropriate measures for each of the success dimensions (Wu & Wang 2006). Instead DeLone and McLean stated that the objectives and context of the research at hand should determine all the measures, and measures tested and proven by other researchers should be used to the extent of its applicability. For DeLone and McLean (1992, 2003), the lack of established measures for the success dimensions can be seen as a result of the complex nature of IS (Wu & Wang 2006). In addition, The D & M model is criticized for its excessive emphasis on quantitative (financial) measures. Change in the nature of the contemporary IS environment, i.e. the modern IS trend, is towards changed organizational structures and behaviors that facilitate inter-organizational activities and study interaction events among components of IS; thus, new measures and evaluation models are required to measure success with contemporary IS, in addition to the necessity of multiple stakeholder participation perspectives in the assessment process. The current model has attempted to quantify the impacts (benefits and drawbacks) of IS by analyzing data collected mostly at very senior levels of the firm (Gable 2003; Sedera et al. 2003).

In conclusion, the D&M model has been widely used and adapted by IS researchers in order to understand and measure the dimensions of IS success. However, rather than being an instrument to measure the success of an IS in real organizational settings, the model has been found to be a useful framework for organizing IS success measurements. Also, it has found to neglect the social and organizational factors in evaluating IS (Christian et al. 2013; Petter et al. 2012).

2.5.3 Fuhr's Holistic Conceptual Framework

Fuhr et al. (2001) proposed a generic and holistic conceptual model for DL evaluation, which is composed of three non orthogonal components: the users; the DL content; and the technological system that supports the DL content (Khoo & MacDonald 2011). Based on these three components, i.e., users, technological system, and content, the proposed framework addressed several questions, such as who, why, and how DLs evaluated. The model was used to gather insights on DL evaluation from researchers as well as to establish a benchmark for comparison purposes (Tsakonas & Papatheodorou 2011). For this model, content is king, and consequently the nature, extent, and form of the DL content determine both the variety of potential users and the essential technological system (Khoo & MacDonald 2011).

This model describes DLs as complex systems that can be viewed from many perspectives, and also recommend that evaluation should be flexible and extensible to cope with rapidly changing DLs; involve practitioners and actual users; use consistent platforms for gathering, storing, and disseminating evaluation data; evaluate user behavior along with sociological, institutional and other factors (Heradio et al. 2012).

Although Fuhr et al., s' model has remarkably influenced several user-centered proposals; it addresses primarily system-centered evaluations (Khoo & MacDonald 2011). Besides, the main drawback of this framework is that it neglects an important DL level, which is interface. In addition, the framework doesn't set any measurement criteria for the interaction components. As a result, from a systematic point of view, a framework that is composed of content, system, user and usage, by itself cannot be regarded a holistic DL model (Zhang 2010).

2.5.4 Saracevic's digital library evaluation framework

Saracevic (2001) defines a digital library as "a set of elements in interaction" with one or more objectives, operating in a series of environments. Saracevic has argued for evaluation considers the effectiveness of system performance in relation to stated goals and it must address four criteria, (construct, context, criteria, and methodology) and construct decides what to evaluate "what is meant by a digital library?" For the rest of the evaluation criteria, the context of the evaluation

(goals, levels of analysis), the performance criteria for selected objectives, specific measures for the criteria, and the methodology for carrying out the evaluation (techniques and procedures) all flow from his definition of DLs (Khoo & MacDonald 2011).

This framework acts both as a categorization method for existing DL evaluation studies and a model for new ones. particularly, a set of guiding principle can be extracted from it in order to make the overall evaluation practice not only less controversial and difficult, but, more considerably, easier to replicate and compare to similar ones so that, in the future, evaluation experiments and their results would not be outdated individual exercises but would serve the entire community and allow for advancement and improvements where required. Saracevic's four dimensions have also proved to be reasonably expressive and sufficiently elastic to describe a range of studies. The classes of constructs, context, criteria, and methodology give a considerable reflection of the DL evaluation field by adding definitions that are important aids for designing an evaluation activity. His classification identified the most critical dimensions of evaluation and the factors that influence it and distinguished those studies that model evaluation processes and those that report findings (Fuhr et al. 2007; Tsakonas & Papatheodorou 2011).

The drawback of this framework is that, the why, what, and how questions are instant and perceptive to use and understand, but obviously have some overlaps in terms of their coverage. Moreover, taken in partition, they are open to individual interpretations and their difficulty can grow out of control. This could make their application to model existing evaluation initiatives or design new ones bulky, complex, and conflicting (Fuhr et al. 2007). Besides, this model doesn't define or discuss any measurement criteria on undertaking the evaluation study. Another weakness of the model is its elimination of environmental, organizational, social, and culture layers (Zhang 2010).

2.5.5 The DELOS Digital Library Reference Model

The DELOS Digital Library Reference Model defines digital libraries in terms of three distinct layers: organizations that manage collections of digital content; systems that connect users to the

library's content; and management systems that manage user interactions with the library and content. The layers support six core concepts which are:

- "content (data and information made available to users)
- users (the various actors entitled to interact with a digital library)
- functionality (the services offered to different users)
- quality (the parameters for evaluating the content and behavior of a digital library)
- policy (the sets of situation, rules, terms, and regulations governing interaction between the digital library and its users) and
- architecture (a mapping of the functionality and content offered by a digital library onto hardware and software components)."

The model can be expanded in a number of directions; for instance, users are defined in terms of end users, designers, system administrators, and application developers (Fuhr et al. 2007; Khoo & MacDonald 2011).

The DELOS model falls into three non-orthogonal components of the DL domain: the users, the content, the technology. Accordingly, the definition of the set of users predetermines the proper range and content of the collection. The nature of the collection also predetermines the range of suitable technologies that can be used. The attractiveness of the collection to the users and the ease of the used technologies will determine the degree of usage of the DL (Fuhr et al. 2007; Khoo & MacDonald 2011).

The DELOS model, also known as "a generalized schema for a digital library" constitutes the first holistic model specifically created for DL evaluation from the research community (Fuhr et al. 2001), and describes an important DL domain, i.e., the research domain. Furthermore, the research domain identifies the four research areas involved in the entities of the DL domain as follows:

- "system/technology: system and technology researchers;
- data/collection: librarians, LIS researchers;
- users: publishers, sociology of science, communication researchers;
- usage: HCI, librarians, systems researchers" (Fuhr et al. 2001)."

This model effectively illustrates the heterogeneity of research fields involved in DLs. However, by excluding policy makers, managers, senior librarians, and administrators, it does not take into account the organizational and social context of the DL (Vullo 2010).

2.5.6 The Interaction Triptych Framework (ITF)

The aim of the Interaction Triptych Framework (ITF) is to explain the interaction process among DL components and to offer a basis for interaction evaluation elements, such as methods and criteria. As a user-centered framework, it explores and emphasizes the conversation elements that are articulated and transacted throughout an interaction period and recognizes the iterative nature of the interaction events (Tsakonas et al. 2004).

Thus, ITF which is a conceptual framework that attempts to incorporate knowledge and experience from the fields of information behavior and human computer interaction is used as a guiding framework to undertake the empirical study of this research.

The idea of ITF originated from the concept of information interaction first detailed by Toms (2002). Toms specifically discussed information interaction as a complex process that integrates three objects that serve as the basis for the model of information interaction, user, content, and system. As depicted in Figure 2.1, the user interacts with the system to access the information content, which is influenced by the systems management of the content and the ability to communicate with the user. Additionally, the user, system, and content are understood as a series of two way communication- the user-system communication, in which the user communicates with the system; the system-content interaction, which is the result of applying a set of IT process that provides accessing, storing, and updating facilities, and finally, the user-content interaction, which occurs between the digital content and the activation of the existing user knowledge.

Although Toms' description of information interaction is vital for understanding the interaction between the three objects (user, content, and system), and for laying the ground for further developing and improving a conceptual framework, its model fails to discuss the processes, criteria, and attributes of the interaction between user and system, system and content, and user and content which remain essential and the basis for interaction evaluation ends.

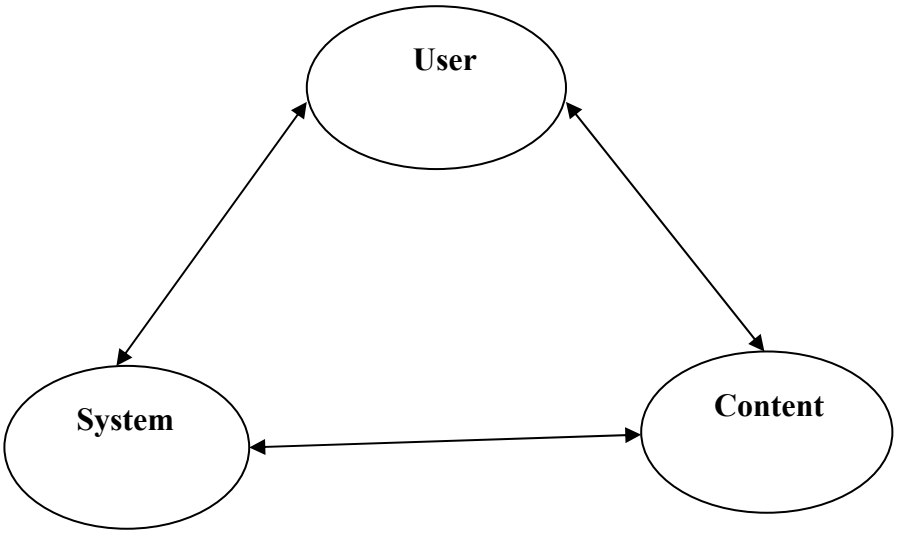

Figure 2.1 An instance of Toms information interaction (Adapted from Toms, 2002)

Based on Tom's (2002) information interaction model, Tsakonas et al. (2004) developed a conceptual framework known as the Interaction Triptych Framework, which is employed as the principal framework for the current empirical study for reasons briefly explained below.

ITF is based on the idea of DL component interaction. Each DL consists of three main components, namely user, content, and system and their relationships (Fuhr et al. 2007; Tsakonas et al. 2004). Fuhr et al. (2007) discussed the components as having a set of properties that are articulated during the interaction as needs, requests, and responses. The investigation of these three interaction components illustrates each component's features. The ITF model, apart from describing the user interaction in the DL, also describes the interactions between the components of the DL itself. The user is the primary poll of the interaction process and his characteristics are difficult and always increasing. The user categories can be different like end users, developers and intermediates that may understand and evaluate a digital library through different sights. User know-how, both on system and content, is another important attribute on the process of evaluating DL. Content is the major reason for interacting with a DL. It addresses the user's information needs decision. The

main attributes of content are divided into those that represent its semantic essence (topic relevance) and those that illustrate it as an object (type and level).

The broad categories and criterion of the ITF can be divided into sub-categories, providing a complete coverage of interaction aspects. The three broad categories, based on the interaction axes can be stated as usability, usefulness, and performance (Fuhr et al. 2007; Heradio et al. 2012; Tsakonas et al. 2004).

Accordingly, it is crucial to provide some information on what each of these categories contains. On the one hand, the category of usability focuses on the easiness of the system to be used in an efficient, effective, and satisfactory way (ISO 1998). A usable system creates the circumstances for the normal and continuous interaction and communication between the user and the system features (Fuhr et al. 2007; Tsakonas et al. 2004). In the light of such general descriptions the attributes of usability can be listed as ease of use, aesthetics, navigation, learnability, and terminology (Tsakonas & Papatheodorou 2008). On the other hand, usefulness as one category is the degree of the connection of a DL to satisfy the information needs of the user. Hence, usefulness examines the properties of the interaction between the user and the content, and its attributes include relevance, format, reliability, level of detail, and coverage (Tsakonas & Papatheodorou 2008). Finally, the category of performance focuses on the relationship between the system and the content features. Thus, the attributes of performance are precision, recall, relevance, and response time (Fuhr et al. 2007; Heradio et al. 2012; Tsakonas et al. 2004). For more understanding of ITF components, criteria, and attributes, please see the following figure (Figure 2.2).

As stated by Tsakonas et al. (2006), the ITF model sets the desired characteristics of user interaction in the digital library environment as: Control, Shift management, and Lucidity. Control is the ability of the user to easily manipulate the system. Desired properties of a controllable digital library include consistency, effective navigation support, error restriction, familiarization and user awareness. Shift management addresses to the ability of the user to stabilize and to orient the interaction process. Shifts are intended or unintended alternations on the user's strategy, which may be caused by system or human interference. Unanticipated location and retrieval of information implies instable and ill-defined information needs, but as a response, an ideally

designed digital library should provide the adequate support functionalities and feedback mechanisms. The logging scheme should describe the events that provide evidence of interaction shifts, as well as to record which point ignited it. Lucidity is an interpretation of semantic and visual visibility. A lucid interface allows projection of functionalities' affordance and the clear and understandable purpose of each object. Lucidity can be achieved by visual and semantic identification of system and content features, meaningful to the user terminology and visual comfort.

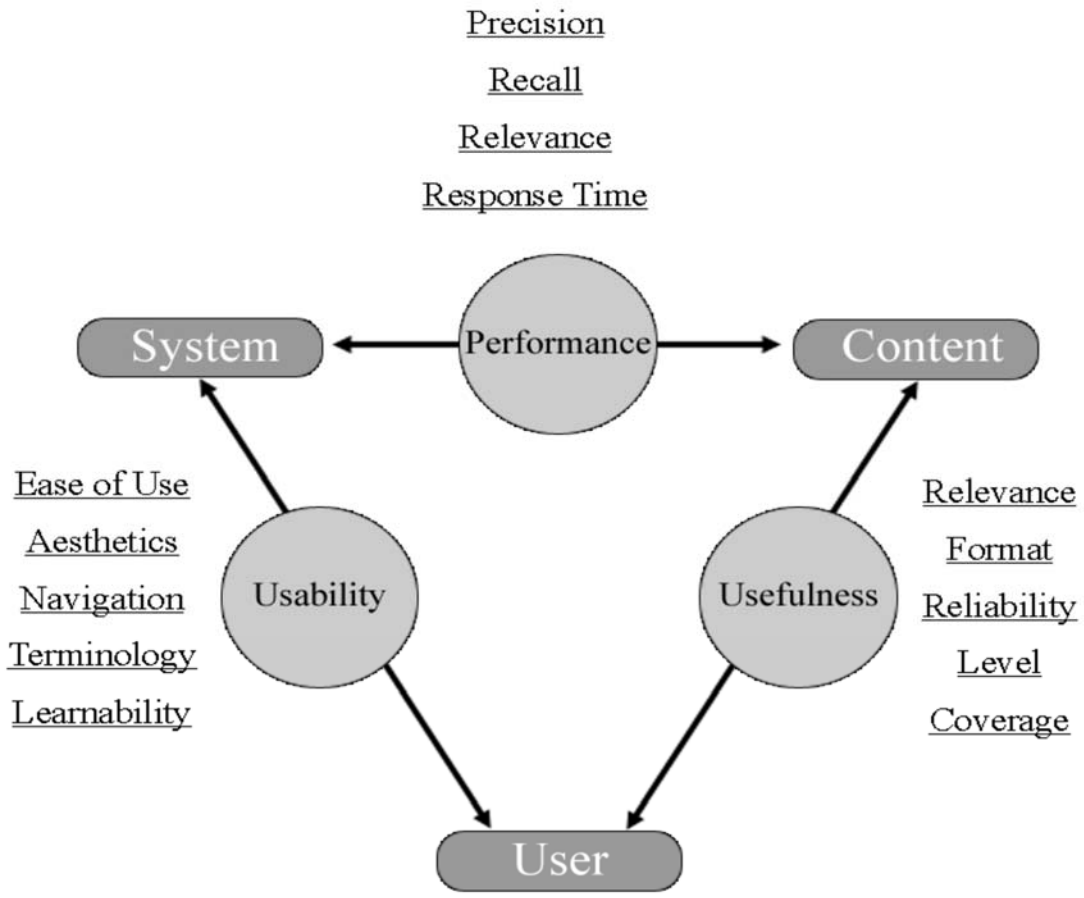

Figure 2.2: Digital Library Interaction Components (Tsakonas et al. 2004, p. 47).

Table 2.3 Comparison of DL evaluation frameworks/models

Framework/model	Aim/purpose	Process	Orientation	Shortcomings
DeLone and McLean's Information System Success Model (D & M model).	To understand and measure the dimensions of IS success.	Organizes IS success measurements. Provides a categorization of IS success that consisted of six variables (system quality, information quality, use, user satisfaction, individual impact, organizational impact).	System centered	Doesn't present any appropriate measures for each of the success dimensions. Rather than being an instrument to measure success of an IS in real organizational settings, it has been found a useful framework for organizing IS success measurement. Not support interaction components of DLs. Not include socio-technical aspects of DLs and the organizational impact of IS seems largely understudied.
Technology Acceptance Model (TAM)	To study and predict the user's intention to use IS. To measure, predict and explain the acceptance, adoption and use of information technology.	Uses perceived usefulness and perceived ease of use as predicting indicators. Model user's acceptance of IS or technology. Explain user behavior in adapting new technology.	User/technology centered	Content component of DL is missed. Doesn't intend to measure the success of IS, but used to study and predict the user's intention to use information systems. Concentrate only on the user dimension. Doesn't define and study interaction events among DL components. No concern for socio-technical aspects of DLs.
Saracevic's Digital Library Evaluation Framework	Acts as a classification scheme for existing DL evaluation studies and a model for new evaluations.	Use four dimensions to describe a variety of DL evaluation studies (content, context, criteria, methodology).	System centered	No measurement is defined or discussed. Not support interaction components of DLs. Exclude socio-technical aspects of DLs. The results are open for individual interpretations
The DELOS Digital Library Reference Model	Describes the DL research domain. To evaluate DLs from the research community point of view.	Use three dimensions of DLs (user, content, technology). It concerns on content quality. Illustrates the heterogeneity of research involved in DLs.	User centered	Doesn't consider the organizational level of the DL and its actors. Exclude policy makers, managers, and senior librarians, from the DL study. No measurement criteria set for interaction components. Doesn't concern about the socio-technical aspects of DLs.

Fuhr's Holistic Conceptual Framework	To gather insights on DL evaluation from researchers. Establish benchmark for DL evaluation for comparison purpose.	Composed of three DL interaction components (user, content, technological system).	Primarily system centered.	It neglects to evaluate the DL interface. No measurement criteria set for interaction components. Doesn't consider the socio-technical aspects of DLs.
The Interaction Triptych Framework (ITF)	Describe the interaction processes among DL components. Provide the basis for interaction elements (methods, criteria).	Based on the idea of DL component interaction. It describes user interaction in DL and interaction between components of the DL (user, system, content). Provide three broad categories based on interaction axes (usability, usefulness, performance). Provide evaluation criteria for each category.	User centered	It doesn't consider the socio-technical aspects of DLs in their evaluation.

From the above discussions and table (Table 2.3) a number of comparisons and conclusions have been drawn as follows.

The main aim of the DeLone and McLean model is to understand and measure the dimensions of IS success. Despite its important contribution towards the improved understanding of IS evaluation and its application in many IS success research, several issues remain in the D & M model. To mention some, even though its process is organizing IS success measurements one of the main limitations of the D & M model is that it does not present any appropriate measures for each of the success dimensions (Wu & Wang 2006). Instead DeLone and McLean stated that the objectives and context of the research at hand should determine all the measures, and measures tested and proven by other researchers should be used to the extent of its applicability.

The D & M model is criticized for its excessive emphasis on quantitative (financial) measures. Change in the nature of the contemporary IS environment, i.e. the modern IS trend, is towards changed organizational structures and behaviors that facilitate inter-organizational activities and study interaction events among components of IS; thus, new measures and evaluation models are required to measure success with contemporary IS, in addition to the necessity of multiple stakeholder participation perspectives in the assessment process. This current model has attempted to quantify the impacts (benefits and drawbacks) of IS by analyzing data collected mostly at very senior levels of the firm (Gable 2003; Sedera et al. 2003).

In conclusion, the D&M model has been widely used and adapted by IS researchers in order to understand and measure the dimensions of IS success. However, rather than being an instrument to measure the success of an IS in real organizational settings, the model has been found to be a useful framework for organizing IS success measurements. Also, it has found to neglect the social and organizational factors in evaluating IS (Christian et al. 2013; Petter et al. 2012).

TAM is different from other frameworks and models as it does not intend to measure the success of the IS/IT, but its' aim is to study and predict the user's intention to use IS. In terms of its process, TAM uses the ideas of perceived usefulness and perceived ease of use as predicting indicators of users' intentions and actual usage of the IS. Its orientation is towards the user and technology centric. However, user centered DL evaluation requires the definition and study of interaction events among DL components and the deep exploration of its physical and digital environments (Thong et al. 2002), which is its main drawback.
TAM also does not investigate the effect of specific attributes in the interaction between the user and content and also between user and system (Hong et al. 2002; Shuraida & Barki 2007). Despite TAM having substantial explanatory power, its other weakness is having a low descriptive richness that would allow researchers to draw conclusion upon. Additionally, TAM relationships exhibits imperfection; there exists large deviation in the predicted outcomes in some researches with divers examples and systems (Nyoro et al. 2015). Another important drawback of TAM is it neglects the socio-technical aspects of DLs in their evaluation.

The aim of Saracevic's digital library evaluation framework is to act as a categorization scheme for existing DL evaluation studies and a model for new evaluations. In its process, it uses four dimensions to describe a variety of DL evaluation studies (content, context, criteria, methodology), but, this framework doesn't define or discuss any measurement criteria on undertaking the DL evaluation study. Another drawback of this framework is that, the why, what, and how questions are immediate and perceptive to use and understand, but obviously has some overlaps in terms of their coverage. Furthermore, taken in separation, they are open to individual interpretations and their complexity can grow out of control. This could make their application to model existing evaluation initiatives or propose new ones burdensome, difficult, and conflicting (Fuhr et al. 2007).

Besides, another weakness of this model is its exclusion of environmental like organizational, social, and culture layers in evaluating DLs (Zhang, 2010).

The aim of the DELOS Digital Library Reference Model is to evaluate DLs from the research community point of view. In the process of evaluation, it uses three dimensions of DLs (user, content, technology) giving more concern on content quality. This model effectively illustrates the heterogeneity of research fields involved in DLs. However, by excluding policy makers, managers, senior librarians, and administrators, it does not take into account the organizational and social context of the DL (Vullo 2010). Besides, it doesn't set measurement criteria for its interaction components (user, content, technology).

The aim of Fuhr's conceptual framework is to gather insights on DL evaluation from researchers and establish benchmark for DL evaluation for comparison purpose. For this model, content is king, and consequently the nature, extent, and form of the DL content determine both the variety of potential users and the essential technological system (Khoo & MacDonald 2011).

Although Fuhr's framework has remarkably influenced several user-centered proposals; it addresses primarily system-centered evaluations (Khoo & MacDonald 2011). Another drawback of this framework is that it neglects an important DL level, which is interface on DL evaluation. In addition, the framework doesn't set any measurement criteria for the interaction components. As a result, without considering the socio-technical aspects of DLs, from a systematic point of view, a framework that is composed of content, system, user and usage, by itself cannot be regarded a holistic DL model (Zhang 2010).

The aim of the Interaction Triptych Framework (ITF) is to describe the interaction processes among DL components and to provide the basis for the measurement of interaction elements (methods, criteria). Based on the idea of DL component interaction, in its process, it describes user interaction in DL and interaction between components of the DL (user, system, content). It Provides three broad categories based on interaction axes (usability, usefulness, performance) and also provide evaluation criteria for each category. The main drawback of this framework is, it doesn't consider the socio-technical aspects of DLs in their evaluation.

2.5.7 Rationale for using ITF as an initial framework.

As described in the above paragraph, ITF is a user-centered framework for DL evaluation. The user-centered evaluation of digital libraries means that the outcomes of this type of evaluations are mainly based on users' opinions, actions, feelings and perceptions. It means that users become the center of attention and reveal the extent to which a digital library supports their needs and demands, their roles and practices. If analyzed in a proper and creative way, the feedback of users can lead to the implementation of user-centered systems (Tsakonas & Papatheodorou 2008). The final output of a user-centered evaluation concept can be used for the implementation of systems focusing on users' necessities, perceptions, mental models and information-processing structures (Fuhr et al 2007).

Although research on the quality evaluation of DLs based on users' perceptions seems to be in an early stage, the importance of evaluating the quality of DLs from the user's perspective is well recognized by the DL community. User-centered evaluation of DLs has drawn considerable attention during recent years. Research in this area has produced a set of varied criteria by which to judge DLs from the user's perspective, measuring instruments to extract users' opinions, and approaches to analyze the elicited data to conclude an evaluation (Heradio et al. 2012). According to the user-centered aspect of the interaction triptych framework, effective interaction depends on system usability and information usefulness. User communicates with both system and content in a unified and indiscriminate way, and that interaction consists of the merging of physical, affective, cognitive, and conceptual actions and judgments. In addition, users select information resources and systems which cover their informational requests, satisfy their information needs, and do not require significant effort in use (Tsakonas et al. 2006).

Even though, a number of digital library evaluation frameworks and models have been discussed above with their strengths and weaknesses, the ITF framework has been found an appropriate one and selected to be used as a lens for undertaking the current empirical study. The main reason for selecting ITF as a framework for this study is its being user-centric framework that the emphasis of the evaluation mainly relies on users' opinions, actions, feelings and perceptions. In this type of evaluation, the users become the center of attention and reveal the extent to which a digital library supports their needs and demands. Besides, ITF describes DL components and the

interaction between them and also provide the basis for the measurement of the interaction elements that is categorizing the interactions and providing measurement criteria, which is not discussed and provided by the other frameworks and models described above. The statements stated below further strengthen and justify the reasons for selecting and using ITF as an appropriate framework for undertaking the empirical research, whose results have been used as a basis for coming-up with an evaluation conceptual framework.

- Increasing recognition of the evaluation research of DLs from the users' perspective by the DL community,
- the effective interaction of the users being dependent on system usability and content usefulness which is strongly supported and thoroughly described by ITF,
- As explicitly stated in the title of the thesis, study objectives, and research questions, the current research being user-centered evaluation of DLs that collect the research data from actual DL users,
- ITF being a user-centered and interaction based framework (interaction of the user with system and content expressed as usability and usefulness respectively), and further provide and describe a number of measurement criteria and attributes for the interaction axes, which are not stated and explained as their properties in the other discussed frameworks.

2.5.8 The need for proposing context based conceptual framework

The primary objective of this study is to propose an interaction conceptual framework used for digital library evaluation in resource constrained countries context, which uses to fill the knowledge gap in information systems and digital library evaluation literature. The framework was constructed based on the researcher's own background technical, research, and experiential knowledge; existing theory and research; and from the outcomes of the current empirical study i.e., from the results of analysis of the collected data from the different users of DLs (Leshem & Trafford 2007). Thus, the researcher's background and experiential knowledge in the field of study, an extensive literature review of conceptual works done in the area of DL evaluation, and the outcomes of the current empirical usability and usefulness evaluation study have been used as a basis for constructing and proposing the new framework.

In the previous section (Section 2.5) of this chapter, different digital library evaluation frameworks and models have been reviewed and discussed, some of them being holistic, others more system oriented, and some others being user oriented. But, including ITF (that has been used as a framework to handle the current empirical research), they are not intentionally developed to be used for evaluation research that deal with the effects of DLs at higher levels (social, institutional, environmental) in terms of how well a DL fits into or even improves people's daily work. Furthermore, they lack measurement criteria devised specifically for DLs in different settings and environment (Zhang 2010). The following paragraphs strengthen the need and importance of constructing a new contextual framework emphasizing on social and environmental issues when undertaking DL evaluation research that the implemented ITF framework also lacks.

In addition to the importance on the interaction among different DL levels and aspects, the concern of contextual effects is another key feature of a DL evaluation approach, distinguished from the user-centered and system-centered approaches. Thong et al. (2002) recommended that in addition to individual characteristics, organizational context is another dimension, which proved to impact perceived ease of use and usefulness of the DL. Similarly, Adams and Blandford's (2002) study revealed that the perceived impacts of DL improvement are associated with organizational, social and political structures. Wallace (2001) also argues that failure in considerate the context of system development and use may yield to evaluation activities inappropriate, ineffective, or even harmful.

A digital library typically has a social and environmental reliance because, its success should be influenced by the institutional/social practices and it should be well supported by the institution and society within which it exists. Grounded on rich and in-depth opinion and evidence about the DL as a socio-technical system, Bishop et al. (2003) advocates for technically informed social analysis for DL evaluation (Zhang 2010).

As pointed-out by several pioneered researchers (Bishop 2003; Marchionini et al. 2003; Saracevic, 2000) in the field of IS, digital library effects are not only restricted in the ways in which people locate information, but also the ways in which they live in a society. Bishop (2003) compared the information use of two different groups of users (academic and low income communities), and shows that DL usage is connected with social practice, beliefs/goals, social norms, knowledge,

technology access/expertise, resource constraints, and the interaction among different communities.

While advocating the likely impact of information technology on scholarly communication, Lyman (1997) pinpoints that societal functions are not simply measured in terms of outcomes, but is an aspect in the productivity of faculty and students. Strengthening the social and environmental dimensions of DLs, Bertot and McClure (2003) proposed that library outcomes in the digital age can be considered by the extent to which a given library service and support meets the predefined goals by the library and/or expected by the group of people the library serves (academic institution, county, city).

Guided by the socio-technical principles that understand DLs through their technical and social perspectives, the proposed DL evaluation framework tries to address how well digital libraries in Ethiopia fit into their larger context (institutional, social, cultural) practices, and how can these DLs be evaluated contextually, which is missed or neglected in previous literature regarding DL evaluation and tried to be addressed by the current work. In the meantime, some other criteria have been recommended or used to inspect what impact and effect DLs may have on the contextual practices. This is the knowledge gap in IS and DL literature that the current study addresses. The proposed framework shares the meaning with Star et al. (2003)'s concept of junction between information artifacts and communities of practice for the reason of "transparency beyond the individual level of scale" in a socialized digital world following and guided by the socio-technical approach in its entire evaluation process.

2.6 Chapter conclusion

In this chapter, review of related literature for the current study has been stated in detail. It contains several sections like Information System evaluation, usability and usefulness evaluation, and qualitative evaluation works which are very related to the current study. It also has discussed about different conceptual frameworks used in IS and DL evaluation research and also the one that is selected and implemented in the current empirical study has been justified. Finally, the importance of proposing a context based conceptual interaction framework for DL evaluation in resource constrained countries such as Ethiopia was justified. The next chapter deals with the description of the followed research methodology, the research design, the sampling techniques and methods used for data collection and also how the analysis of the collected data is performed.

CHAPTER THREE

3 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction to the chapter

This chapter is divided into ten sections as follows.

Section 3.1 is an introduction to the chapter. Section 3.2 discusses the research paradigm followed in the study. Section 3.3 is devoted to the description of the research methodology employed in the entire work. Section 3.4 deals with the employed research design. Section 3.5 detailed the general population and sampling techniques employed to select study participants. Section 3.6 is devoted to a detailed discussion of the data collection methods/techniques implemented in the study with their justifications. The process of data collection is discussed in Section 3.7 which deals with clarifying the research sites, the participants, and the data collection process. It also contains a description of the methods and processes of transcription of the interview data. Section 3.8 is started by elaborating the data analysis process that deals with how the collected data have been analyzed and interpreted. It discusses the steps followed in the analysis, that is, how the process of coding, categorization and classification were implemented on the transcribed and other collected data. The trustworthiness of the study is detailed in Section 3.9. The last section (Section 3.10) holds the conclusion of the chapter.

3.2 Research paradigm

From the philosophical assumptions viewpoint, this research is categorized under the interpretive research paradigm which is based upon the ontological assumption that reality and our knowledge are social constructs, unable of being studied independent of the social actors that create and make sense of reality. Unlike the positivists' approach that tries to search for cause-effect relationships, the interpretivist approach focuses on understanding the actors' view of their social work (Cater-Steel & Al-Hakim 2009).

In this regard Creswell (2014) further pointed out that interpretive research is a form of investigation in which case, researchers make an interpretation of what they scrutinize, listen to, and know. This indicates that the researchers' interpretations cannot be separated in one or another way from their own environment, history, viewpoint, and previous understandings. As clearly argued by Walsham (2009), an interpretive approach to evaluation research is a way of gaining an in-depth understanding on the nature and process of the evaluation itself, besides the evaluation process been regarded as a means that encourages the involvement and commitment of different stakeholders. Walsham (2009) further strengthens his argument by stating that the aim of an interpretive evaluation as to involve a wide variety of stakeholders in the study that is organized around their concerns, issues, and values. For instance, in most circumstances, after a research report is issued, the readers as well as the participants build an interpretation of the study on their own explanation. Thus, with all these diverse interpretations, it is likely to see how several views of the problem can appear (Creswell 2014).

As this study is mainly concerned with understanding and interpreting users' internal characteristics, (as clearly envisaged in the outline of the research question and research objectives) such as perception, attitude, feeling, and expectation on the DLs they use, following the interpretive research paradigm is supposed to be more suitable. As this study is solely concerned with users' internal attributes, such as perception, attitude, feeling and expectation the interpretive research paradigm is believed to be suitable.

3.3 Research methodology

In accordance with the philosophical assumptions, two leading research strategies, namely qualitative and quantitative which associate themselves with interpretivism and positivism respectively, are generally adopted by researchers. In qualitative research, the stress is on interpretive analysis and understanding, which is mainly concerned with budding concepts. On the contrary, quantitative research emphasizes causal analysis and predictive understanding while qualitative data emphasize words and concepts rather than numbers and statistics (McNicol 2004; Walsham 2006).

It is also asserted in this respect that qualitative evaluation methods are appropraite for any research that needs to consider a variety of diverse viewpoints, perspectives, and opinions. Possibly, its maximum potential advantage is that such a method can lead to better engagement with users. Moreover, explanatory qualitative data can be regarded as very important for any decision making or service development and maintenance activities that result from an evaluation (McNicol 2004; Walsham 2006).

The overall structure of the research methodology in this study is qualitative. As the study was a qualitative research in nature, it employed a qualitative research strategy. This is because it is a design which combines the research participants, the researcher as a research instrument, and appropriate data collection techniques in a collaborative process of producing meanings from data and using that meaning to evaluate the performance of the DLs that is used to come up and propose a DL evaluation framework appropriate for developing countries DLs.

The rationale behind using the qualitative research methodology in this study is that as being a user centered research, the study is based on the beliefs, attitudes, opinions, behaviors, and experiences of the respondents (DL users) and their interaction with the digital library components (see Section 5.10) which has an interpretive character aimed at discovering meanings and relationships. Since the main objective of the current study is to evaluate the DLs and come-up with the DL evaluation framework that suits in a developing country context, the process of interpreting the DL users own explanations becomes essential for evaluating the DLs and then after developing a new theory or framework. This process can be handled through employing qualitative research methodology. Therefore, having considered the nature of the study being examining the users' own words for answering the research questions, the researcher believed the qualitative methodology to be the most suitable.

Additionally, employing qualitative research methodology can be justified by a number of reasons: Firstly, qualitative research concentrates on studying peoples' daily activities in detail, focusing on behavioral and organizational contexts. It is conducted in normal settings using data in the form of words rather than numbers. Secondly, data collection involves reporting of statements, activities, and appearances of people in their environments. The oral statements and actions of the

subjects are analyzed for meaningful interpretations (Kaplan & Duchon 1998; Snow et al. 2008). In supporting and strengthening this concept, Yin (2011), explains that the qualitative methodology is a better preference when the research question requires an understanding of processes, actions, and associations in the context of the social and cultural situations. Instead of generating numerical data supporting precise hypotheses, it aims to construct descriptions based on face-to-face knowledge of persons and social groups in their ordinary settings. In other words, the technique is usually used not only for providing in-depth descriptions of procedures, beliefs, and knowledge, but also for exploring reasons for certain behaviors, including the opinions of respondents about particular issues.

On account of such particular understanding of the issue at hand and for the purpose of adding conceptual clarity, it is worthwhile to have a glimpse of the following four basic features of qualitative research which are put forward by Yin (2011).

- "studying the meaning of people's lives, under real-world conditions, representing the views and perspectives of the people (participants) in a study;
- covering the contextual conditions within which people live;
- contributing insights into existing or emerging concepts that may help to explain human social behavior; and
- striving to use multiple sources of evidence rather than relying on a single source alone."

Regarding the disadvantages of the qualitative methodology, it is mentioned that respondents usually provide their own understandings and explanations (may not be sometimes true) in a participatory discussion with interviewers (Patton 2002). This can be generally taken as one form of the weakness in using qualitative methods. Patton (2002) also stated another weakness as collecting and analyzing qualitative data being labor intensive and time-consuming. Consequently, the number of respondents upon whom the methods are going to be applied is usually far less when compared with those in quantitative based methods. In this respect, according to Yin (2011) another critique at times is that qualitative methods are frequently not objectively verifiable.

Thus, when looked at from the point of view of the nature of the problem under study, the research questions, and the preceding explanations, the qualitative research design is chosen as the most suitable for this work.

3.4 Research design

The research design employed in this evaluation research is a case study research, where the "case" is digital libraries of four Ethiopian Higher Learning Institutes. The "case study" is evaluating the usability and usefulness of the digital libraries, whose result is used to propose a conceptual interaction evaluation framework that will be detailed under Section 5.10.

The rational for using a case study design in this research is that, to gain an in-depth examination of a "case" within its real-world context. Compared with other evaluation methods such as surveys, experiments, and quasi-experiments, case study evaluations can capture the complexity of a case, including relevant changes over time, attend fully to contextual conditions, including those that potentially interact with the case and explain how the "case" usually as a planned intervention or an ongoing initiative, works (Creswell 2014).

Additionally, as case study is an empirical method that investigates a contemporary phenomenon, the "case" in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident. Therefore, the researcher selected to do a case study because he wants to understand a real-world case "the digital library" and assumes that such an understanding is likely to involve important contextual conditions pertinent to the case. The use of case study in doing this evaluation research is to gain an in-depth examination of a "case" within its real-world context.

3.5 Population and sampling

3.5.1 Population

A population consists of all the subjects or all items to be studied which are available in any field of the inquiry. In this study, two types of target population are involved. These are the population of institutes (public university) DLs and the population of users of the public universities' DLs.

With regard to institutes, the population of the study is the public Ethiopian Higher Learning Institutes (EHLIs) DLs. According to the recent report issued by the FDRE Ministry of Education (2011), currently there are 33 public funded universities throughout the country. Thus, they are drawn as the population of the current research. From among the general population of a given public university DL users, doctoral and graduating class masters students, faculty/research scholars, and librarians are considered to be users of the DLs and population of the study.

3.5.2 Sampling

Usually, it is not as such possible and plausible to examine every item in the general population because of time and resource limitations. Specially, in qualitative research, this is also not necessary, as long as a point of conceptual saturation is reached. Due to such reasons, occasionally it is possible to gain adequately accurate results by studying only a part of the total population known as a sample (Kothari 2004). For instance, Kothari (2004, 55) defines sampling as:

> *"A sample design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt in selecting items for the sample. Sample design may as well lay down the number of items to be included in the sample i.e., the size of the sample. Sample design is determined before data are collected."*

The sampling approach have to be chosen to meet the intention of the study, the offered resources, the questions to be asked, and the constraints being faced. Under normal circumstances, this remains true for sampling strategy in addition to sample size (Patton 2002).

So long as the research methodology followed in this research is qualitative, it is imperative that it be solely guided by a purposive (purposeful) sampling method to select the participants from both the institutional DLs and the heterogeneous users of such DL population. The rationale behind implementing a purposive sampling technique for selecting the institutes and participants is due to the nature of the study being qualitative. Since the researcher's interest is focused on the understanding of phenomena through people's experiences, opinions, attitudes and behaviors, the appropriate criterion is not a statistical representation of the population of interest, but a substantial representation of it. In situations like the current study which employs a qualitative research methodology, implementing the purposive sampling technique is useful to attain the set objectives

through collecting rich and thick data from information- rich respondents selected purposefully from the general population (Patton 2014).

The logic of purposive sampling lies in selecting information-rich cases for in-depth study. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research, (Patton 2002). When sampling purposively, the researcher identifies criteria that are essential for choosing the sites and participants to be studied. The purposive sampling method, also called the judgment or purposeful sampling, is the cognizant selection of participant due to the qualities the participant possesses. It is usually a nonrandom method that does not need basic theories or a number of informants. Instead, here the researcher is at liberty to decide with discretion the reason he wants informants to provide, and searches to find some. Simply put, the researcher decides what is going to be known and plans to find people who are keen to provide the important information by the good quality of knowledge or experience (Ngimwa 2009). Patton (2002) also stresses the logic and influence of purposeful sampling as forming a foundation for selecting information-rich respondents for in-depth study. Information-rich respondents are believed represent those from whom one can learn a great deal about issues of vital importance to the purpose of the investigation. Taking such in perspective, therefore, studying information-rich respondents yields insights and thoroughly understanding rather than experiential generalizations.

Although it is assumed that the choices the researcher could make during sampling size determination might seem open, this may not always be the case. For one thing, researchers raise the possibility of identifying important sites and subjects like organizations, groups, and individuals and secure their participation in the research through accessing existing social networks (e.g. colleagues, friends, and other personal contacts) which can be helpful for gaining important information and facilitating entrance. For another thing, because a high level of trust is crucial to carry out a qualitative research, using a special contact which can guarantee what the researcher seeks is very essential (Devers & Frankel 2000). Thus, assessed sites and sample size are determined by the availability of staff, time, and resources. In this respect, particularly when using purposive sampling, there is no need of mathematical calculations to determine the ultimate number of sites. This will instead be based on informed decision and on the importance of securing

information from a cross-section of institutions and population groups studied. In all such cases, it remains critical that the sample size must not only be small enough to be convenient, but also large enough to produce useful information (Technical brief: purposive sampling and site selection 2011).

This study encompasses four of the 33 Ethiopian public universities, namely Addis Ababa University, Bahirdar University, Haramaya University, and the University of Gondar, which provide DL services to their communities. The DLs of the four universities are selected based on the following criteria so as to sort out the justifications behind:

- being member of the Ethiopian Higher Learning Institutes (EHLIs) Digital Library Consortium, that can enable them to share the DL resources they held in their respective DLs through the consortium,
- availability and functionality of DLs and provision of DL services to their community,
- availability of postgraduate programs in the university whose faculty and students are believed to be actual and potential users of the DLs.
- availability of colleagues (friends) in the universities who can help or assist the researcher for reaching and accessing the key informants.

Other public and private university DLs have been excluded from the study because of their not being members of the EHLIs digital library consortium, the unavailability of the DL services, the relative absence of postgraduate programs, in addition to the major constraints of both time and resource considerations that the researcher has faced.

Out of the general population of DL users, a total of 34 doctoral, and graduating class masters' degree students, who are believed to utilize the DLs for the purpose of doing their assignments, projects, and thesis works, faculty/researchers who are believed to best utilize the DL resources for undertaking their research, and librarians whose duty is directly connected or associated with provision and use of DL resources and services are selected purposefully as participants in the study. The justification for inclusion of these three groups of DL population members lies on the believe of the researcher as this group being potential and actual users of the DLs. Undergraduate students and administrative staff of such universities have not been included in the sampling

process. This is mainly because they are not believed to be the primary users of the DLs as that of the above stated ones.

In connection with determining the adequate sample size for qualitative studies, there are no rigid and fast rules. According to Patton (2002) sample size depends on what the researcher needs to know, the reason of the study, what is at stake, what will be valuable, what will have trustworthiness, and what can be completed with available time and funds. For instance, in-depth information from a limited number of participants can be important, especially if the respondents are information-rich. However, Onwuegbuzie and Leech (2007) emphasize at least the following considerations for sample size, based on the approach of the research or the implemented data collection method:

- *"What sample size will reach saturation or redundancy? That is, how large does the sample need to be to allow for the identification of consistent patterns? That is, the concepts, themes, etc. begin to be redundant."*

- *"How large is a sample needed to be to represent the variation within the target population? That is, how large must a sample be in order to assess an appropriate amount of diversity or variation that is represented in the population of interest?"*

3.6 Data collection methods

For the purpose of this study, various data collection techniques, namely in-depth semi-structured interview, open-ended questionnaire, and field observation were implemented. These techniques can be seen as different sources of information that can be used for construction a logical explanation for addressing the trustworthiness of the study and also the outputs of each data collection techniques have been used as an input for the construction of the new conceptual framework.

3.6.1 Interview

A semi-structured interview is the main data collection technique for the study. Due to the nature of the study being a qualitative research; and in view of the in-depth nature of the study, data were collected using face to face open-ended semi-structure interviews. Interviews are the primary data collection instruments for qualitative studies. The most significant, suitable and effective way to find rich information and explore the local context is the direct involvement of primary users in the evaluation of the DLs and the best- fitted tool for this purpose is judged to be the face-to-face,

in-depth, semi-structured interview (Kaplan & Duchon 1998). Additional justification to prefer interview as the main data collection technique is because it is considered the most appropriate method to collect the important data used to answer the defined research questions (Patton 2002). The researcher felt that the use of the interview would help to get the views of the DL users and get important insights and adequate information for evaluation of digital libraries which ultimately used for developing an evaluation framework for developing countries DL context.

The researcher conducted face-to-face in-depth semi-structured interviews with 17 key informants. The key informants for the interview and the open-ended questionnaire were accessed through colleagues, friends, and other personal contacts with the concerned universities using a snowball method. This is fundamentally related to the very aims of the study, which are to learn about users' behavior, motivation, and conceptualization. Interview schedules were designed to include semi-structured questions which were used to facilitate in-depth probing and prompting interviewees. The researcher interviewed a single person at a time. This helped him establish a close personal contact with the interviewee. The interview was conducted at a pace consistent with the respondent's ability. Implementing the interview schedule, the interviewer was in a position to probe the respondent and clarify his/ her responses. This method also enabled the researcher to get detailed descriptions and in-depth information by discussing issues more openly and exhaustively. The researcher has made prior arrangements with interview participants regarding the time and place the interview will be held. At the beginning of each interview, the researcher took the initiative to exchange greetings with the participant, do the introductions, talk about the aim and the objectives of the study and express his interest in the topic. In addition, the researcher assured the participant about the confidentiality of all information made during the interview. A consent form (Appendix A) was developed before the interviews and copies were distributed to the participants during the interviews to read and understand what the interviews entailed. The participants had to fill in the consent form to confirm that they agreed to take part in the study on their own, without being pressurized by the researcher. The interviews were carried out in the interviewees' work place or offices.

The in-depth open-ended interviews were held for 45-60 minutes with each participant. The interview process continued until data saturation was reached. To these ends, the interview included some demographic questions about the participants, usability and usefulness questions,

and some other important questions on the purpose of use, problems encountered by users on using the DLs, benefits of using the DLs, and expectations of users from the DLs. In doing so, the interview protocol was used for asking questions and recording the responses, whereby an audio recorder was used with volunteer interviewees after securing their consent for being recorded. All the 17 participants involved in the interview process were volunteer to be recorded. Before starting work, each participant was requested to select the type of instrument (interview or open-ended questionnaire) he/she would like to respond to. If the participant prefers an interview, the process continued, otherwise i. e., If the preference of the participant is filling the open-ended questionnaire, the attached consent form and the prepared open-ended questionnaire whose contents is similar to that of the in-depth interview is distributed to him/her. This allows the participants to feel as comfortable and confident as possible with the process of answering the questions posed to them and facilitates the acquisition of a rich data set.

The purpose of interviewing as Patton (2002) puts it is to let the researcher enter into the other person's viewpoint. According to Patton (2002), qualitative interviewing starts with the assumption that the viewpoint of others is meaningful, knowable, and able to be made explicit. Put simply, it helps with the opportunity to find out what is in and on someone else's mind. This particular idea is well supported by I-TECH technical implementation guide No.5 (2010), which clearly describes qualitative interview as the "backbone" of qualitative evaluation research. Unlike surveys which consist of carefully worded, closed-ended questions, qualitative interviews are generally one-on-one by their nature in that they make interactive communications possible between the interviewer and the interviewee.

A qualitative interview also provides a good ground for gathering detailed information through narratives or stories of participant experience, local history, and shared knowledge which makes it possible to obtain a verbal picture of systematic behavior. The availability of such relative merits makes qualitative interviews rich and deep descriptions that provide explanations and meanings to the lives of people. For qualitative interviews three options namely unstructured, semi-structured, and structured may be selected (I-TECH, 2010). Also, three basic approaches for acquiring qualitative data through open-ended interviews are discussed by Patton (2014) as informal conversational, general interview guide, and standardize open-ended interview approaches. Owing

to the overall governing principles articulated here in above, the semi-structured interview with the general interview guide approach was selected and used for this research project.

Additionally, Boyce and Neale (2006) envisaged in-depth interviewing as a qualitative research method that involves individual interviews with a small number of informants in order to investigate and discover their perspectives on a particular idea, program, or situation. The authors emphasized the suitability for use in circumstances where the researcher purposely wants thorough information about people's opinions and behaviors or desire to investigate new issues in depth. Before Boyce and Neale, Seidman (2005) argues that the purpose of the in-depth interview is neither to obtain answers to questions, nor to test hypothesis, rather it is concerned with understanding the lived experience of other people and sensing the meaning they make of their experience. Being concerned in others is the key to some of the vital assumptions underlying the interviewing technique that requires interviewers to recognize that they are not the center of the world, rather to understand that their actions as interviewers point out that others' stories are crucial.

The main advantage of the in-depth interview, as articulated in Seidman (2005), is that it provides much more in-depth information than what is available through other data collection methods, such as surveys. It may also provide a more comfortable feeling to collect information in which people may feel more relaxed having a discussion with the interviewer about their agenda as opposed to filling out a survey. That is why this study has employed an in-depth semi-structured interview as the main data collection tool.

However, there are a few limitations and drawbacks around conducting interviews, as noted by Seidman (2005), who states that it can be prone to bias, can be time-consuming, requires properly trained interviewing techniques, and yields results which are not usually generalizable.
These drawbacks are resolved by using several data collection methods as the interview, open ended questionnaire, and observation techniques, and different respondents, such as instructors, students, and librarians participated as informants. This enhances the quality of data collected from different related and integrated sources that insure the credibility of findings drawn from participants' direct and original responses.

3.6.2 Open-ended questionnaire

It is anticipated that some of the study participants may be communicative enough to effectively express and articulate their feelings, opinions, interests, and perceptions, while others prefer to do it by writing. To this end and for the purpose of collecting some important ideas that might be forgotten during the interview process, participants who are interested in and comfortable with participating in the open-ended questionnaire rather than the interview would be asked to fill out an open-ended questionnaire containing similar questions with the interview that include some demographic questions about the participants, usability and usefulness questions, and some other important questions on the purpose of use, problems encountered by users on using the DLs, benefits of using the DLs, and expectations of users from the DLs. As that of the interview, key informants are accessed, and reached assisted by colleagues and friends in the universities and using the snowball method. Finally, the interviewer distributed the questionnaire and made an arrangement on the response date to collect it. If the return date is more than a week after the distribution, he assigned colleagues to collect the responses and return these to him, otherwise the researcher himself collect the distributed open-ended question responses.

All the justifications asserted under using the open-ended in-depth interview are also reasons to prefer and implement open-ended questions in the questionnaire as the stated questions are similar for both methods except for the formats, and breadth and depth of the collected information.

Since an open-ended question is unstructured, likely answers are not recommended, and the respondents answer it in their own words. In its essence, the question is framed in such a way as to encourage the explanation of answers and reactions in a single sentence, paragraph, or even a page or more. It should be a complete expression of an attitude, containing nuances, instead of only having to select an answer from a predestined set of answer categories. So, this allows the interviewer to better access the participants' correct thoughts on an issue and tends to make answers more objective and questions less leading compared to closed-ended questions (Popping 2008).

Open-ended questions often provide qualitative rather than quantitative information since they try to answer the “how”, “what”, “when”, “where”, and “why” questions. It is on the basis of this that

Popping (2008) further explains the diversity of the responses of open-ended questions. This is basically because all respondents do not have identical ability of expressing sentiments or the same writing approach. If the investigator believes that plenty of answers are going to be collected than can be captured in a question with preset response possibilities, open-ended questions can be used as nice alternatives to closed ones. Once again, with regard to variations, according to Tesfaye (2011), it is very unlikely that the selection of statement of any substantive response will be similar to the other. By the very nature of this difference, open ended questions are more investigative. They are more dependent on what respondents are thinking about a given subject than a quantifiable indication of their views (Tesfaye 2011). These types of data can offer a rich explanation of respondent reality at a fairly low cost to the researcher. Moreover, in comparison to in-depth interviews or focus group discussions, open-ended questions can offer greater anonymity to respondents and frequently are means to obtain more truthful responses (Jackson & Trochim 2002).

Drawbacks of open-ended questions would be that analyzing open-ended data is usually time-consuming; some questions may not be answered by respondents, and the reliability and validity of the results can create threats due to the coding decisions made by researchers in relation to the likelihood that the respondents will only discuss what comes to their mind which in turn might be merely part of what could have been covered than the cases where the closed questions are employed. Another problem that is potentially encountered is even with respect to one issue, a single respondent might provide extra information than another respondent. In effect, the consequence is that the investigator must be persuaded on the additional value of an open-ended question (Jackson & Trochim 2002; Tesfaye 2011) These kinds of drawbacks were overcome by implementing member checking, and observation field note techniques.

3.6.3 Observation

Patton (2014) defines observations as,

> *"Fieldwork descriptions of activities, behaviors, actions, conversations, interpersonal interactions, organizational or community processes, or any other aspect of observable human experience. The data consists of field notes: rich, detailed descriptions, including the context within which the observations were made."*

Observations are methods which researchers use to gather first-hand data from programs, processes, or behaviors under study. It provides evaluators with a chance to collect a wide range of behavioral data, to capture a great variety of interactions, and to openly explore the evaluation topic. It can be used to evaluate people, behaviors, reactions, physical settings, and environmental settings (Program development and evaluation 1996). Moreover, it becomes an important instrument when the researcher wants to have field notes on the behavior and activities of the participants in the real research environment (Creswell 2009).

The main purpose of collecting observational data is to explain the setting that is observed, the activities that take place in the setting, the people who participate in those activities, and the meanings of what have been observed as such. In view of these general understandings, the quality of observational reports is largely determined by the extent to which the observational report might allow the reader to understand the described situation (Patton 2014).

Thus, due to this contextual importance, direct observations of a setting to be studied have a number of advantages. Some of the advantages as discussed by Patton (2002) are that the observer is able to understand and capture the context within which people interact; being on-site, the observer has less need to depend on his/her prior conceptualization of the setting from verbal reports or written documents; in case of the interview, respondents may not be willing to provide information on topics which are very sensitive, particularly to strangers, which can be addressed through direct observation, and finally, direct observation can provide a chance to move ahead of the selective perceptions of others i.e. observers can simply arrive at a more comprehensive view of the setting being studied simply by making their own perceptions of the data, than forced to depend entirely on second hand reports gained through interviews.

Based on the above explanations and assertions made about the advantages of direct observation, in this study, direct observation of the DL settings, and the users while they are using the DLs has been employed as one of the data collection techniques. In so doing, the researcher observed the behaviors and activities of participants as they used the DL system and content. He used an observational protocol (field notes) for recording information during observation.

The observation method was employed to observe the participants in their natural work environment, i.e., post-graduate libraries of each institute, where they have an access and use the DLs. Using this method the researcher provided first hand information and a better understanding of the use of the facilities and their general condition, like the suitability and conduciveness of the DL accessing environment, the availability of internet connection and its speed, the number of computers connected to the Internet, and availability of library staff to assist users when using the DLs.

The researcher used an observation schedule in his observation and data collection process. Schedules assisted the researcher to remain focused on the key issues observed in the study. An observation checklist was used to guide the recording of observations during data collection. The observation is done unobtrusively, i.e., without the knowledge of the participants about their being observed. Finally, the observation data were transcribed and coded by the researcher as that of other collected data.

3.7 The data collection process

As stated in the previous sections, four sites or universities were selected for collecting all types of data (in-depth interview, open ended questionnaire, and observation). These are Addis Ababa, Bahir Dar, Gondar, and Haramaya Universities. The data were collected by the researcher himself. The data collection started at Haramaya University and lasted nine days, from May 11 – 19, 2015. Within this period, two detailed interviews were held and a total of ten open-ended copies of the questionnaire distributed eight of which were collected giving a response rate of 80 per cent. Additionally, within this period, the Postgraduate Library of Haramaya University was observed for 20 minutes by the researcher.

The next site of data collection was Addis Ababa University, where data were collected from May 21 – 30, 2015, followed by two in-depth interviews and ten open-ended questionnaire completion. Seven of the ten open-ended copies were returned with a response rate of 70 per cent. Again, The Addis Ababa University Postgraduate Library was observed for 25 minutes by the researcher within the specified period.

The third site for data collection was Bahir-Dar University, where data were collected from June 16 – 25, 2015. Four in-depth interviews were conducted and eight open-ended questions distributed, of which only two were collected with a response rate of 25 per cent. As the previous universities, observation has been done for 20 minutes at the Postgraduate Library of Bahir-Dar University.

The last site for data collection was Gondar University; here the data collection process took place from July 1 – 23, 2015. Nine in-depth interviews were conducted with no open-ended questionnaire. The Academic and Development Research Center (ADRC) of the Gondar university , which holds DL resources and provide Internet access to the faculty and postgraduate students has been observed by the researcher within the specified period of time.

The reason behind collecting only interview data in Gondar University was to increase the volume of the interview data because only limited such data was gathered from the other sites, making it necessary to balance the two forms of participant responses. Participants at Haramaya and Addis Ababa universities preferred the open-ended questionnaire to the interview. That was why a limited number of interviews were held in the two institutions. Finally, a total of 38 documents, that is, 17 interviews, 17 copies of the open-ended questionnaire with a total response rate of 60.7 per cent, and four observation data were gathered. The different types of collected data from the sites are summarized and represented in the following table.

Table 3.1 Collected qualitative data types by sites

Site	Interview	Open-ended question	Observation	Total
Addis Ababa University	2	7	1	10
Bahir Dar University	4	2	1	7
Gondar University	9	-	1	10
Haramaya University	2	8	1	11
Total	17	17	4	38

3.8 Data analysis

According to Leech and Onwuegbuzie (2007), one of the most important steps in the research process (data analysis) can be considered as the most difficult and critical parts of a qualitative research. It is a way of processing qualitative data for the purpose of communicating to others what has been learned. Qualitative data analysis involves a number of essential tasks that range from organizing and interrogating the data in different ways to allow researchers to observe patterns, recognize themes, determine associations, develop explanations, build interpretations, raise critiques, or produce theories (Leech & Onwuegbuzie 2007).

The data collected through the interview, open-ended questions, and observation were transcribed (organized and prepared for analysis), coded (organizing the data into text segments), categorized (identifying themes or categories), and finally interpreted. The study made use of one of the well known computer assisted qualitative data analysis software (CAQDAS) named Atlas-ti version 7, for analyzing the gathered data. In the process of analyzing the data through utilizing Atlas ti, the first step after transcribing the collected data was creating codes, quotations, and categories. In this case, the noticing, collecting, and thinking (NCT) approach known as the Computer-assisted NCT analysis (Friese 2014) was followed.

The NCT approach is an iterative process of noticing interesting things in the collected data, collecting similar interesting things together, and thinking about those interesting things thoroughly (Friese 2014). Therefore, analysis is performed by moving back and forth between noticing, collecting, and thinking.

The process of finding interesting things when reading the collected data through interview transcripts, field notes, and open-ended questionnaire is called noticing. To capture these things, notes were written down, segments were marked, and preliminary codes were attached by the researcher. The important point in this process is to mark the interesting things of the data and to name them (Friese 2014). In the next process, the data was read further to identify similar interesting data segments, and put together with the previously noticed codes, to newly created codes, or simply renamed codes besides creating categories and sub-categories for the codes (Friese 2014). Finally, on the thinking process, more analytical works were done for the purpose

of finding patterns and relations in the data (Friese 2014). Next, how the processes of transcription, coding, and categorizing the collected data were performed is discussed.

3.8.1 Transcription

The first step in qualitative data analysis is transcription. As stated by Bailey (2008), the representation of recorded data in a written form is an interpretive process with different levels of detail and different representations depending on the aims and methodological approaches selected by the researcher. As an important first step in data analysis, transcription is an inevitable, problematic, time consuming, and tedious process that requires a close observation of data through repeated careful listening and re-listening (Bailey 2008; Frick 2014; Lapadat & Lindsay 1998).

The process of transcription is grounded in two main methods, called naturalized and denaturalized. The naturalized transcription method focuses on the written aspects of the conversation in a more generic form in which every utterance is transcribed in as much detail as possible, while the denaturalized approach is more loose with idiosyncratic elements of speech, like pauses, accents, and nonverbal motions and body languages (Oliver et al. 2005). According to Oliver et al. (2005), the denaturalized approach has less to do with depicting accents or involuntary vocalization. Rather, it focuses on the substance of the interview, i.e., the meanings and perceptions created and shared during the interview.

On the basis of the above discussion of transcription, for this study, the investigator selected and implemented the denaturalized transcription approach for the interview transcription. The rational for selecting and implementing the denaturalized approach of transcription is due to the current study is more concerned with the substance, the meanings, and perceptions created and shared during the conversation process rather than recording all utterances, including laughter, accents, and overlapping speeches of the conversation which is the focus of the naturalized transcription approach.

The transcription process of the interview data started on October 20, 2015, and completed on December 14, 2015. The 17 interview records were transcribed using the windows media player

through repeated listening, pausing, replaying, and slowing down the speed of the player processes. The text data was created using the Microsoft Word application software and saved as Rich Text Format (RTF), which is a format supported by the utilized analysis software (Atlas ti).

All the other data from the open-ended questionnaire and observation were converted to Microsoft Word format and saved as a rich text format to be compatible with Atlas ti. This process was completed on 18 January, 2016. Finally, a total of 38 documents was created and prepared for further analysis.

3.8.2 Coding and sub-coding

Codes are used to summarize, condense, synthesize, and sort large amounts of text data which become the fundamental means of developing the analysis. They are also used to pull together and categorize a series of discrete events, statements, and observations which are identified in the data (Charmaz 1983).

A number of coding strategies are available for researchers. Structured coding is a technique that was used in this study because of its suitability for creating codes and sub-codes from the research questions and/or interview guide questions. Structured coding applies a content- based or conceptual phrase for representing a topic of inquiry to a segment of data that relates to a specific research question used to frame the interview or the open-ended questionnaire. This approach works for data collected using structured or semi-structured interviews or focus group guides that have specific questions and probes that are repeated across multiple files in a data set. Each discrete question and its associated probes are assigned a code that is then applied or linked to the question and subsequent response text in each data file. Sets of questions that comprise a conceptual domain of inquiry can also be given a structural code (MacQueen et al. in Saldana 2009).

The justification for using structured coding is that, structural coding is appropriate for all qualitative studies, particularly for studies employing multiple participants, structured or semi-structured data-gathering protocols, and exploratory investigations as that of the current study, to gather topical lists of major categories or themes. It refers to question-based code, rather than theme-based code and generally results in the identification of large pieces of text data on broad

topics used to form the basis for an in-depth analysis within or across topics (MacQueen et al. in Saldana 2009; Saldana 2009).

Before starting the coding process, certain tasks have been performed by the researcher. These include reading about and becoming familiar with the qualitative analysis software (Atlas-ti 7), creating the project, importing the 38 documents to the project as primary documents, and creating document families from the primary documents.

The project was created on 18 January, 2016. The primary documents were loaded and document families created on 19 January 2016. Next is the coding process. The initial coding processes started on 24 January, 2016. Twenty initial codes were created based on the interview questions and by looking through the transcript documents thoroughly, selecting and using only five primary documents out of the 38 as a sample, and assigning quotations to each broad code. Based on these five documents, lots of sub-codes that are, initially around 82 and finally 112 were created. The next task was to assign quotations to the sub-codes. This process was iterative, and subject to improvement and refinement. Working on the remaining 33 primary documents assigning quotations to the codes and sub-codes continued until 15 February, 2016. In addition, writing descriptions for the codes every time refinement was performed, further document family creation and writing initial memos were the performed tasks.

As coding is an iterative process, the initially created analytical/descriptive codes should be re-coded and refined into conceptual codes and sub-codes and more structured categories and classifications, which again help the researcher to be more familiar to the data. The conceptual coding and the categorization process continued until April 30, 2016 (along with other analytic processes to be discussed later); finally a total of 138 codes were created within well organized categories.

The research questions of the current study were created based on or have a direct relationship with the selected and implemented framework (ITF) which deals with usability and usefulness evaluation. The questions provided for the participants were also derived from the research questions and objectives to be attained. The created codes, sub-codes, and categories were also

based on the interview and open-ended questions which make the coding process structured as discussed in the above paragraphs. The implemented ITF was used as a lens to guide the researcher on undertaking the empirical research and to reach to the outcomes of the evaluation. The outcomes can be used to develop an evaluation framework that suit to developing countries DLs context.

3.9 Trustworthiness of the study

Unlike quantitative research, qualitative research is based on subjective, interpretive, and contextual data. Therefore, qualitative researchers have developed measurement concepts in line with the qualitative paradigm to increase the trustworthiness of a study (Shenton 2004). Guba (1981) proposes four criteria to increase the trustworthiness of a qualitative study which are also used as a measurement to indicate the trustworthiness of the current study. These are credibility, transferability, dependability, and confirmability.

Credibility is defined as the confidence that can be placed in the truth of the research findings. Credibility establishes whether or not the research findings represent reasonable information drawn from the participants' original data and is a correct interpretation of the participants' original views which can be expressed in terms of reflexivity (field journal), and interview techniques (Shenton 2004). In the current study, such data collection methods as the interview, open ended questionnaire, and observation techniques were implemented for data collection, and different respondents, such as instructors, students, and librarians participated as informants'. This enhances the quality of data collected from different related and integrated sources that insure the credibility of findings drawn from participants' direct and original responses.

Transferability refers to the extent to which the outcomes of qualitative research can be transferred to other contexts with other respondents. Transferability can be judged through implementing a thick description and purposeful sampling (Bitsch 2005). In the current study, detailed and thick descriptions have been provided in all parts, especially in the methodology, analysis, and interpretation chapters to enable other researchers to replicate the study in similar conditions in other settings. Additionally, the technique used to select participants and the universities where the study was conducted was purposeful sampling, which helped the researcher to focus on rich informants that can facilitate transferability.

According to Bitsch (2005), dependability refers to the stability of findings over time. It involves participant evaluation of findings, interpretation, and recommendations of the study to make sure that they are all supported by data collected from informants. Therefore, this study implemented member checking technique at Gondar University (sending the transcripted version of interview data for four participants for checking what they say in the interview is similar with the transcripted data, whose response is positive), in addition to the implemented multiple data collection techniques used to strengthen dependability of the findings.

Finally, confirmability refers to the degree to which the results of an inquiry could be confirmed or corroborated by other researchers (Baxter & Eyles 1997). It is also concerned with establishing that data and interpretations of findings are not figments of the researcher's imagination, but clearly derived from the data. It is the degree of neutrality or the extent to which the findings of a study are shaped by respondents, not by researcher bias, motivation, or interest (Shenton 2004). Studies suggest that confirmability of a qualitative inquiry is achieved through using an audit-trial and reflexive journal (Shenton 2004). In the current study the observation field note technique was implemented to ensure the confirmability of its results.

3.10 Chapter conclusion

In this chapter the research methodology followed throughout the study, the employed research design, the population and sampling techniques, the various data collection methods implemented, and the analysis techniques used in the current study, i.e., transcribing, coding, sub-coding, and categorizing the collected qualitative data have been discussed in detail. Finally, the trustworthiness of the study results were justified accordingly. Attempts have been made to analyze and interpret the collected qualitative data by using Atlas-ti CAQDAS software in the next chapter, which contains exhaustive discussions supported by direct user opinions (quotations of study participants), tables, figures, and abstract concepts and relationships found among the concepts as indicated by Strauss and Corbin (1998) that is, the vital step to develop and coming up with an evaluation framework.

CHAPTER FOUR

4 ANALYSIS AND INTERPRETATION

4.1 Introduction to the chapter

This analysis chapter is organized in the following manner. It starts by introducing the contents of the chapter. Then, a detailed descriptive and conceptual analysis and interpretation process has been stated based on the identified themes and supported by figures, tables, and user quotations. Along with the analysis processes described above, other related activities were also performed. These can be referred to as creating primary document families and code families that are important for further analysis. Additionally, a number of codes-primary document tables and network views diagrams (from co-occurring codes, that are, the quotations co-occur more than three times in different codes) were created under some research questions and themes where appropriate, using the Atlas-ti analysis software feature, which was used in the further analysis and interpretation processes. Based on Strauss and Corbin (1998) qualitative data analysis processes, descriptive and conceptual analysis has been made which enables the researcher to describe the findings and further conceptualize and find relationships among the themes and their properties.

As previously stated in Chapter three, guided by ITF model, this study collected qualitative data from DL users employing various data collection techniques. Next, the collected data have been transcribed using structured transcription technique, and from the transcribed data a number of codes were created, where similar data were collected together under specific codes. The coding process is iterative which is guided by noticing, collecting, and thinking (NCT) approach. The codes were further refined and classified into broader categories that help the researcher to come up with the research themes. Finally, the researcher constructed the following seven themes of which some being meta-themes, each with sub-themes as listed below:

1 **Purpose of use**

2 **Usability**

- Ease of use
- Aesthetics
- Learnability
- Ease of navigation
- Terminology
- Task accomplishment

3 **Usefulness**

- Content format
- Timeliness
- Relevance
- Reliability
- Level of detail
- Coverage

4 **Challenge**

- Network problems
- Access restrictions
- System design
- Attitude, concern and culture
- Plagiarism, privacy and viruses

5 **Benefit**

- Enhance the quality of teaching and research
- Access to resources
- Minimal resources

6 **Expectation**

7 **Awareness creation**

4.2 Analysis and interpretation based on the themes.

The whole analysis process was performed guided by the ITF, and based upon and according to the identified themes. Under this section, each theme and sub-themes of some broad themes were analyzed based on the collected data from respondents; these were then interpreted and discussed in detail to attain the objectives of the study. The analysis is held at descriptive and conceptual levels and thick and detailed description has been made under each theme to justify the analysis. Ultimately, the output of the analysis has been used as an input for coming up with the evaluation framework.

4.2.1 Theme 1 Purpose of use

Respondents were asked to explain for what purpose they were using the digital library system. For this "purpose of use" concept three use types or properties (self update, service provision and teaching and research) and three dimensions (instructors, librarians and students) were used. Based on this concept, it was observed that the majority of the users with a status of instructor and student used the digital library for teaching and research purposes, followed by self update (using the DLs resources for updating themselves on their respective fields) purposes. It should be clear that a single respondent can mention multiple purposes or reasons for using the DLs. For instance, an instructor can use DLs for teaching or research purposes and for self-update purposes. Self update is also highly related to teaching and research since after updating themselves in their respective subject areas using the DL contents they can use the updates for teaching their students and/or applying on their research activities (Sinha, et al. 2011). Librarians use the DLs mainly for the purpose of service provision as they are the ones' responsible for providing DL services to the users in their respective universities.

As teaching students and conducting research are the main activities of instructors, learning and doing research are also the responsibilities of students. Besides, as current students might have previously been instructors, it was possible that they were expressing their past experiences with regard to the usage of the DLs. In fact, instructors can also be assigned as librarians. These ideas were supported by the following quotations from students and instructors.

One student respondent said:

"I use those digital libraries as references for teaching and learning purposes. I used different journals and articles for my MSC thesis, and for the course I teach.."

An instructor respondent stated the following:

"I usually use the digital library for two major purposes. One is for research; when I conduct research I try to search using the digital library. The other one is for teaching purpose, when I offer courses to postgraduate and undergraduate students, I usually use the digital library."

Another instructor stated that all his purposes for using the DLs were related to teaching and research, and include.

"I used the DLs for collecting teaching materials and references for teaching/ delivery of courses, using them as supplementary sources of citation and a literature review to conduct research projects and theses; using them as vital instruments of developing articles, essays, for publication in periodicals and as sources of accessing contemporary research findings, knowledge, and information."

One librarian had this to say:

"Haramaya University is one of the earliest universities in the country. We started graduate programs in the 1970's and we have been doing research since that time. So it is obvious that our researchers and senior professionals want access to academic journals and e-resources; otherwise, they cannot produce good or quality research results. Since the library is mandated to provide access to these resources, we have been participating through national initiatives such as PERI and others to access and amplify our access to journals and e-resources. We have more than 150,000 journals accessed online and at the same time we also have 420000 e-journals packed in a single hard drive. In addition to these, the library is mandated to provide training and support regarding use of such resources. So our aim is to support one major goal or pillar of the university, that is, research."

From the above quotations, one can understand that besides providing the digital library contents and services to the users, librarians at Haramaya University also provide training and support for their users. The trainings and supports provided for the users concern, awareness creation (train users on how to use the DL system properly and marketing or promoting the available DL contents). Awareness creation is one of the themes of this study (Theme 7) and its dimensions are training and promotion or marketing. This indicates the existence of a relationship between using the DL system and educating the users how to use and informing them what materials are available. This can be described according to Strauss and Corbin (1998) in terms of condition, action/ interaction, and consequences as follows. The importance of user education or awareness creation

for the users is vital for the proper use of the DL system (condition). Educating the user for utilizing the DL system is a process (action/interaction), and using the DL system properly for the intended purpose after being aware of it is a consequence of the awareness creation activity.

Table 4.1 Purpose of use attributes relationship with other attributes

Purpose of use attributes	Relationship with other attributes
Purpose of use	Format, Relevance, Awareness creation.

In general, this study has found out that the DL is mainly used for teaching, learning, and research, followed by self- updating purposes. Librarians use the DLs for providing services to other DL users. One of the services provided by librarians is educating users how to use the DL system simply called "awareness creation" expressed as provision of training and marketing or promotion. Therefore, as stated in Table 4.1, user education or awareness creation has a strong relationship with DL use, that is, users can use the DL system for their different purposes. But, for users of DLs in developing countries like Ethiopia, where there is a limited experience of training and marketing/promotion services for their users, awareness creation or user education becomes vital. These results are used as an important inputs for the constructed evaluation framework.

4.2.2 Theme2 Usability

The research question, "How do users perceive the usability of DLs in EHLIs?", has been addressed through six sub-questions. Usability can thus be understood as a Meta theme.

As stated in Section 2.3.1 of Chapter 2, Usability is concerned with the ease of use of a given system in an efficient, effective, and satisfactory way (ISO 1998). According to the ITF, that is, the framework chosen and used in this study, usability stands on the user-system axis, focuses on the effective, efficient and satisfactory task accomplishment and aims to support a common and continual contact between the user and the system.

The following are sub-themes or attributes of usability with their operational definitions stated by Tsakonas and Papatheodorou (2006) and Heradio, et al. (2012).

- Ease of use refers to how easy it is to use all functions provided by the system. It is the easiness to use the system features and processes.
- Aesthetic appearance is the graphical and structural elements of the system which may influence the users affectively.
- Learnability is an intrinsic property of usable systems that delivers users from the process of self-instruction or attending structured courses. It is the intuitiveness of a system in learning the user to operate it.
- Navigation is the ease of navigation through the system. That is the ability to alter spatial states in an easy and uninterrupted way.
- Terminology refers to the comprehensibility of terms and phrases used to describe functions or content. It is the employment of proper terms and phrases for describing screen elements and information.
- Task accomplishment is accomplishing users' searching tasks in relation to their information need.

Now, it becomes important to discuss the above usability sub-themes in detail with regard to their dimensions and also in terms of the process, that is, the condition, action/interaction, and consequence which is vital to search relationships among them and conceptualize the relationships for further findings.

4.2.2.1 Sub-theme 2.1 Ease of use

Ease-of-use, for the purpose of this work, can be defined as how easy it is to use all functions provided by the system. It is the easiness to use the system features and processes (Heradio et al. 2012).

Participants were asked their feelings about the ease-of-use of the digital library in general (The easiness to use system features and processes).

Ease of use is one of the properties of usability with its dimensions: "depends", "hard", "easy" and "federated search". The depends category holds quotations that indicate ease of use as being dependent on access provision of the DL contents and type of user as being experienced or novice

on using the DL system. Here, access provision can be understood as providing DL services to users with free access, or with no user name, password, and payment restrictions. If that is true, ease of use becomes easy for the users, otherwise, hard or not easy. This statement has a direct relationship with one of the properties of the "Challenges" theme of this study described as payment, password, and copyright restrictions on using the DL system as one of the important challenges usually in developing countries like Ethiopia (Musoke & Kinengyere 2008; Odiri 2011). The other concept with depends dimension is information literacy skills. US National Commission on Library and Information Science (2003) defined Information Literacy as "knowledge of one's information concerns and needs, and the ability to identify, locate, evaluate, organize and effectively create, use and communicate, information to address issues or problems at hand". Information literacy is to know when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner. The skills required to be an information literate person call for an understanding of: a need for information, the resources available, how to find information, the need to evaluate results, how to work or exploit results, how to communicate or share your findings and how to manage your findings (CILIP, 2012).

In our case, the DL users' perceptions and responses resulted from their frequent use of the DL system, that is, their information literacy skills have an important impact on the ease of use. If the users have good information literacy skills, then they perceive ease of use as easy, otherwise as not easy. Respondents that feel "ease of use" as not easy, indicated it in terms of different access restrictions (the difficulty to access the required information with regard to payment, password and copyright restrictions as indicated under "depends" dimension and also under the "challenges" theme, and also due to lack of awareness in terms of marketing or promoting the DL contents, and lack of training on how to use the DL system, that is, the concept associated with another theme of the current study called "awareness creation". For those users who perceive ease of use as "easy", some of them indicate the DL system's easiness provided that, having previous training or experience on using it, or acquainted with using it. Therefore, easiness is the result of having training and marketing services and being an information literate user of the DL system. Being unaware of or having less information literacy skills is a precondition for the importance and practice of making users aware of the DL system and content, and having good information literacy skills, ultimately makes the DL system easy to use.

Federated search category of ease of use i.e., the simultaneous search of multiple online databases discusses users' suggestions on the importance of implementing federated or meta search for the ease of use of the system.

Ram et al. (2014) defines federated search as follows:
"Federated search is identified as Meta searching, which provides capability to users to search many information resources from one platform. The types of resources that can be searched incorporate local and remote library catalogues, abstracting and indexing resources and institutional repositories. From the technical point of view, this system distributed search methods across various resources using many search procedures."

Absence of Federeted search created a problem on the DL users which necessitated the importance of creation/implementation of it. The action or practice of implementing Federated search makes the DL system easy to use and search through different databases at a time.

Responses from Bahir- Dar University do not regard ease of use as dependent on other factors, whereas responses from other universities indicate ease of use as being dependent on other factors, like access provisions, and whether users are information literate or novices. Haramaya University respondents did not mention a problem with ease of use. This may be the result of the provision of awareness creation and training to users by the librarians at the HU, as confirmed by the librarian. The majority of responses are positive about ease of use and the response distribution is even across all universities. With regard to federated search, a librarian respondent stated the following:
"I think the ease-of-use, defers from database to database. But these days, what is interesting is that federation has been the call of the day. Many of our databases are moving towards using federated search engine. Even our digital library which is in its infancy has initiated its own plan to federate our academic databases."
On assessing ease of use with regard to the status of participants (student, librarian, and instructor), from the three status categories, librarians do not respond on ease of use being dependent on user type (information literate or not) and as being not easy. This may be due to their professional status that makes them more familiar and enable them to easily understand and use DL features. As we can observe from Table 4.3, out of ten quotation responses on "ease of use being hard", seven are student responses, and this may indicate the necessity of awareness creation activities being

marketing (promotion) and training (on how to use the DL system) for the students as indicated and discussed under Figure 4.1.

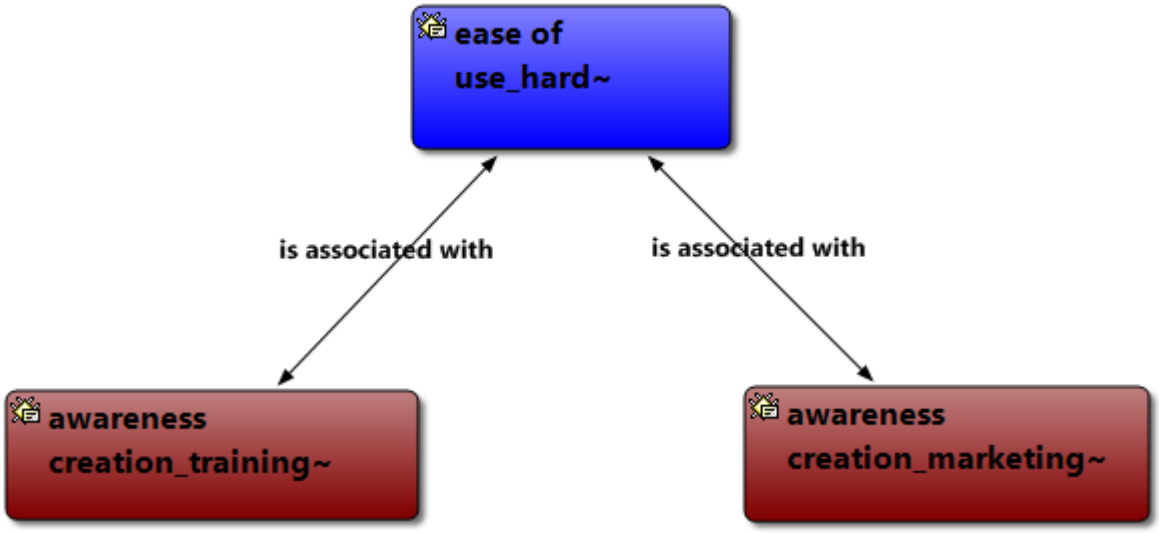

Figure 4.1 **A network view for the association of ease of use being hard with other factors.**

As indicated in Figure 4.1, ease of use as being hard is associated with the shortage or absence of user training on how to use the DL system and on the absence or limitation of marketing (promotion) on the available DL system and content to users of the DL. This is to say that if training on how to use the DL system and marketing or promotion on the available DL system and content is not properly provided to users of the DL, the DL system cannot be easily used by the users, and if training and promotion is provided to users of the DL, ease of use may become easy. Therefore, when we describe it conceptually, ease of use has a relationship with one of the categories or themes called awareness creation, and also with users' information literacy skills on using the DL system. The above statement supports the results of a research reported by Roger (2011) and showed that most of the subjects of his study found the system easy to use when searching information, further explaining the importance of users' information literacy skills on searching information, he stated that the majority of students with information literacy skills in information searching said that the system was quite easy for them to use and find the documents they needed. His study was concluded with a statement "If a tool is not easy to use, then it is likely to result in inefficient use."

This has been commented by an instructor as follows:

"I think there is a problem on user interface, particularly students who are not experienced in the technical aspects."

Table 4.2 Codes-primary documents table for ease of use of DLs by status

	Status= Instructor	Status= Librarian	Status= Student	TOTALS:
UBL: ease of use_depends: access	5	3	3	11
UBL: ease of use_depends: user type	6	0	2	8
UBL: ease of use_easy	19	2	6	27
UBL: ease of use_federeted search	1	6	0	7
UBL: ease of use_hard: access	2	0	4	6
UBL: ease of use_hard: awarness	1	0	3	4
TOTALS:	34	11	18	63

In general, ease of use has been perceived positively by the majority of the participants. That is, as observed from Table 4.2 above, out of a total of 63 quotations, 27 are for "easy", ten for "not easy", 19 for "depends on other factors", and seven for "importance of federated search" as the importance and implementation of federated search engine in the DLs has also got due attention by some users. Being unaware of or having less information literacy skills user is a precondition for the importance and practice of making users aware of the DL system and content, and making more information literate users, ultimately results the DL system easy to use. Additionally, absence of single, simple, and comprehensive search service for different interfaces and several databases of the DL create a problem on the ease of use of users. This problem leads to the creation/implementation of federated search engine in the DLs. The action or practice of implementing federated search makes the DL system easily used by the users since, their requests can be searched from different databases.

4.2.2.2 Sub-theme 2.2 Aesthetic appearance

Aesthetic appearance of the system may influence the users affectively. Aesthetic refers to the consistency and appropriateness of the system interface design, in particular layout, fonts, and graphic properties (Heradio et al. 2012).

Aesthetic appearance is one of the six attributes or properties of usability. Thus, participants were asked to answer how they perceive the aesthetic appearance of the interface of the digital library (The graphical and structural elements of the system)?

Based on the answers of the participants, aesthetic perception was categorized into the following dimensions: perceived negatively because of finding it confusing and unattractive; perceived positively by some others for being attractive and user friendly. Other perceptions of users were further classified as "mix of both positive and negative perceptions", "the need for improvement", "user information literacy skills ", and "not priority" for those users who gave priority to content rather than aesthetics.

First, an investigation into the connection between aesthetics and participants' information literacy skills revealed the following. Out of ten quotation responses for negative perception of aesthetics, eight were from those with fewer than ten years' of work experience and two with ten or more years'. This may indicate the impact of work experience on aesthetic perception, that is, the less experienced the users are the more negatively they perceive the aesthetic appearance of the interface and vice versa.

Regarding aesthetics positive perception, many users with less work experience (with fewer than ten years of experience) associated their perception with the attractiveness of the interface, while more experienced users (with ten or more years of experience) relate it to the user friendliness of the interface (ease of use). This indicates that for less experienced users attractiveness of the user interface matters most (if it is attractive to them, its aesthetic appearance is nice), while for more experienced users, it is not attractiveness that matters most but the user friendliness of the interface. For that reason, we can say that, usability properties "ease of use" and "aesthetics" have a relationship or overlap with each other on evaluating user friendliness of the interface that uses for both properties.

For negative perception of aesthetics, there are ten quotation responses eight of which associated it with the interface being confusing, and only two indicated interface was unattractive. In this regard, some users pointed out that the interface was full of unnecessary or irrelevant information, like advertisements and links. This study also found that an interface congested with several unrelated and irrelevant information can divert the users' attention, affect their taste and interest to use and decrease attractiveness. The following quotation from a student participant supports the above statement:

"The digital library sites that I usually use appear to be less destructive in terms of the mode of display and coverage of the useful information it holds on a given page. But, on account of levels of attractiveness for users, some pages would not have very much comfortable appearance due to the existence of overloaded, congested, and irrelevant sets of preferences, links, and formats which in most cases affect my taste and interest to use the services provided."

The interesting thing here is that as clearly stated in Table 4.3, out of a total of sixty-five quotations, almost half (30) were positive perceptions of aesthetics. But out of those 30 responses, 13 were from HU and the rest 17 from the other three universities. Again out of the 13 quotations of HU, eleven were specifically related aesthetics with the attractiveness of the interface, and only two associated it with the user friendliness of the interface that entails us attractiveness has got more attention than user friendliness especially at HU where the majority of the participants have less year of experience.

4.3 Codes-primary documents table for aesthetic appearance associated with location.

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS
UBL: aesthetics_negative perception: confusing	3	0	3	2	8
UBL: aesthetics_negative perception: not attractive	0	1	1	0	2
UBL: aesthetics_other perception: mix	2	2	2	2	8
UBL: aesthetics_other perception: need improvment	3	0	0	4	7
UBL: aesthetics_other perception: not priority	1	1	5	0	7
UBL: aesthetics_other perception: user experience	0	2	1	0	3
UBL: aesthetics_positive perception: attractive	1	3	1	11	16
UBL: aesthetics_positive perception: user friendly	4	3	5	2	14
TOTALS:	14	12	18	21	65

There are a total of seven quotations regarding other perceptions that are "not priority". For those participants, aesthetic appearance of the interface is not a priority; rather their focus is on the availability of contents that is "coverage", which is one of the properties of usefulness theme of the current study. Respondents of GU constitute five of the seven responses in this regard. This tells us that some users do not give due attention to the aesthetic appearance (one of the usability attributes) being attractive or user friendly, rather their concern or priority is the availability of contents (usefulness) they need in the DL collection. This point supports the following statement of Greenberg and Buxton (2008) discussed on the usability and usefulness of DLs. "While usability remains an important criterion in DL evaluation, it is also true that a usable system may not be always useful for the user, i.e., systems could prove to be usable, but functionally useless." The above discussion entails us the existence of an association between usability and usefulness themes.

The following is a quotation from an instructor that supports the "not priority" category:

"Most materials are attractive. For me, what is most attractive is whether I get the full text or not. So I usually do not focus on the interface. The most important thing for me is, can I get the full text or not? That makes the item very attractive for me not the interface. I don't give due attention to the interface that I am using."

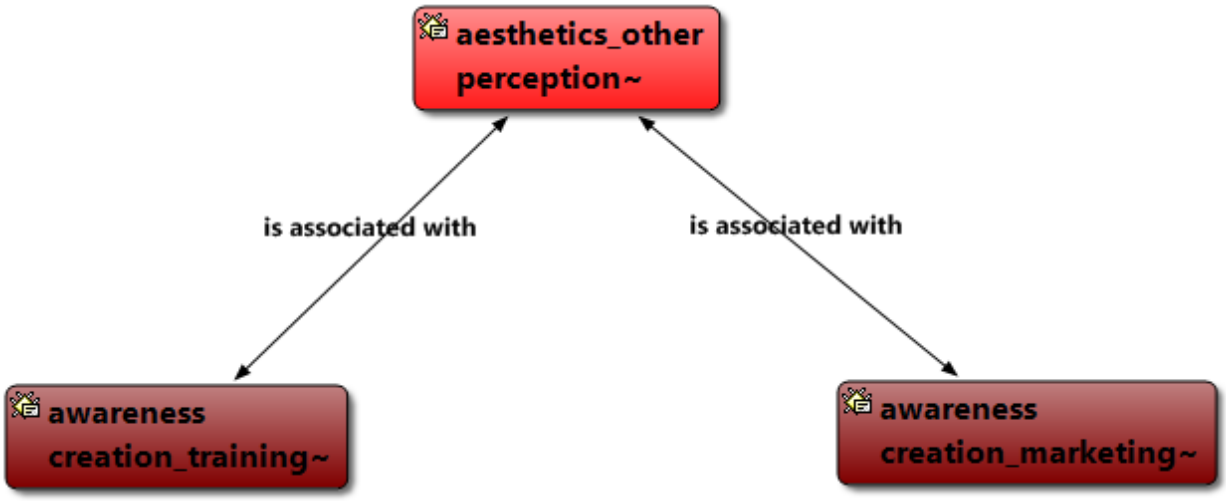

Figure 4.2 A network view for the association of aesthetic perception with other factors.

The above network view (Figure 4.2) shows us the association of aesthetic perception's other factors, especially user information literacy skills on using the DL system and with awareness creation, i.e., provision of training and marketing or promotion of the DL system and content -(the more the users use the DL system the more they understand it easily and vice versa). It means user information literacy skills with regard to aesthetic perception has a strong association with the users having or being provided with training and marketing or promotion on the DL system and content. If users have information literacy skills in using the DL system and additionally provided with awareness creation (training and promotion or marketing) on the DL system and content, then they perceive the aesthetics positively.

The following quotation from a student supports the above stated idea:

"It depends on the experience of the user. If you are an experienced user, it is easy for you to manipulate and face no problem with the aesthetic appearance. An introductory courses on how to use the DLs is also useful, but the more you use them, the better you know them."

Generally, participants perceived aesthetic appearance of the DLs positively. It was also observed that responses of instructors and librarians were favored the positive perceptions; 20 of the 44 and seven of the ten quotations, respectively, and responses from the students inclined towards negative perception i.e., four of the eleven quotations. Additionally, aesthetic was perceived positively by the majority of HU respondents. Respondents of GU gave priority to availability of contents than aesthetics. Usability properties "ease of use" and "aesthetics" have a relationship or overlap with each other on evaluating user friendliness of the interface that uses for both properties. Also, some users do not give due attention to the aesthetic appearance (one of the usability attributes) being attractive or user friendly, rather their concern or priority is the availability of contents (usefulness) they need in the DL collection which entails us the existence of a negative association between usability and usefulness themes. Information literacy skills with regard to aesthetic perception has a strong association with the users having or being provided with services of training and marketing or promoting on the DL system and content.

4.2.2.3 Sub-theme 2.3 Learnability

Learnability is also one of the properties of usability. It is an intrinsic property of usable systems that deliver users from the process of self-instruction or attending structured courses. It is an important attribute to assess how easy it is to learn the site. In other words, learnability refers to the capability of the system to enable users to feel that they are productively using the system right away and quickly learning new functions. Learnability is considered as the most fundamental aspect of usability, since learning how to use the system is the first user experience (Nelson 1993). It can also consider how easy it is for infrequent users to learn the system after periods of inactivity (Rubin 1994).

Participants were asked to express their perception on the learnability of the system (the easiness of the system to the user in learning to operate it, memorizing the system when reusing it after a certain period of time). From their answers, the following dimensions were generated: "easy to learn"," hard to learn" and "depends on the system" and on "information literacy skills."

Respondents from BDU and GU were more inclined towards learnability being dependent on the information literacy skills dimension. This strengthens the idea that holds the exposure and familiarity to the DL system (information literacy skills) makes it more learnable and memorable. Again, regarding learnability being hard, responses from BDU and GU relatively took the majority. The good learnability of the DLs system was proportionally supported by AAU and HU responses. In general, out of the 85 total quotation responses, only 14 were negative about learnability; 37 said it was good; 28 responses indicated that it depended on user information literacy skills level, and six indicated that it depended on the system features as seen from Table 4.4.

Table 4.4 Codes-primary documents table for learnability codes and location.

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS
UBL: learnability_depends: system	1	3	0	2	6
UBL: learnability_depends: user experience	5	7	12	4	28
UBL: learnability_easy	13	7	10	7	37
UBL: learnability_hard	1	5	6	2	14
TOTALS:	20	22	28	15	85

For some users, learnability of the DL system is dependent on the type of the database. Different DL databases may have different features and characters. Some of them may be easily learnable, while others may remain hard to learn. The federated search engine, the concept discussed under ease of use also needs to be discussed with regard to learnability. As explained above, different DL databases have different features that make the system not easily learnable by the users. This problem may be resolved through developing and using a common platform for all available databases implementing a federated search engine. For that reason, properties of usability, named ease of use and learability can be related to each other through federated search engine dimension since it is used to evaluate both properties. A response of one librarian regarding learnability being dependent on the system features was the following:

"We have 32 major databases. Each has their own feature and character. When we talk about learnability again, it depends on the specific database that we have."

The current study also found that for those users with limited information literacy skills of using the DL system, the practice of awareness creation (providing users with training and marketing or promotion) is an important factor in making the DL system more learnable and memorable to them. With regard to awareness creation, an instructor from HU said:

" It is very easy to understand the DL. We actually took training arranged by the library, and we all trained to understand and to memorize it."

As discussed in the above paragraph, learnability can be expressed in terms of users' information literacy skills, that is, less information literate users and more information literate users. More information literate users associate learnability with reasons depending on other factors, like learnability being easy for information literacy skilled users. But for learnability being a problem, the majority of the responses came from users with less information literacy skills, supporting the idea that users with good information literacy skills learn the DL system more easily than users with less information literacy skills.

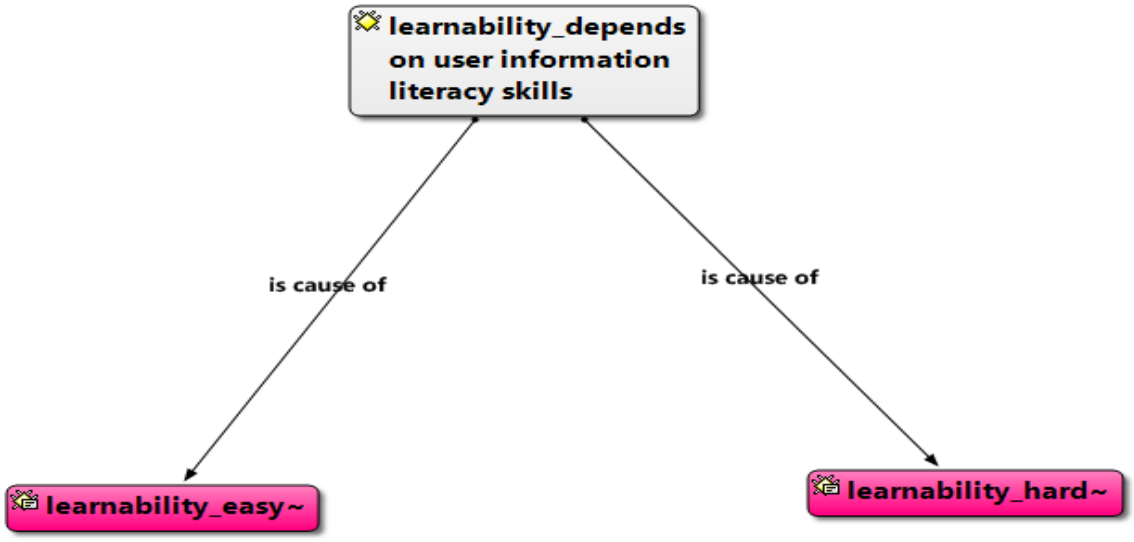

Figure 4.3 A network view for user information literacy skills being a cause of learnability hard or easy.

The above network view shows learnability as being dependent on users' information literacy skills. This means user information literacy skill is a cause for learnability being easy or hard. If the user has more information literacy skills in using the DL system, learnability becomes easy, otherwise; learnability becomes hard.

An instructor's response to this idea was as follows:

"I know where to go and what to find. I know which material is where; I know which articles are included where, and then, once you know it really, there is no problem."

Another respondent said:

"Given my background, it is very easy for me. But with other users, they have some difficulty because at times they need some kind of orientation by a librarian or by any professional person. So, I wouldn't say that it is very easy."

Additional quotations of respondents on the learnability of the DL system being dependent on the information literacy skills and exposure of the user on using it were stated as follows:

"At the beginning, you need someone who can assist you while you start searching via the digital library. Once you have the information to how you are going to manage the tool, the thing is very easy. Initially, I had a problem on how to access the best journal, but when I did it repeatedly, then I came to master."

"For the first time it is difficult. Somebody has to introduce them how to use. You should learn from your colleagues. The more you work on it, the more it becomes easy to use. But for the first time it is not as such simple."

"Once you get accustomed to it, it is not a difficult task. During or at the beginning of using the DLS, some of the features are difficult to understand. But later, through different efforts, by trial and error I was able to use it."

Overall, participant perception of the learnability of the DL system was positive. For some respondents, learnability had a strong association with user information literacy skills. The more information literate users found the DL system easier to learn than those with less information literacy skills. For some users learnability of the DL system is dependent on the type of the database. Since different DL databases have different system features and characters, some of them may be easily learnable while others may remain hard to learn. Properties of usability, named ease of use and learability can be related to each other through federated search engine dimension since it is used to evaluate both. For those users with limited experience of using the DL system, the practice of awareness creation (providing users with training and marketing or promotion) is an important factor in making the DL system more learnable and memorable to the user. Therefore, information literacy skills and federated search are two concepts that have a direct relationship with learability.

4.2.2.4 Sub-theme 2.4 Ease of navigation

Navigation refers to the ease with which users can traverse the interface, using the navigation tools available to them (bars, icons, menus, color), and at any point in time, how aware they are of their current location. Location awareness is a key aspect of navigation as disorientation (being lost)

can lead to cognitive overload that reduces the use of DL systems (Otter & Johnson 2001; Pearson et al. 2007).

Participants were asked to express their opinion on the ease of navigation through the system (the ability to traverse a site using available navigation site features like back button and links); on intuitiveness of navigation; provision of aids to navigation; easiness to get back to the "home page" to a search screen if were lost anywhere and easiness to log off or exit.
Navigation is one of the properties of usability which is divided into two sub-categories: "provision of aids to navigate", and "easiness to go back to the home page and exit", both categories having "easy" and "hard" dimensions.

Some users found navigation hard because the system does not provide aids on navigation. When they need to traverse from one page to another in their searching process, the DL system does not provide them with the necessary navigational aids. They try to overcome the traversing problem through opening multiple windows for each page. This action ultimately causes memory consumption, leading to a decrease of the processing power of users' device, resulting in wasting their time.

A student's response with regard to the above concept of navigation was stated as follows:

"I have to open multiple pages as a new window. I thought that I could traverse between pages/windows of the system. Traversing is only possible within the same page/window. It would be good to navigate with the whole system without losing my session. It is better to re-design the system to allow easy navigation having content intact. Opening multiple pages causes low memory on my computer and then closes wasting my time."

The idea of federated search also becomes important to be mentioned under the navigation property, since users need to navigate the whole DL system without losing their current session. The traversing and other problems of navigation can possibly be solved through utilizing the federated search technology, which enables users to navigate the whole DL system without losing their current session. Federated search technology has a relation with ease of navigation. Therefore, using federated search can possibly solve problems of navigation in DLs.

Regarding ease-of-navigation being easy, when users search for an idea or content, the provided navigational helps support them to access similar or related information from other sites or DLs. In the light of these users navigation seems easy. This idea was strengthened by the following statement of a student:

"Unless otherwise there happens to be Internet or network connection problem with the server, the digital libraries I use have a well functioning and fast navigation systems regarding the way the keys and additional shortcut mechanisms it gives to the users. Thus, I believe the sets of mechanisms found within the site pages are simple and guiding to each piece of alternative services they lead."

Some respondents have associated navigation with concepts of users' information literacy skills and having training on DL use. They reported that if users have previous information literacy skills in navigating the DLs and have got training on how to navigate through the DL system, navigation becomes simple, otherwise, it becomes hard.

Table 4.5 Codes-primary documents table for navigation codes and status.

	Experience < 10 years	Exprience >= 10 years	TOTALS:
UBL: ease of nav_aids: easy	9	11	20
UBL: ease of nav_aids: hard	2	4	6
UBL: ease of nav_exit back: easy	6	9	15
UBL: ease of nav_exit back: hard	3	3	6
TOTALS:	20	27	47

In general, it was found that participant perception of ease of navigation is positive even though there are some negative perceptions associated with problems of absence of aids and exit back features on the interface. Table 4.5 indicate out of a total of 47 quotations, 35 are for navigation being easy (20 for providing aid and 15 having exit and back features) and 12 for navigation being hard with equal responses for both not providing aids and exit back features. If users have "good information literacy skills in navigating the DLs" and have got training on how to navigate through the DL system, navigation becomes simple, otherwise, it becomes hard. Federated search technology service has a relation with ease of use, aesthetics, learnability and ease of navigation properties of usability.

4.2.2.5 Sub-theme 2.5 Terminology

Terminology is one of the properties of usability. It refers to the comprehensibility of terms and phrases used to describe the functions or content. It is the employment of proper terms and phrases

for describing screen elements and information. Alternatively, terminology considers how well the user can comprehend the terms and phrases used to describe functions or content within the interface (Tsakonas & Papatheodorou 2006).

Participants were asked to describe the terminology used in the system (the comprehensibility of terms and phrases used to describe screen elements, functions, information content) Does it use standardized terms or any jargons? Does it describe the functions of screen elements (screen tips)?

Participants' answers to the above questions have been classified into four dimensions, namely: "jargon", "standard", "screen tips available" and "screen tips not available".

The terminologies used in the DL system contain jargons for some users whose background is not from the library and information science and computing disciplines. These users indicate the importance of screen tips to easily understand used terminologies. A student expressed his opinion on the used terminologies as follows:

"It is another big issue. For instance, when I start to gather some literature concerning my PhD study, I was very confused because, I didn't have any clear idea about "catalog", "journal", and the like, which are jargons for me. And there was no clear description or help to clarify that unless I ask a person who specialized in library science. So it was very difficult for me because it was not my field."

Table 4.6 Codes-primary documents table for terminology and status

	Status= Instructor	Status= Librarian	Status= Student	TOTALS:
UBL: terminology_jargon	7	2	1	10
UBL: terminology_screen tips	12	2	5	19
UBL: terminology_standard	21	7	10	38
TOTALS:	40	11	16	67

The majority of the responses indicate terminology used as being standardized and easily understandable. Table 4.6 shows us out of a total of 67 quotations, more than half, 38 indicated that terminology is standardized; ten indicate terminology uses jargons; ten say screen-tips not available, and seven screen-tips available. Since current academic databases available in the DLs are from well known publishers who have their "own specialists in interface design and used

terminologies", the majority of the respondents found the terminologies easily understandable and standardized. This idea was supported by the following quotations from respondents.

"I think because our databases are academic there cannot be much problem. The phrases usually added to academic words are department subjects. So because of this, there won't be much confusion. Clear standard wording and phrasing is used in academic databases."
"The electronic resources have descriptive names and searching the resources is supported by standard terminologies used in international repositories."

"Most of the sites use common web language. So, I do find familiarity and similarity among the digital library providers in terms of widely known notions and features in the captions, titles, headings, and signs you need to explore. Hence, there are significant similar screen elements and basic features that easily help to lead the user."

"Every terminology I was tested on is common terminology which everybody can understand easily, especially for academic society, it is easily understandable."

Some respondents reported the availability of screen-tips and help menu for the terminologies at the left side of the interface. The screen-tips may be very important for users with little or limited experience in using the DL system. This leads to a conclusion that "terminologies used may be jargons for users with less information literacy skills on using the DLs and standardized terms for users with more information literacy skills." A student respondent told us the following for the availability of screen-tips:

"In fact, the contents and signs found in the screen have enough guiding information which includes brief statements, both necessary and sufficient about the description and outcome of each activity you need to know while using and carrying out any tasks."
Other users reported the absence of screen-tips, justifying it as not being a problem since, these days screen-tips are substituted by supporting help pages, even though supporting help pages and screen-tips are not replaceable by one another. The above idea was expressed by a librarian respondent as follows:

"Screen tips are not common these days; I have not seen them yet. But each web site has its own support help page, for example, for searching and for advanced search, etc., and it does that instead of screen tips."

Taken together, this study found that the majority of the participants had positive feelings on the terminologies of DL interfaces, as being standardized terms which are easily understandable by the users, and having enough guiding information about the screen. Terminology has a relationship with users' information literacy skills i.e., expressed as

“terminologies used may be jargons for users with less information literacy skills on using the DLs and standardized terms for users with more information literacy skills.”

4.2.2.6 Sub-theme 2.6 Task accomplishment

Task accomplishment is defined as something that have been achieved successfully. The successful accomplishment of a task, or the fulfillment or completion of a task (Oxford dictionary of current English 2006).

How do you feel about the accomplishment of your task effectively using the digital library? Do you feel it is enabling for different types of searches for different skill levels and preferences, various options for searching, like A - Z list, search by subject, or general search. These are questions provided to respondents with regard to task accomplishment.

Being one of the properties of usability, task accomplishment which is associated with accomplishing the search task of users has got its dimensions, namely "effective", indicating effectively accomplishing their search task, "depends on resources", task accomplishment is dependent on the type of the resource, "options", availability of different options for searching purposes, and "no options", the unavailability of options for searching.

Few respondents associate "task accomplishment" with accomplishing their objectives or needs i.e., pursuing teaching and research using the DL system rather than accomplishing their searching task. This has happened on answering the open-ended questions, where asking probing and additional questions are not possible.

Table 4.7 Codes-primary documents table for task accomplishment codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS:
UBL: task accomplishment_depends on resource	2	1	5	1	9
UBL: task accomplishment_effective	7	5	6	8	26
UBL: task accomplishment_options	13	6	6	10	35
UBL: task accomplishment_skill level	4	1	0	1	6
TOTALS:	26	13	17	20	76

Task accomplishment has been expressed positively by respondents, i.e. Out of 76 quotations, 26 indicated "effective task accomplishment", 35 "availability of options", nine "depends on resource type", and only six "on skill levels" as indicated in Table 4.6. The following quotations of respondents were stated with regard to effective task accomplishment and availability of options.

"It provides a simple search for intermediate users and advanced search for those who want to filter content by date, publication type, paid vs. free, and preference to save my search history."

"Yes. We have a general option, subject option, and title option to search. Search by itself has title search, author search, and key term search. If someone needs to access e-book using the subject, he can click on a subject and select the subject that is needed."

"I have several options. I use the key words and sometimes A to Z for journals. To find the journal list for medicine I go to M. Then I go to the letter M and look what list of journals in medicine is. And the other is year of publication. For critical literature review, I put the year as a cut off point, so that I search and find the material."

In summary, task accomplishment has been expressed positively by respondents in terms of the provision of different search options. For the minority of users, availability of different options on searching depends on different database procedures.

Table 4.8 Usability attributes relationships with other attributes

Usability attributes	Relationship with other attributes
Ease of use	Aesthetics, Format, Federated search, Access restrictions, Information literacy skills, Awareness creation.
Aesthetics	Ease of use, Federated search, Information literacy skills, Awareness creation, Feedback.
Learnability	Ease of use, Federated search, Information literacy skills, Awareness creation.
Navigation	Federated search, Information literacy skills, Awareness creation, Feedback
Terminology	Information literacy skills, Awareness creation.

In conclusion, as far as the usability of DLs is concerned, all attributes/properties of usability have been perceived positively by the majority of the quotations of respondents. As it was observed from the previous discussions on usability and also from Table 4.8, the majority of

the usability attributes have been associated or influenced by the availability of services such as, awareness creation (training on the DL system use and promotion/marketing of the DL system and contents), the level of users' information literacy skills in using the DLs (being information literate user or not), and on implementing a federated search engine. These concepts have a direct relationship with the different usability properties. Especially the necessity of awareness creation and information literacy skills concepts should be understood in the context of the developing countries like Ethiopia, where lack of user education or awareness creation and limited user information literacy skills prevails (Gowda & Shivalingaiahs 2007; Megersa & Mammo in Rosenberg 2008). The outcomes of this usability study and its relationships with other attributes have been used as an input for the construction of the proposed DL evaluation framework (see Section 5.10.3.3).

4.2.3 Theme 3 Usefulness

Usefulness is the degree to which a specific information item will serve the information needs of the user. The concept of usefulness defines whether DLs constitute valuable tools for the completion of users' tasks. Usefulness answers the questions if DLs support users' information needs and work completion. In general, usefulness refers to the quality of being useful or to what extent something is useful. We can also say that it is the quality that makes a thing useful or suitable for a given purpose, advantage, usefulness, worth, and utility. It is actually the act of using or the state of being used to satisfy required needs (Tsakonas & Papatheodorou 2006).

Usefulness in this study has been understood as a meta-theme that has several sub-themes. How users perceive the usefulness of DLs in EHLIs is a research question that is going to be answered through the following sub-themes or properties of usefulness with their operational definitions stated by Tsakonas and Papatheodorou (2006) and Heradio et al. (2012):

- Format is a resource attribute that connects with the user's work practice and/or the available technological infrastructure.
- Timeliness investigate how a current information resource is and how well it will satisfy information needs.
- Relevance denotes how (topically) content corresponds to the work task.

- Reliability investigates how credible the resource is and how well it satisfies present and future aspects of the work task.
- Level of detail refers to the various representations of information provided, such as abstracts, full text, bibliography.
- Coverage refers to the depth and extent of the information. It is the degree to which information and contents are presented according to various topics through the DL.

4.2.3.1 Sub-theme 3.1 Content format

Format is a resource attribute that connects with the user's work practice and/or the available technological infrastructure. It is one of the properties of usefulness.

What do users think about the availability of digital library contents in an adequate format, like text, pdf, rtf (the availability of content in an information medium)? What format/s do they prefer? Why do they prefer this/these format/s? These questions have been provided to participants. Based on their responses, the questions were categorized into three, that is, "format availability", "format preference", and "reason to prefer". Dimensions of format availability are hypertext markup language (HTML), portable document format (PDF), text, power point presentation (PPT), and several. For format preference, PDF, text, and other dimensions were used. Again, for reasons for format preference: attractiveness, compatibility, easiness to use, and not easily infected by viruses have been created guided by respondents' quotations..

From table 4.9 below, we can see that out of a total of 47 quotations regarding format availability, the PDF format is mentioned by the majority of participant quotations (20), followed by several other formats, like video, audio, and multimedia (14). Text and HTML formats are with fewer quotations (seven and six respectively). Therefore, PDF format is used to represent the majority of the contents of the DLs.

Table 4.9 Codes-primary documents table for format availability codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS:
UFL: content format_availability: html	1	1	4	0	6
UFL: content format_availability: pdf	5	4	6	5	20
UFL: content format_availability: several	5	2	4	3	14
UFL: content format_availability: text	2	0	4	1	7
TOTALS:	13	7	18	9	47

Regarding the format preference question, Table 4.10 indicated from a total of 40 interviewee quotations, 30 prefer PDF format, six prefer text, and four other formats, like HTML, PPT, video and audio. All AAU respondents prefer only PDF. Around half of the GU respondents prefer PDF and the rest text and other formats.

Table 4.10 Codes-primary documents table for format preference codes and status

	Status= Instructor	Status= Librarian	Status= Student	TOTALS:
UFL: content format_preference: others	3	0	1	4
UFL: content format_preference: pdf	18	5	7	30
UFL: content format_preference: text	4	1	1	6
TOTALS:	25	6	9	40

Content format preference is also varied by respondent status (instructors, librarians, and students), PDF being highly preferred by all groups proportionally. Text format was preferred by a small number of respondents. The text format is preferred for the purpose of providing handouts and preparing power point presentations for students.

Format preference can also be seen from the point of view of current needs and the purpose of use of respondents. Purpose for using DL resources has been reported as being mainly for teaching, learning and research. This means, if users need to prepare lecture presentations, they prefer the PPT, for handout preparation for their students they prefer the word document formats, and for research purposes they prefer the PDF formats. Some relevant participant quotations were the following.

"Even if it is a PDF, there are also others. For teaching purpose, I want to select some parts of the PDF and convert it to the word format. I prefer the word format. Word format can be converted to PDF or other formats."

"It depends on my purpose. For example, if I am looking for a teaching material, power points are preferred. For references, either for proposal development or research paper, I find PDF being preferable."

"Document and power point which can help to prepare handouts for students and prepare class presentation are required and preferred."

Reasons for preferring particular formats were classified as easiness to use (being easy to operate, magnify, print, edit, highlight) and compatibility (being easily usable by different hardware and software platforms, convertible to other formats, usable with different media) as pointed in Table 4.11, 17 and 14 quotations respectively, out of a total of 46. Not easily infected by viruses and attractiveness were the reasons in fewer responses, eight and seven quotations respectively. AAU and BDU respondents gave more emphasis to compatibility, while GU and HU to easiness to use.

Table 4.11 Codes-primary documents table for format preference reason codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS
UFL: content format_reason: attractiveness	1	2	2	2	7
UFL: content format_reason: compatible	6	3	3	2	14
UFL: content format_reason: easiness to use	4	2	6	5	17
UFL: content format_reason: not easily infected	2	1	3	2	8
TOTALS:	13	8	14	11	46

Compatibility of the document format by itself can tell us if the document is easy to use (one of the usability properties). If the document is compatible with different software and hardware devices and easily converted between different formats, it also is easy to use. This idea was supported by some respondents as:

"For one thing, it is very much readable. The other thing is, whenever you try to print it, it is printer friendly. And you can easily magnify and select it. Especially if you have different software, you can easily select, highlight, or comment on it. And regardless of the computer and the media, it is very much compatible."

"Because, when I read live on the screen, I adopt it and I always practice to use PDF. It may be because of a friend using it, and in PDF you can enlarge and adjust a file and for compatibility."

"I prefer PDF for its originality; you get the original document. PDF cannot be managed by anybody. For print out, user friendliness, and compatibility, I prefer the PDF format."

"This is solely because the PDF formats are easy to read and are compatible with any type of Personal computer I use. Besides, it gives me safety and comfort to work with as many documents as possible."

When reasons for preference are examined by the status of users, instructors' reasons focus on easiness to use, students' for compatibility, and librarians' for both compatibility and easiness to use. It seems librarians do not bother about virus infection and have less concern for the attractiveness of formats, but gave equal emphasis to both compatibility and easiness to use reasons.

In general, it was found that most of the DL resources are represented in PDF format. The document format most preferred by respondents is again PDF. But the reasons for a preference for a particular format/s are dependent on the current needs of users, that is, for what purposes users need the document. Being easy to use (being easy to operate, magnify, print, edit, highlight), which has a relationship with ease of use property under usability theme, and compatibility (being easily used by different hardware and software platforms, converted to other formats, using with different media) are reasons for preferring a specific document format. Attractiveness and being not easily infected by viruses are reasons with less attention.

4.2.3.2 Sub-theme 3.2 Timeliness/up-to-datedness

Timeliness investigates how current the information resource is and how well it satisfies information needs. Timeliness/currency considers the extent to which the information is sufficiently up-to-date for the task it is to be used for, as users generally attach high value to current information (Xie 2006).

Timeliness is one of the properties/attributes of usefulness. Participants have been asked to answer how they perceive the timeliness (up-to-datedness, currency) of contents of DL resources. Are contents updated regularly or not?

Based on the responses of participants to the above questions, timeliness has been classified into the dimensions "up-to-date", "outdated", "ambivalent" (both a mix of up-to-date and outdated) and "resource type" (up-to-datedness depends on resource type).

It is interesting to observe from Table 4.12 that the positive and negative responses about the timeliness of DL resources is nearly equal, that is, out of a total of 54 quotations, 19 indicated the resources were updated, 17 got it outdated, 12 said it depended on resource type while six said ambivalent (a mix of up-to-date and outdated).

Table 4.12 Codes-primary documents table for up-to-datedness codes and experience

	Experience < 10 years	Exprience >= 10 years	TOTALS:
UFL: up-to-dateness_both	3	3	6
UFL: up-to-dateness_outdate	8	9	17
UFL: up-to-dateness_resource type	2	10	12
UFL: up-to-dateness_update	6	13	19
TOTALS:	19	35	54

Some of the participants' associate up-to-datedness with types of available databases since the databases hold different contents. Some databases hold up-to-date/ timely resources and update their contents regularly, while others hold outdated resources. Other quotations emphasized the question of applicability of the resources for local needs, even if they are updated. Again, some users may need to go back to find old editions doing a retrospective search to satisfy their current needs, while others may need much updated resources. The following are response quotations in this regard.

"It depends. Most resources available in DLs are from developed countries. And the problem with these ones is the year of publication may be some years back, or if you get something up-to-date, the methodology may be quite different. So it depends on the type of resource that you get."

"But if you go to back files, it is a matter of trade off, it is a matter of choices."

"Lack of up-to-datedness of the resource is another challenge for local resources."

Respondents who have found DL resources outdated, indicate that the availability of outdated resources has led them to use or consult other sites that hold updated resources. This means, the problem of holding outdated resources force users to search other resources to get updated ones, which in turn resulted on under utilization of DL resources and the vice versa. In relation to this idea, some respondents said the following:

"Unless, these digital libraries incorporate latest research results, how can we cope with technology? Therefore, students are obliged to use other options."

"Content is not as such timely. You don't see such materials being added to it frequently. Because, now especially when you talk of the digital library, people have also access to different materials through the web. So if the DL is not up-to-date you prefer not to go to the digital library frequently. You might use other resources as well."

With regard to the status of respondents, for librarians, the resources are up-to-date since they didn't mention out datedness and depends on resource type dimensions. For a large portion of students, up-to-datedness is associated with or depends on the resource type. Instructors have equal perceptions for up-to-date and outdated options.

When examined up-to-datedness in relation to participants' degree of work experience, more experienced users (10 or more years) associated up-to-datedness of resources with resource type, while only two of the less experienced users (less than 10 years) did so. The less experienced users indicate that the resources are relatively outdated, while the more experienced ones stated that the resources are up-to-date.

To summarize, it was observed that timeliness or up-to-datedness of DL resources is in question since almost an equal number of quotation responses were collected for both the up-to-date and outdated dimensions. An important point mentioned on the availability of outdated resources was that if users didn't find up-to date or timely content for their needs, they tend to use other alternatives, like the World Wide Web (WWW) that decreases the utilization of the DL resources. Timeliness is also associated with the resource type the user needs to use since some users need to get documents published some years back, while others need up-to-date ones. Another perspective respondents put forward is the problem of finding locally published up-to-date materials. Therefore, DL in EHLI should work hard on updating their resources through subscriptions and collecting and digitizing recent locally published resources.

4.2.3.3 Sub-theme 3.3 Relevance

Relevance denotes how (topically) content corresponds to the work task. Relevance is one of the properties/attributes of usefulness. Its dimensions are "relevant", "relevant but not complete", "relevant but purpose", and "relevant but search experience".

Participants were asked about how they describe the contents of digital library resources in terms of relevance to their information needs (The subject proximity of the resources to the information needs; how the content corresponds to the work task).

Table 4.13 Codes-primary documents table for relevance codes and rank

	Rank= Lecturer	Rank>= Assistant Professor	TOTALS:
CF relevance relevant but	10	3	13
UFL: relevance_information need	7	4	11
UFL: relevance_work task	10	3	13
TOTALS:	27	10	37

In response to this question, out of a total of 37 quotations, 75% (24) indicate that DL contents are relevant to their information needs or work task as simply observed from Table 4.13 above. The following participants' quotations can confirm the above statement:

"There is no question in terms of relevance. They are highly relevant, up-to-date. You know what is going on in the globe. You will have current information and it is relevant."

"When I subscribed for free, I usually pick my area of interest. So, usually if I want to read, I can get a relevant material. When I say relevant, it is in terms of content."

"They are very relevant, especially for research; to prepare proposals they are very relevant."

"The contents of the available resources perfectly suit all the information I need to possess."

Other quotations under the "relevant but not complete" dimension said the contents of the DL system were relevant but not complete content wise. They emphasized on holding or collecting works or contents produced locally by students and instructors of universities in order to increase relevance. Relevance in terms of incompleteness in subject proximity and locally produced contents can be associated with the concept of "coverage" which is another property of usefulness in this study. Under coverage, it was discussed that some universities inclined to collect more contents towards specific subjects, for instance, BDU towards pedagogy and engineering, GU towards medicine, and HU towards agriculture. Users outside these subjects can find the DL contents being relevant, but not complete in their coverage towards the users' specific disciplines. Therefore, the two properties of usefulness named coverage and relevance have a relationship, that is, coverage can affect the relevance of the collection. This is also true for the locally produced materials, that is, if the collections of the DL aren't holding in-country produced contents, the

relevance of its collection is questionable. Timeliness (one of the properties of usefulness) also have an association with the relevance of the collection. This can be expressed as, if the collections are timely or up-to-date, then they become relevant for the users' information need, otherwise, irrelevant. In relation to the local emphasis and limitations of locally published resources, the next quotations can give us important support.

"Somehow it is relevant. But there could be other ways to make it more relevant by including works that are written by students and faculty members. Because, for other articles that are published, I need not go to this specific portal. I can go anywhere and get it. So in order to increase its relevance, much emphasis should be placed on research works and project outputs that are done locally within the university."

"The problem with getting context based resources is that, very limited amount of resources may be available in DLs in developing countries."

"The resources I have gotten are very relevant, but they are limited in number."

Some respondents try to associate relevance as being dependent on the purpose of the user who needs to use the DL resources. As information needs vary among several users of the DL system, the contents might or might not be relevant depending on the type of collections the DL holds. In general, for such respondents, content relevance is dependent on the purpose of the user, that is, whether the user needs the material for research, teaching/learning, or entertainment purposes, and the purpose of the DL system, that is, for what purpose the DL is there. To strengthen this point, the following quotations of participants were selected.

"Relevance is normally determined by the purpose. If somebody likes to read a book for general knowledge, the DL content may not be relevant. But for academic purpose, it is relevant."

"Depending on the category of items submitted or the prevalence of similarity in topics on a given subject, the resources produced might not be related in terms of the contents you are interested in."

"In terms of academic information it is relevant. But we don't have other resources like fiction and the like."

Out of eight quotations on relevant but not complete, seven came from instructors. Librarians have not mentioned about relevant but not complete, and relevant but search experience or information literacy skills dimensions. For some respondents, relevance depends on the information literacy skills of users on searching DL contents. Students are the only respondents on the relevance but search experience responses which may indicate their limited searching experience may hinder them from getting relevant resources for their needs. We can conceptualize that users' information

literacy skills is an important precondition on searching a relevant material from the collections of the DL for gaining relevant resources. On the other hand, it might tell us the importance of awareness creation, especially providing training to users on the use of the DL system with the ultimate goal of having the relevant contents.

To conclude, the relevance of available resources and services in a DL environment is a key issue for an effective use of the DLs. Respondents expressed relevance positively, indicating DL resources are relevant for their information needs. Some respondents try to associate relevance as being dependent on the purpose of the user who needs to use the DL resources. As information needs vary among several users of the DL system, the contents might or might not be relevant depending on the type of collections the DL holds. Properties of usefulness named coverage and relevance have a relationship, that is, coverage can affect the relevance of the collection. Timeliness (one of the properties of usefulness) also have an association with the relevance of the collection. If the collections are timely or up-to-date, then they become relevant for the users' information need, otherwise, irrelevant. We can conceptualize that information literacy skills is an important precondition on searching a relevant material from the collections of the DL for gaining relevant resources. On the other hand, it might tell us the importance of awareness creation services, especially providing training to users on the use of the DL system with the ultimate goal of having the relevant contents.

4.2.3.4 Sub-theme 3.4 Reliability

Reliability investigates how credible the resource is and how well it satisfies present and future aspects of the work task. It refers to the accuracy, dependability, consistency and credibility of information (Tsakonas & Papatheodorou 2006).

What do users feel about the reliability of the content of the DL resources? How do they trust it? How do they believe the reputability of the content creators, that is, publishers or providers? Are they clearly identified? What about the authority of the resources or their academic credentials? These are questions provided to participants regarding reliability.

Reliability is one of the properties/attributes of usefulness. Its dimensions are “ambivalent” (mix of reliable and not reliable), “not consider” (the reliability aspect is not considered), “not reliable” and “reliable". We can observe from Table 4.14 that out of a total of 43 quotations of participants, more than half, 29 indicated that DL contents are reliable; 12 content is ambivalent (some are reliable and some others are not); ten resources are not reliable, and only two have not considered the reliability aspect of DL contents.

Table 4.14 Codes-primary documents table for reliability codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS:
UFL: reliability_mixed	3	1	5	3	12
UFL: reliability_not consider	0	0	0	2	2
UFL: reliability_not reliable	3	2	3	2	10
UFL: reliability_reliable	9	7	6	7	29
TOTALS:	15	10	14	14	53

The reliability aspect of DL resources was perceived positively. As mentioned above, the majority of users considered contents reliable. It was due to publishers and providers of the contents are reputed and well known, and for journals having high impact factor. Some quotations supporting this idea were selected and presented as follows. A Librarian said:

“Most of the books are from known publishers, like Springer, Elsevier, etc. We depend on well known publishers. But for our local repository, we store theses and dissertations only those have very good and excellent grade.”

“When it comes to commercial databases, this is not an issue, because they are leading publishers in the world. Our access is from them so they are reputable; they themselves set standards in the world. But this issue is introduced and reflected in open-access resources.”

“They are reliable because the publishers are reliable sources; I believe that these are more reliable. Rather than searching through the Internet like Wikipedia, they are more reliable. We believe the publishers and journals.”

“As it is subscribed to most and widely renowned academic journals, the reputability and authenticity of publishers, authors, and providers are highly regarded.”

Participants who mentioned that the contents of DLs were unreliable have tried to associate their reason to the open-access materials and local publications. According to these respondents, the open-access and locally published and produced contents have questionable reliability because of

having low impact factor, being predatory (published for making money) and published by less reputed publishers or providers. If contents are collected from reputable publishers and providers, not predatory, fulfill stated standards, and with high impact factor, then, they become reputable, otherwise not. Some participants' quotations support this idea as shown below.

"If you go to locally published journals, I have a question on their reputability."

"In open-access resources, this is an issue. Some of them are predatory journals. So as a library, we should always think about which resources are predatory and try to avoid as much as possible all predatory journals."

Other participants' responses indicate that some of the resources are reliable and some not reliable. They associate the reliability issue with dependence on the reputability and authoritativeness of providers and publishers, on the other hand, being free sites, fulfilling the stated standards, and their impact factor. If they fulfill all the reasons stated above, they are reliable; otherwise, they are not. Some respondents strengthen this idea as follows:

"I have got mixed feelings about this. Sometimes you can get some resources where their methodology is not acceptable, or the reputation of the journal may be questionable. So, in these cases you feel that there is unreliability. But quite often, most of the resources that you get, at least the topics in the abstract, are from reputable journals."

"It depends on the publishers. There are some organizations which publish the same content with slight terminology differences."

Out of 53 responses, only two instructors stated that they did not consider the reliability of resources because they left the issue for their university or librarians; 29 responses indicated that the contents were reliable, followed by 12 responses who had mixed ideas, and ten which said not reliable.

In general, the reliability of DL collections has been seen positively by the majority of the participants as expressed in their quotations, which were based on the reputation of publishers and providers, especially on commercial databases. Associating reliability with the reputation of publishers and providers, some users have mixed feelings, i.e., materials from reputable sources are reliable, while others, like open accessed and some locally published materials are not reliable because of being predatory or provided by less or non reputable publishers. Based on the above explanations, we can say that reliability of the DL

collection is dependent on the reputability of their publishers and providers, having high impact factor, and not being predatory. Leaving the issue of reputability for their university librarians a small portion of respondents did not consider the reliability of the collections.

4.2.3.5 Sub-theme 3.5 Level of detail

Level of detail refers to the various representations of information provided, such as abstracts, full text, bibliographies (Heradio et al 2012). Level of detail is one of the properties/attributes of usefulness. Its dimensions are "depend on the importance and restriction on the material", "limited", and "sufficient".

Participants were asked what their opinion was on the level of detail of the information, i.e., the various representations of information provided such as abstract/summary, full text, bibliography? Based on their responses, the following explanations were derived.

Level of detail has a total of 36 quotations of which a significant number (15) stated that level-of-detail of documents depends on other factors, like the importance of the material, and restriction on accessing the content; 12 said sufficient and ten said limited according to Table 4.15. From among the university users, more than half of GU respondents associated level of detail with dependence on factors related to importance and restrictions. HU respondents seem satisfied with the level of detail of DL contents since there is only a single response for limited dimension.

Table 4.15 Codes-primary documents table for level of detail codes and rank

	Rank= Lecturer	Rank>= Assistant Professor	TOTALS:
CF level of detail depends	8	6	14
UFL: level of detail_limited	7	3	10
UFL: level of detail_sufficient	7	5	12
TOTALS:	22	14	36

Respondents who indicated level of detail was sufficient, pointed out the availability of DL contents in various formats, and indicated the importance of these different formats in deciding the relevance and appropriateness of the contents for their information needs. Simply by looking for the abstract of the document, it is possible to decide to get the full text or not. Representation of

DL collections in different level of details helps the users to decide the relevance of the material for their current information need or not. This indicates the relationship between the level of detail and relevance attributes of usefulness theme. The availability of contents in different levels is very important for different purposes of users, and the idea was supported by different participants' quotations as follows:

"They are very necessary. Thus, I believe having an abstract / summary is the bold necessary condition, because users can easily understand the contents of their needed materials by simply looking at the abstracts."

"Each resource gives options to display either a summary and/or abstract, then provide a full text for download, accompanied by references and bibliographies."

"In my opinion, we have established a standard that varies from discipline to discipline; in health and public health, they have to fulfill the methodology, abstract, summary, and detail. Having detail methodology is very important. If there are key findings, they should be there. I am sure that all information is available, appearing in the digital libraries."

For level of detail being limited, participants say that some specific resources have limitations, as some databases provide only the abstracts of topics while others are incomplete as follows:

"For PUBMED you will always get only the part of the article. You will never get the entire general article and you may not get complete information."
"The dissertation and thesis repositories are not complete with such detailed representation."

Some DL resources can be freely accessed, while others could only be accessed if users are able to pay. Some other resources can provide users with only the abstract of the article, while others let users access the full text. Regarding e-books, some allow users access the full textbook, but others allow only a chapter of the book to be freely accessed, and if users need to get the full text, they are asked for payments. Therefore, for some respondents, availability of resources at different levels of detail depends on restrictions imposed on the resources, whether they are freely accessed or subscription based, which is also associated with coverage property of usefulness and also accessibility property of challenge theme. Therefore, level of detail has a relationship with coverage and accessibility properties. The above statements can be strengthened by the following quotations:

"In most of the medical literature, there are some online journals where you can have all types of information accessed. Others are only abstracts so that they may not be useful to get detailed information. For our purpose, we need to read the whole content, not only the abstract. The abstract is only useful to

help or understand whether it is relevant or not to you. Otherwise, you go down and understand the detail. And some literatures lack such kind of information because they provide only the abstracts."

"If this question is about the richness of the information, most provide you only with limited information, and later they can ask you to purchase it. In that case, you can't get full information. But there are also papers that can be accessed freely. They are published, peer reviewed, and you can get access to the full document. In that case, the information is full. In most of the cases, they give you very limited information. And these people are looking for money; they give you a very few and relevant information which is not sustainable as they leave the details behind."

"Sometimes you will get only the topic, and sometimes you will get the topic with the abstract. Sometimes you will get only the preview and it will be only about the first page or part of the methodology; then you will be asked to pay. And sometimes you get everything. Also, sometimes in some textbooks, after searching with your keywords, it takes you to that chapter of the textbook, and it shows you all the details in that chapter, but the problem is you will not be able to copy them or to save them, but only to read"

"As a librarian, it is absolutely good if DL contains the full content of the document, unless there is an embargo period. If that is happening, it is advisable to put the abstract, the title, or some parts of the document until the embargo period is over."

For some users, the availability of DL contents in different levels of detail is dependent on the importance of the material and on the material being contemporary or not. The availability of abstracts has been considered as important in deciding to continue to get and read the full text, or to stop. Additionally, for contemporary publications that hold up-to-dated information, accessing the full text is a serious problem. Quotations by such types of users are quoted as:

"Most digital libraries provide or show you only the abstract of the material and it is very important because by reading the abstract, I will decide on the importance of the material."

"When I first look at anything, I check for the abstract or the summary. Then, I stop there. If something is good or important, then I go into the details of the method, the result, and discussion. There are some restrictions as you know. In some journals, we are usually interested in the study tool; in others in how they are approaching that point, what study tools they used. They don't put details about the study tools, how they did it. They only put the result and discuss the issue. Otherwise, I don't have difficulty."

"Yes, in most of the digital libraries (contemporary ones) we have detailed information the user wants to know before making any efforts. However, depending on the source of the provider and the availability of up-to-date results, the chance of getting the full text will be a serious problem."

To generalize, the level of detail or availability of resources in different details (abstract, summary, full text, bibliographic) in DLs has been perceived as dependent on restrictions - imposed on the resources and the importance of the specific details for the user. Some of the

participants pointed out that the level of detail is limited and that some resources like, PUBMED provide only abstracts, and some other resources restrict the full text to be accessed on payment. Other users found the level of detail sufficient to them despite all restrictions. All in all, the level of detail is much related to coverage and accessibility properties to be discussed next and under theme 4.2.4.2 respectively.

4.2.3.6 Sub-theme 3.6 Coverage

Regarding coverage, participants were asked about their understanding of the coverage of DL resources; how they perceived digital library resources in terms of width, depth, completeness, sufficiency of information relating to a particular topic. Based on their responses, the following points have been discussed.

Coverage refers to the depth and extent of the information. It is the degree to which information and contents are presented according to various topics through the DL. It is believed that coverage is the most important criterion for improvement if the DL is to be useful and have good information value (Tsakonas & Papatheodorou 2008). The resource should cover the subject adequately and extensively.

Coverage is one of the properties/attributes of usefulness. Its dimensions are "depends" on (accessibility, emphasis, and reality), "limited", and "sufficient". "Depends on accessibility" refers to whether the resource is freely available or not; "depends on emphasis" refers to the emphasis given to the kind of collection by the university or by the librarian, and "depends on reality" concerns about a general idea or truth of coverage, like "no DL in this planet has a complete collection."

Compared with the other attributes of usefulness, coverage has less positive responses (sufficient). "Limited" and "depends on other factors" dimensions outweighed "sufficient". This can be observed from Table 4.16 that out of a total of 53 coverage quotations, 20 indicated that coverage was limited, 14 pointed out coverage was sufficient, and 19 stated coverage was dependent on other factors (accessibility, emphasis and reality).

Table 4.16 Codes-primary documents table for coverage codes and rank

	Rank= Lecturer	Rank>= Assistant Professor	TOTALS:
CF coverage depends	10	9	19
UFL: coverage_limited	11	9	20
UFL: coverage_sufficient	9	5	14
TOTALS:	30	23	53

Some respondents associated "limited coverage" with uneven distribution of resources among different disciplines, (some disciplines have sufficient collections, others small or limited collections). This can be explained in terms of the emphasis or priority given to specific types of collections. For instance, as discussed under relevance (property of usefulness) at HU most of the collections were agriculture and natural sciences related, and at BDU engineering and pedagogy had more collections. This idea indicates the existence of a relationship between coverage and relevance, that are, properties of usefulness. If the DL collection covers users' specific discipline or subject area, then, it is possible to say the collection is relevant to their information need and used by users, otherwise, not. Others describe coverage as limited due to subscription, restriction, budget and fund problems with all problems related to each other. One of the reasons for having limited coverage is related to the library subscription policy that limits subscription only to freely accessed resources. It may be the problem of budget and fund especially for resource constrained countries like Ethiopia that ultimately leads to restriction on resources accessed through payment making DL coverage limited. This observation can be supported by the subsequent quotations of respondents.

"It is not complete. If you take, for example, our university, the resources are not fully available in all faculties and departments. They are limited."

"It is difficult to get the needed materials. Some of the disciplines have no collections other than the names of the disciplines. Some were told they had a digital library, but when you see the collections, nothing is there."
"However, the content should not be only in agricultural fields, but also in other disciplines."

"Some subjects and contents are not available."

"Still, there are a number of documents that are not open; these are commercial that need to be disclosed by any means. The resources are not enough."

"That was a problem that I was encountered. Because, for most of the records you may find the copy, and you may not find a detail about the document. In Ethiopia, because it is free of payment, there are few

journals which can be easily accessed. Otherwise, many challenges are there. I find the title and the abstract, and then I am interested in the detail about the method and discussion but, I couldn't find that one. So in some cases, I have that challenge."

"Coverage is very poor. It is simply enough to say something is better than nothing. There are top journals on this planet. I think it is our capacity, no surprise that we have limited funds."

Some respondents found the coverage of their DL collection as sufficient, deep, and comprehensive. It was mentioned in the previous discussion that coverage of DL collections is limited due to the uneven distribution of resources among different disciplines. That is to say some disciplines may have limited collections and others sufficient and comprehensive collections. Therefore, respondents from DLs whose disciplines' have enough or comprehensive collections, said that their collection were sufficient coverage wise, but respondents whose disciplines' collections were not covered well, their response was, no surprise, "the collection was limited in its coverage." Next, some of the quotations from "coverage sufficient" responses were selected that support the discussion.

"They are wide, deep, and complete in topic."

"Relating to a specific topic which I observe is that the coverage goes in depth and the content is complete."

"The coverage of the digital library system encompasses health resources, agricultural content, environmental science. It is like a one-stop-shop providing books and journals on one site. Content discusses issues in detail with graphs and tables."

"In terms of the depth and comprehensiveness of the coverage, relatively I find most of the things I need."

Under the dimension "coverage depends on accessibility", participants tried to relate coverage with several accessibility privileges and problems. Some of them said research outputs from Ethiopia and written in local languages are not accessible, and others pointed out pre-conditions for accessing contents like availability of Internet connection, subscription issues, and being well experienced users or not on using the DL system. The accessibility is also more related to the availability of power, network, cost, and property right which are properties of challenge theme. Accessibility has more attention from assistant professors and reality from lecturers. The following quotations are put here for strengthening the point of discussion.

"They are wide, deep, even up-to-date, especially, these TEEAIL collections. The AGORA ones, sometimes frequently change their password. Even some of the contents are not available fully, and you can only have access to the abstracts. But TEEAIL is wide, deep and up-to-date. But the only problem is that what you get

is research outputs from abroad. You can't find or not have access to research done in Ethiopia. There are different societies, like the Plant Society, a number of agricultural societies and a number of journals, but we don't access them online."

"Actually, it depends on the language. For example, in international languages, like English, we can access resources in different perspectives, but in our own local languages there are no digital resources."

"If you are experienced, if the Internet connection is good and the university subscribes many journals, you can retrieve the details."

The emphasis on a specific DL collection development is a factor that determines its coverage. Therefore, 'coverage depends on emphasis' was selected to be used as one of the dimensions of DL resources. This issue can limit the resources of DL collections to cover only the emphasized areas, topics, and/ or disciplines. Some supporting quotations for this idea were listed underneath.

"Our collections are not in general form. They are specific and technology oriented, especially the local resources are technology related and we are selective when we enter books because we need them for academic and research purposes.There are some specific collections, like education and medical collections. But most of them are on technology. We have electrical engineering, computer science, engineering, civil and mechanical engineering. So the books are useful, because, we have interfered when we enter into a system. We have made some sort of selection before we entered to our system."

"That depends on the topic. Some are fully covered and you can easily get different kinds of information; some are limited because of the extent of the study. For example, in our setting you can't access some of the research topics, like different aspects of gens… and so on. So that information may not be accessed or applicable."

"As a user, our collection covers all subject areas, but the emphasis has been on agriculture and life sciences because agriculture and life science are dominant here in the university. Of course, we have also significant social sciences resources, such as the Emerald and Ebsco and also provide access to social science materials, management, and others."

Interestingly, some respondents try to discuss coverage in relation to the reality on the ground and being relative. They tend to express their understanding of coverage by denoting that "no DL in this planet can be able to cover everything in its collection", therefore, it is a matter of the human mind to get things here and there or within different collections. The idea is supported as follows.

"By the way, I think regarding this description of adequacy or full information, I guarantee you no digital library on this planet is complete. Some of them are better, and some of them do not include the material. For example, if you go to jestor, you can go to 1800s, but you may not get everything on it. If you go to elsiver, you can't get anything produced before 1970, but you get something current. Some of them are current and some of them are extended to some 120 years back. So, I think it is the purpose of the human mind to make use of. When something is missing here, you can go there. So, I don't expect everything

complete or adequate in digital libraries in Ethiopia, particularly in Africa let alone here; you may not get everything in the best collection of the world."

"Usually I go for health related materials and it is very difficult to say DLs fully cover everything."

"Of course, having a full digital library is difficult in our context because it needs more effort, like human resource, capital, and technological resources. Especially people who are skilled in technology, information organization, good metadata editing as well as liaisons who communicate and promote the system. That is the only means to have a full digital library."

In summary, from those properties/attributes of usefulness, coverage is the only one that has been perceived negatively by the majority of respondent quotations, and this result corresponds to the results of other studies (Megersa & Mammo in Rosenberg 2008; Tsakonas & Papatheodorou 2008). When they evaluate open access digital libraries and PERI resources use respectively, they came up with results indicating appreciation for most of the usefulness attributes by users, except for coverage attribute that participants were not satisfied with. The reasons mentioned for DL content coverage limitation were uneven distribution of resources among different disciplines (some disciplines have sufficient collections, but others small or limited collections); subscription of resources highly limited in those freely accessed materials; restriction imposed on resources like copyright and payment, and inadequate budget and fund problems. Again, a significant number of respondents tend to express coverage as dependent on accessibility of resources, placing emphasis only on specific types of collections and the unavailability of DL that cover everything anywhere. Respondents that are able to get resources for their needs feel contents as being sufficient, that may be their institutions gave more emphasis to the collections related to their disciplines or their resources may be accessed free of charge.

Table 4.17 Usefulness attributes relationships with other attributes

Usefulness attributes	Relationship with other attributes
Format	Purpose of use, Ease of use.
Timeliness	Relevance, Network availability, Access restrictions, Local contents Budget/Fund.
Relevance	Purpose of use, Format, Timeliness, Coverage, Network availability, Access restriction, Local content, Information literacy skills, enhance teaching and research, Minimal resources, Awareness creation.

Reliability	Local content
Level of detail	Relevance, Coverage, Network availability, Access restriction.
Coverage	Relevance, Network availability, Access restriction, Local content, Budget/Fund, Sustainability, Information literacy skills, Staff.

Finally, as far as the usefulness attributes of DLs is concerned, coverage is the only one that has been perceived negatively by the majority of respondent quotations. Timeliness and level of detail attributes were also in-question since the quotations are somehow equally distributed between the positive and negative perceptions. The rest of the attributes of usefulness such as format, relevance, and reliability have been perceived positively. As stated in Table 4.17, usefulness attributes have several relationships with other attributes of the study. The outcomes of the usefulness study and its relationships with other attributes have been used as an input for the construction of the DL evaluation framework (see Section 5.10.3.1).

4.2.4 Theme 4 Challenge

Challenge is a complaint lodged by a library user acting as an individual or representing a group, concerning the inclusion of a specific item in a library collection (Online Dictionary of Library and Information Science 2002).

Respondents were asked to discuss the major challenges (problems) they have encountered or experienced when using the DL system and resources. The challenge theme has several properties, like access (completeness, local publications, reliable and up-to-date), network (accessibility, infrastructure, interruption and speed), restrictions (password, payment, and property right), attitude, concern, culture, electric power interruption, plagiarism, privacy, system design and viruses with their respective dimensions.

As displayed in Table 4.18, a total of 160 quotations have been provided by participants concerning the challenges they have faced in using the DL system. Out of those quotations, 47 were associated with problems with network, 40 restriction, 17 access, 15 power interruption, 13 system design,

19 culture, attitude, and concern related, 9 plagiarism, privacy, and virus. Each of these is discussed below.

Table 4.18 Codes-primary documents table for challenge codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS:
CF challenges access	2	4	6	5	17
CF challenges network	9	4	24	10	47
CF challenges restriction	9	1	23	7	40
challenges_attitude	1	1	0	3	5
challenges_concern	0	3	0	1	4
challenges_culture	2	3	4	1	10
challenges_electric power interr	2	2	9	2	15
challenges_plagiarism	0	0	3	1	4
challenges_privacy	1	0	0	1	2
challenges_system design	5	4	1	3	13
challenges_viruses	0	0	3	0	3
TOTALS:	31	22	73	34	160

4.2.4.1 Sub theme 4.1 Network availability and speed problems

Starting with network problems, the network accessibility problems that are mostly associated with limitation of university networks being functional or accessible only on university campuses. The pre-condition for using the DL system is that users should first connect to the network or Internet at their respective universities. If the users of the DL system need to use DL resources at home or anywhere outside the university campus, the network is not functional or accessible leading to users' inability to use the DL system.

The network accessibility problems are also directly connected to university policy and infrastructure problems. As some universities have a number of campuses located far apart, campuses in some of the universities are not yet connected to their university network. Additionally, even if the network is functional, some computers are not yet connected to the network at HU. Some participant quotations to justify these types of problems were the following.

"One problem in accessing is connectivity. Unless otherwise you are within the intranet here in the Addis Ababa University, whenever you are outside, the accessibility and connectivity are problems."

"In general, our university is talking a lot about the Internet, but it is not sufficient. There are lots of propaganda. But in every scenario, being academicians, we have to be connected not only in our offices but also at home."

"Connection is an issue. Not available on all computers in Haramaya University."

"The other is the infrastructure facility. For example, we tried to reach all university campuses. But there are some campuses that are not connected to the university network. Reaching those people is somewhat difficult."

"The negative aspect is that they need infrastructure to reach all users. Otherwise they are good."

Network challenges are also sub-categorized as frequent network or Internet interruption problems. This is a common problem that I faced during my observation of the DLs. Two of the four universities observed do not have an Internet connection due to power interruption. The problem can be understood as a countrywide problem as far as there is no Internet connection or power throughout the country which are out of the control of the universities. Otherwise, network and Internet connection problems and power interruptions may happen inside the universities due to several reasons. Some respondents connected network or Internet interruption problem to the frequent electricity power interruptions; some others indicated interruptions of network or the Internet even when power is available. These are common problems occurring in developing countries like Ethiopia, where network and power interruption are frequently occurring, which enforce users to use other resources like the traditional library of the DLs. Some quotations relating to this point follow.

"The other is power interruptions. Most of the time, you cannot access the Internet due to interruptions."

"The first thing I need to mention is power interruptions. This morning, I faced two interruptions of power. You don't have Internet access. In that case, I used my CDMA on my smart phone."

"Fluctuation of power is a drawback. When I am trying to get a particular material I try to read the digital library of our faculty. And I prefer to download that material, even to take it and read it later on my laptop. Power can go three or four times a day and may be off for half a day."

"Internet is available, but at the time of this observation electric power was interrupted. Only students with their own laptops are able to access the Internet."

"And the other is the interruption of connection even when power is available. Even now at this time, we do not have connection to communicate on our e-mails. Nowadays, we have many students of public health. I have more than 20 MPH students to advice, and more than ten PhD students to consult. To tell you frankly, I did most of my work at night in the late hours that is in the evening. Sometimes, we could not find connections. So, the interruption is one of the problems."

"When I say country based, the connection from telecommunication may be missing for three or four consecutive days, or if you get it within a week, that connection is not firm."

The above mentioned network problems, which are the most frequently mentioned problems of respondents have negative implications in the process of the proper use of the DL system and of accessing DL resources. To overcome such problems, universities' ICT staff should be on standby status to troubleshoot the problems and provide power supply units for their routers and servers, and the universities should possess their own power generators to overcome power interruptions.

Another challenge faced by users was the low speed of the network. Respondents pointed out that even if the power and network or Internet connections were available, the speed remained sluggish, forcing some users to connect and use the DL system at nights or out of peak usage hours. For some other respondents, the speed of the Internet was affected by the social media and some unethical site connections that slow down the process, suggesting the implementation of controlling mechanisms on such sites for better usage of the bandwidth for DL utilization purposes. The next quotations in this regard were selected:

"Even in the presence of the Internet, you cannot download some of the very important issues because of the speed of the Internet. These are the very major challenges that I have encountered."

"On the side of the digital library system, there are no major challenges that I experienced so far, but on the side of the network infrastructure, speed is the major problem in accessing the system effectively."

"The problem is an Internet connection. Sometimes we are using it even in the evening or in the afternoon when users have left the campus."

"A number of challenges are there. The first thing is access. Access, in a sense, you may get access to the Internet, but just the Internet may not be strong enough to search. Sometimes, you may need the time, but the connection may force you to wait a long time. The internet connection speed is one of the problems"

"So sometimes you will be forced to browse at your sleeping time, at night. It is very difficult to browse at a day time. It is a problem related to our country's telecommunication connection."

"I am worried that these days we have DLs. But the DLs may be affected by other social media. I have been talking about the access and to make the Internet connection strong, and so on. By doing so, if we let the other social media, like Facebook uncontrolled, it would have impacts on the DLs speed and the like. There should be a controlling mechanism for these social media. It is used at the expense of the DLs. Because of the social media use, we can't get access to the Internet to use the PUBMED and HINARY and other DL resources."

These network problems can be seen into two perspectives. The first one is external problems which are not going to be handled by the DLs as that of usability and usefulness problems. These are absent of, frequent interruption, and sluggish speed of the Internet, and interruption of power. The problems can be understood as a country wide that is common in countries like Ethiopia which needs the interference of other government bodies like telecommunication or Internet Service Providers and the power supplying authorities. The second problems are internal for the university DLs and can be solved by themselves.

4.2.4.2 Sub-theme 4.2 Access restrictions (payment, copyright, and password restrictions)

Another important challenge or problem faced and mentioned by participants includes restrictions, imposed on DL contents further sub-categorized as payment, copyright, and password. Some selected quotations for these problems were stated underneath:

"The problem is, there are some information contents which are restricted and not accessed. Restricted means, which I cannot access. When I ask for them, they ask me to enter my e-mail, my account, like an ATM card, and the like which cannot be accessed without payment."
"The other is the financial problem. Because most of the very important journals which are highly relevant to my current study area are not easily or freely accessible."

"We have a problem; some sites are subscriptions, and even if you have the money, you cannot have electronic transfer of money."

"Even if you wait and get access, you may not get the full information. Sometimes they ask you much money, which you can't pay. Even if you decide to pay, there is no way to pay, that is, the electronic payment system in our context."

"You will be forced to use very old documents as a result of subscription fees. That is really the problem I observed, but more or less it is good."

Copyright challenges were mentioned by some respondents. The majority of the copyright restrictions are associated with payment. One problem of copyright mentioned by a librarian concerns the process of DL creation, especially to scan and convert hard copy publications to digital formats is prevented by the copyright issue.

The access problem which is also much related to payment restriction is one of the challenges stated by participants. As discussed under Section 4.2.3.5, it is the problem of accessing complete

contents of publications due to payment or copyright restrictions. The following quotations were nice to be seen.

"For me, you can get a very interesting article or topic in your area of interest, but simply you can get the abstract, and you have to subscribe and this is a major problem. In terms of access, those free of charge digital libraries are convenient."

"For example, if you go to the PUBMED what you get is only abstract. And whenever you try to get full text of the document, you may either be asked for payment or you may not be allowed to get the full document. And in these conditions the usefulness of the DLs is affected."

Other access problems mentioned were problems with accessing locally published materials from the DLs and the problem of accessing reliable and up-to-date publications. In the eyes of some respondents, materials published in Ethiopia are not usually available in the DL collections, and even if some limited are available their timeliness is questionable.

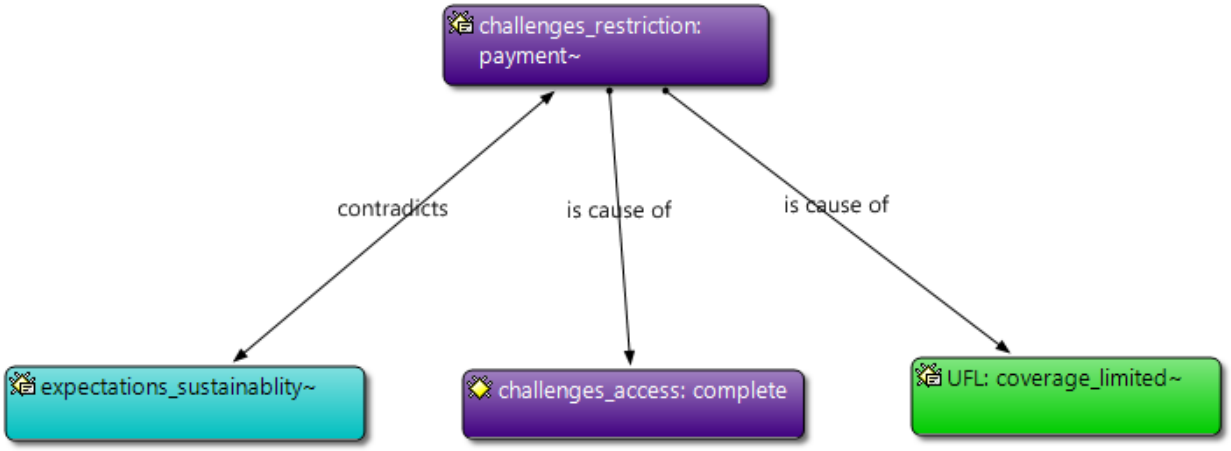

Figure 4.4 **Network views on challenges of the payment restrictions being causes of limited coverage and incomplete contents and its contradiction with sustainability of the materials**

The above figure (Figure 4.4) tells or shows us the relationship between payment restriction problems with limited coverage, problems of getting complete content, and sustainability of the DL resources. When users intend to access some important DL resources, the resources couldn't be accessed due to their providers' request to subscribe to them in order to have full access. Otherwise, users can be provided only with the abstract or summary of the resources. Since users are unable to afford the subscription request or even if they are able to pay for, the absence of electronic commerce or credit card payment system restricts them from subscribing and having access to the full content. In this case, the payment restriction imposed on users becomes a cause

for the problem of accessing complete information or having incomplete information. Again, the payment restriction challenge also becomes a cause for DL resources being limited in terms of coverage. Finally, the payment restriction has a negative association with the sustainability of DL resources. If the user or the DL fails to pay for those resources, the sustainability of the resources becomes questionable; otherwise, the resources should be accessed freely. This entails the provision of a service without ensuring its sustainability creates a problem (Megersa & Mammo in Rosenberg 2008).

4.2.4.3 Sub-theme 4.3 System design

Challenges relating to system design are also the other concerns of respondents. Absence of feedback mechanism or feature from the DL system, lack of DL interfaces to provide alternate search and help, designing the DL interface by less experienced designers that decrease the attractiveness and user friendliness of the interface, absence of federated search engine technology, lack of alternative methods to use the DL like offline access through the Intranet are some of the problems mentioned under system design challenges. As indicated in Table 4.8, all the above mentioned problems have relations with some properties of usability theme like ease of use as the absence of federated search and feedback features, navigation through lack of alternate search and help in the interface, decrease the attractiveness and user friendliness of interface affecting the aesthetic appearance, and as a result of the above problems unsatisfactory task accomplishment may happen. To the above stated points, some quotations were selected and presented next.

"The other thing is that I don't see any mechanism of getting user feedback. May be it is my own problem. I might not navigate it well to see that facility. Once I searched a digital library it is good to request me for feedback. It is not being user centric. So it is another limitation that I have seen."

"Concerning the graphical user interface, I think some digital libraries are being customized by people who are not experienced in ICT. That can be a drawback. So experts in this field must be consulted in order to increase the attractiveness, and it has to be made in a user friendly manner in order to attract the attention of users. And users must not face any difficulty."

"So we need to introduce a technology, such as the federated search engine that we have started to develop where people will see only a single interface in the digital library website to access the journals. That is our future activity."

"Lack of alternatives to use offline (without an Internet connection) methods."

4.2.4.4 Sub-theme 4.4 Attitude, concern, and culture:

Users' attitude towards DL collections, i.e., since they access them freely, they undermine or underestimate their importance, and the attitude "Google has everything" that leads users to prefer and use Google than the DL has been mentioned as users' attitudinal problems. From the point of view of "concern", giving less attention to and having limited knowledge of the importance of DLs by the university management were the other problems. Cultural challenges have been associated with techno-phobia (being not comfortable to use the technology and using/reading the digital version on screens, accessing unethical or destructive sites through using the bandwidth of the universities, and being addicted to reading only from computer screens that end up in problems if power is interrupted). Regarding these ideas, some responses were given below:

"The other thing is we access many of these resources for free. Because they are freely accessed, people, the staff, can underestimate it, that is a big issue. If the management allocate a significant amount of its budget, it is nice to control the use of the digital library by checking user statistics etc."

"The other is, people's attitude is a big issue. From my experience, most people feel that Google is everything for them, even for the academics. But different research shows as if you are using Google, may be, you will access around six up to ten percent of the academic resources. So people are stacked with such mentalities and changing these attitudes is a big problem for a librarian. So our information literacy training tries to adjust these issues."

"One challenge is the institution by itself doesn't give any attention to the digital library."

"Some people may not need to use the electronic version due to technophobia."

"And the bad side of digital library nowadays is what we are very much suffering from. Some times ago, people were just accessing many pornography and other irrelevant materials. Even what I really advise is Facebook is not important. People are not using it, for deliberate action. So, most of the time, especially many of our colleagues are abusing e-library. Sometimes it has a disadvantage if we do not use it purposefully. And cultural issues are very debatable because of such communication."

"The other thing is, you will become addicted to reading only from the computer. If there is no power, I don't want to read from hard copy. That is the disadvantage. I use it regularly and I don't want to read it from the hard copy."

4.2.4.5 Sub-theme 4.5 Plagiarism, privacy, and viruses

Through utilizing DL resources, plagiarism practice has become easy for students in a form of copy/paste which leads to abstraction rather than synthesizing. Asking users about their personal information, like email address, name, and any other information trigger question of explaining

privacy. Lack of provisions for anti-viruses by the concerned body leads to the spread of computer viruses causing problems on users' devices. The following are some related responses.

"The negative part is that sometimes there are copy paste approaches. Because things are very easy like a spoon feeding, if you easily access things very easily you don't need to read in detail about that information."

"Asking personal information about the user, like e-mail, names, and other vital issues affect privacy."

"The problems are internet viruses causing problems on our computers."

"The other thing is technicians available at the computer centers are not able to provide us with anti-viruses. Viruses are disturbing our computers."

Table 4.19 Challenge attributes relationships with other attributes

Challenge attributes	Relationship with other attributes
Network availability	Timeliness, Relevance, Coverage.
Access restriction	Timeliness, Relevance, Coverage, Budget/Fund, Local content, Sustainability.
System design	Ease of use, Aesthetics, Navigation, Feedback, Federated search.
Sustainability	Coverage, Access restriction.

To summarize, the challenges encountered and expressed by participants were many and vast in their nature. Network problems expressed in terms of accessibility problems at some university campuses and at home, frequent network interruptions, speed associated with limited bandwidth, and frequent interruptions of power are common problems occurring in developing countries like Ethiopia, where network and power interruption are common, which enforce users to use other resources like the WWW instead of the DLs.

Access restrictions imposed on some DL contents, like the password, payment, and property rights were also mentioned as serious challenges on the utilization of DLs. The access restrictions discussed and expressed under section 4.2.4.2, as payment password and copyright restrictions can be observed in relation to several properties of usefulness theme. For instance, if the current contents are restricted by one of the mentioned reasons, users can obliged to use outdated resources which affect the up-to-datedness property of the collections. Again, if the documents from well reputed journals, publishers, and providers happen to be restricted, this can enforce the users to use materials from other none or less

reputed sources and raise a question on the reliability and relevance of the resources. Finally, as a result of access restrictions imposed on the contents, if users are only able to access abstracts and some part of the materials, the level-of detail and coverage properties of the DL collections are going to be affected negatively. The access restriction problems lead users to use other available online resources with a consequence of under- utilization of the DLs. The payment restriction imposed on users becomes a cause for the problem of accessing complete information or having incomplete information. Again, the payment restriction challenge also becomes a cause for DL resources being limited in terms of coverage. Finally, the payment restriction has a negative association with the sustainability of DL resources. If the user or the DL fails to pay for those resources, the sustainability of the resources becomes questionable; otherwise, the resources should be accessed freely.

System design problems are also stated as the absence of user feedback mechanisms and federated search systems. As indicated in Table 4.19, the mentioned system problems have relation with some properties of usability theme like ease of use as the absence of federated search and feedback features, navigation through lack of alternate search and help in the interface, decrease the attractiveness and user friendliness of interface affecting the aesthetic appearance, and as a result of the above problems unsatisfactory task accomplishment may happen. Attitudinal (concerns given to DLs) and cultural problems were the other challenges pointed out by participants. Challenges like plagiarism, privacy, and the spread of viruses were problems rarely mentioned. These Challenge results and the relationships exist between them and other attributes of the study have also been used as a basis for construction of the DL components interaction evaluation framework.

4.2.5 Theme 5 Benefit

The concise Oxford dictionary of current English (1990) defined benefit as favorable or helpful factor or circumstance, advantage or profit.

Participants were asked to convey their understanding of the positive aspects/benefits of DLs. Their answers have been classified as: “easy access”, “easy share”, “enhance teaching and research”, “minimize cost”, “minimize space”, and “minimize time”.

A total of 76 quotations were collected for the benefits category. Out of these quotations, 12 indicated enhance teaching and research, 16 easy access, 14 minimize cost, 14 minimize space, 10 minimize time, and 10 easy share benefits as stated in Table 4.20. Each of these is discussed below.

Table 4.20 Codes-primary documents table for benefits codes and status

	Status= Instructor	Status= Librarian	Status= Student	TOTALS:
benefits_easy access	11	0	5	16
benefits_easy share	5	3	2	10
benefits_enhance teaching/research	6	2	4	12
benefits_minimize cost	6	3	5	14
benefits_minimize space	6	3	5	14
benefits_minimize time	4	3	3	10
TOTALS:	38	14	24	76

4.2.5.1 Sub-theme 5.1 Enhancing the quality of teaching and research

Starting with the advantages of DLs for enhancing the quality of teaching and research, respondents stated DL resources are being fundamental and essential for any academician who needs to pursue academic research. Some also mentioned their importance for accomplishing their tasks (teaching, learning, research) for the preparation of research proposals, teaching materials, and lecture notes. The following are quotations supporting the above idea.

"They are fundamental. Someone who wants to pursue any academic research has nowhere to go. You can't get the hard copy of these things; you can't import them. So if you make use of them appropriately, they are fantastic. You can't move an inch without them if you are serious in academic."

"In general, the positive aspects are: there is no problem of finding papers and research publications. The availability of DLs can make life very simple and easy. It is not a problem to find a research problem. If someone needs to do something, he can open his computer and look for a problem and methodology easily. You may look for papers done by someone and you may contact that individual to get his expertise."

"The digital library tries to support research and teaching learning activities,"

"Positive aspects include, among others, the easy access to contemporary research findings, widely accepted publications (periodicals, journals), accommodative and comprehensive sources of studies, etc., that help the user perform research and academic activities without the need to go anywhere."

4.2.5.2 Sub-theme 5.2 Easy Access to resources

Easy access of resources is another important benefit of using DLs. Especially, free access to DLs can be seen as a special privilege for developing countries like Ethiopia, where problem of limited

budget is common. Some participants commented on the ease of access to DL resources by contrasting it with that of hard copy materials which involve such cumbersome activities as getting pockets, asking for materials, borrowing, and finally returning, perhaps, with overdue fines. Some others talked about easy access of contemporary and updated research findings, accommodative, reputable, and comprehensive information besides the ease of handling. The DL resources being easily sharable among researchers, instructors, and students is also dependent on the easily accessibility of the resources. If you need to share a resource, first you have to access it easily, that makes the sharing process easier. The following are supportive quotations.

"The positive aspect is accessing free information. By the way, you can't get free information, free access to the digital library anywhere in the world. It is a special privilege to developing economies."

"The very positive aspect of it is having it by itself. Having a digital library is an advantage in that you don't need to carry the hard copy from place to place. Getting it for free, having access to different journal articles without having the subscription of the journal is very positive."

"I can also share the material with students and other colleagues, so it is easily sharable."

"It is useful. It facilitates learning. They benefit us to get the important tools to learn."

"With a less number of books and/or less space to accommodate books, digital library gives the mobility and access to more users."

4.2.5.3 Sub-theme 5.3 Minimal resource (cost, space, and time requirements)

Other advantages or benefits of DLs can be their capacity of minimizing resources (cost, space, and time). Minimizing cost refers to accessing DL contents for free or with minimum cost from any part of the world which is an important benefit for developing countries like Ethiopia, who have limited funds for subscribing the resources of the DL system. Additionally, the nature of the contents of the DL, their being digital and sharable, make owning multiple copies of the some material unnecessary which minimize cost and space features. Space minimization rules out the need for a big room or physical space as that of the traditional libraries, because accessing the materials can be done being anywhere, in the office or at the cafeteria, making the world smaller by accessing a material from any part of the globe. Simply, it is a library without a hall. Saving the time of the user is another benefit of DLs since there is no need of going to the library physically; and in a few seconds, one can access a material from any part of the world. The following are supportive quotations for the above benefits of DLs.

"The positive aspect is that it can save time because instead of going searching for a book manually, I can get it digitally from my phone. I can subscribe or have an access to that; even there is no need of providing room. Everybody can get a book and it saves time."

"The first one, it doesn't require any physical space. I am not expected to go to the library, so I can access those learning materials or research materials in my office, and I can elaborate my understanding and do my work at working times. Second one, if I get these materials I can take them. I can also share the materials with students and other colleagues, so it is easily sharable. And concerning security issues, there is no difficulty, as you may know there are a number of procedures to be passed in order to get a book or a material from the traditional library."

"The positive thing is you can access information whatever the information you need in a short period of time."

"It gives power to search the information resources without the hindrance of place, location, and time."

"Besides, in terms of cost, time and other resources based concerns, the digital libraries have completely solved many problems."

"Here, easy access and easy share of DL resources can enhance teaching and research and also minimize resources like cost, space, and time."

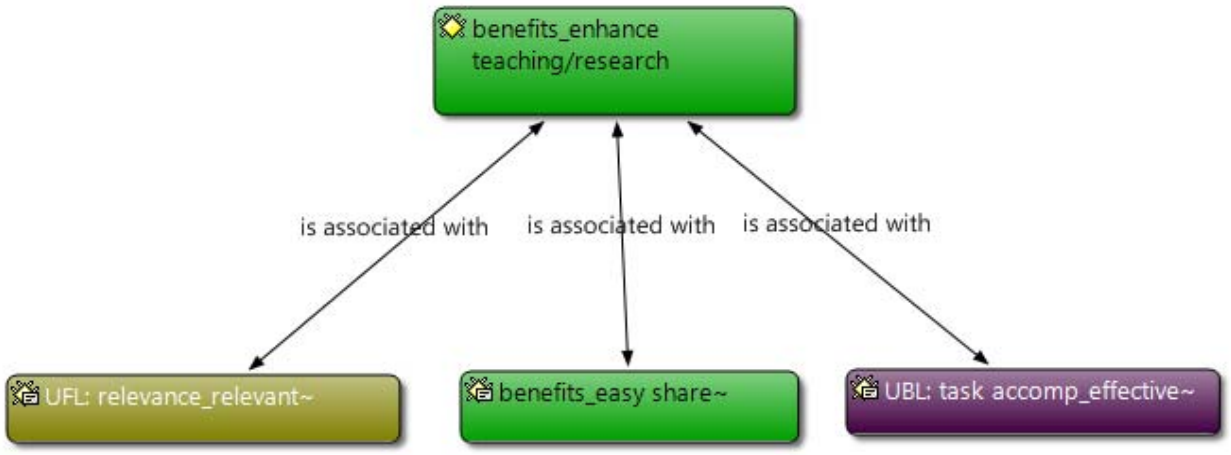

Figure 4.5 Network view for the benefits of DL in teaching and research and its association with effective task accomplishment and relevance

According to the above figure (Figure 4.5) one of the benefits of DLs, that is, enhancing teaching and research has an association with one of the usefulness categories called relevance. As discussed under Section 4.2.3.3, relevant DL documents for users can enhance their teaching, learning, and research activities. In other words, DL resources that enhance teaching and research are relevant for the information need and task of DL users. Another benefit of DL resources, unlike traditional library resources, is their digital nature which makes them easily shared among

instructors, students, and researchers. As discussed under Section 4.1.2, if they are easily sharable, and shared among different DL users, they enhance the teaching, learning, and research processes of the universities. Effective task accomplishment also has an association with enhancing teaching and research. If DL resources enhance teaching and research activities, then they are vital instruments for effective task accomplishment. Also, if users of DLs accomplish their tasks effectively, this in turn can mean enhancing teaching and research activities.

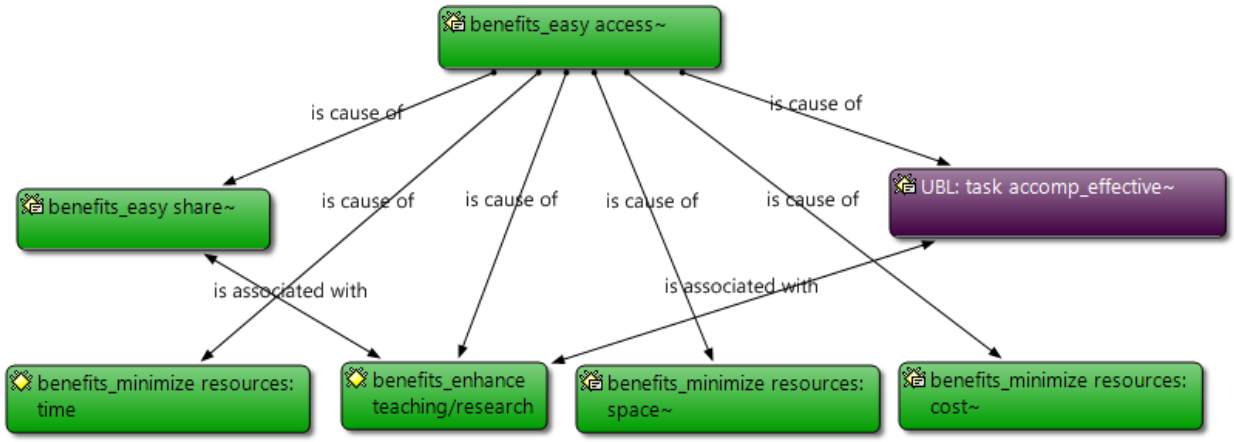

Figure 4.6 **Network view for the benefits of DL that is easy access being a cause of and associated with several factors**

Figure 4.6 shows us the importance or benefits of easily accessing DL resources to be used as causes for other different benefits. For instance, to easily share a DL resource, first, the resource should be easily accessible. If the resource is easily accessible, then it is possible to share it among different users. Again, if the DL resource is easily accessed, then minimizing resource in terms of time, cost, and space is possible. Additionally, if a DL resource is easily accessible to the user, ultimately, it can enhance the teaching and research process. Lastly, through accessing the DL resources easily, users can be able to accomplishing their tasks effectively. The association between enhancing teaching and research and easy sharing, and effective task accomplishment were discussed under Figure 4.5.

Table 4.21 Benefit attributes relationships with other attributes

Benefit attributes	Relationship with other attributes
Enhance teaching and research	Relevance

Easy access to resources	Task accomplishment, Easy sharing, Enhance teaching and research, Minimal resource.
Minimal resource	Relevance, Task accomplishment, Budget/Fund, Accessibility.

Generally, a number of benefits of DLs have been mentioned by participants. Easy access of resources is an important benefit of using DLs. Especially, free access to DLs can be seen as a special privilege for developing countries like Ethiopia, where problem of limited budget is common. The DL resources being easily sharable among researchers, instructors, and students is also dependent on the easily accessibility of the resources with an ultimate benefit of enhancing teaching, learning, and research. Other advantages or benefits of DLs can be their capacity of minimizing resources (cost, space, and time). Table 4.21 stated the existence of several relationships between benefit and other attributes. The benefit enhancing teaching and research has an association with one of the usefulness categories called relevance. Easy access of DL contents were expressed as the cause for the other different benefits, like enhancing teaching and research, minimizing resource (cost, time, space) and enabling easy sharing of the accessed DL contents. Benefits of easily accessing DL resources can be cause for other different benefits. Lastly, through accessing the DL resources easily, users can be able to accomplishing their tasks effectively. All these results of benefits and relationships with other attributes have been used as an important input on the process of developing the DL components interaction evaluation framework.

4.2.6 Theme 6 Expectation

According to Oxford dictionary of current English (2006), expectation is defined as a belief that something will happen or be the case. Thing that is expected to happen. An act or instance of expecting or looking forward for something hoped for.

Expectations of respondents from the DL system were classified as availability, commitment, local emphasis, network improvement, sustainability, system redesign, and timeliness.

It can be observed from Table 4.22, that out of the 78 quotations collected on participant expectations 26 were concerned with the availability (accessibility) of DL resources, 16 with system redesign, 9 on the emphasis on locally published materials, 12 on the improvement of

network infrastructure, eight on sustainability issue of resources, seven on the timeliness of resources, five on the importance of commitment of stakeholders, two on accessibility issue for disabled users, and two on future directions, indicating that different studies will be carried out.

Table 4.22 Codes-primary documents table for expectation codes and experience

	Experience < 10 years	Exprience >= 10 years	TOTALS:
expectations_availability	14	12	26
expectations_local emphasis	4	5	9
expectations_network improvement	3	9	12
expectations_sustainablity	8	0	8
expectations_system redesign	10	6	16
expectations_timeliness	4	3	7
TOTALS:	43	35	78

Participants' expectations with regard to availability issues were to have access to more resources in addition to the currently available freely accessed ones that can use to solve the access restriction problem of the challenge's theme. Universities should subscribe for resources which are accessible only on payment to cover collections of all disciplines. Some users gave attention to the importance of creating connections among Ethiopian university DLs that may enable them to share the resources. Some other users emphasized the importance of availability of resources in different formats like multimedia. Additional expectations of availability include DLs being available 7 days a week and 24 hours a day (7/24), and that on all campuses of universities to be used by the whole academic community. The expectations were related to and focused to solve the different problems of DLs discussed under the usefulness, and challenge themes, like coverage, timeliness, relevance, reliability, network accessibility, and restrictions imposed on some DL contents. Here are some quotations connected to these concepts:

"In order to attract users and their attention or in order to increase their engagement, it must be reliable and 7/24 available."

"I do expect the digital library to make available all information for any scholar end user."

"Now the world is working on freely available program. There are publishers who are working on them to solve the challenge of accessing all information for end users. So I will be very happy to obtain all information in the globe with minimum payment."

"In terms of accessing, again, you may not get the most important article and knowledge. So in the future, things should be changed. Even at the macro level the government should be involved and at the organizational level the university should subscribe."

"What I expect from the DLs is anything in the new development of the western world could be easily accessible here. Everything from the journals, book, movies, and religious lectures should be accessed, that is my wish particularly regarding our profession."

"As a health personnel, what I also expect from the DLs is DLs should be installed in all clinical setups, so that students, postgraduate doctors and instructors would use them for patient care, to improve the care service, to enrich their clinical skills and knowledge."

"These databases are commercial databases, so in terms of quality and the type of service they provide, they are world leading institutions. So they will as much as possible, try to satisfy the user interest in their own specific discipline. So I am always happy with these resources, but in our context, there is dissatisfaction that some resources cannot be accessed through basic subscription. This is the big hurdle for our users."

Expectations concerning system redesign include incorporating new and additional features and services to the DLs, like providing alerting or notification services to users on the arrival of new and updated materials (marketing/promotion), having user feedback collection features, implementing standards and common platforms on developing DLs in Ethiopian universities which enables them to collaborate and share their resources, consider the human computer interaction issues of the interface such as improved usability and having well educated professionals on developing and maintaining the DLs. Supporting quotations for the above ideas were underneath.

"The other thing is I wish them to provide specialized kinds of services. For instance, I work for School of Information Sciences so at least whenever there are additional new arrivals coming to the collection, as the traditional library system, sending these types of e-mails to people to alert that we have these ones and getting introducing a system whereby feedback, even introducing the culture of making the copy of whatever material the university is publishing can be included in the digital library."

"Digital libraries should have standards. Universities are developing digital libraries without standards, without common platforms. So, if regulation is there it guides to train, to educate librarians; in that regard it will be good for libraries to have common platform."

"It has to consider the human computer interaction aspect, such as increased usability,"

Giving more emphasis to locally produced and published materials and to materials written in local languages like research reports, project output, theses and dissertations done in Ethiopia need incorporated in the available DL collections were other participants' expectations which is associated with expanding the coverage of the DLs and support the findings of Lamont (2015) that focuses on the importance of collections of local interest. Lamont suggested continuing digitization with collections concerning local San Diego companies, focused on immigration and border issues, as well as international trade. The idea of incorporating locally published materials was supported by the following quotations.

"Addis Ababa University did not have even a single journal, whereas Jimma University has a Journal of Agricultural Economics. AAU has nothing. That is why I am complaining. How can we say that AAU did not have a single journal in AGORA, whereas we have many professors in Medicine, Social Sciences, Geography, and Development Studies. So this is surprising. That is a negative aspect."

"So, in order to increase its level of usage and its relevance, much emphasis should be put on research, project outputs that are done locally within the university."

"Sometimes, we are interested to have research which is not published internationally, but locally. Locally, there are lots of theses, but are not easily accessible through the digital library because they are in a form of hard copy on the shelf. Most of our references are not contextually representing our socioeconomic and demographic condition. There are lots of studies which are left on the shelf, and they should be accessed by the digital libraries in the country to anyone."

"Well, the current digital library was also good in terms of depth as we said; in terms of up-to-datedness they are good. But the main problem as I have said earlier is, it is difficult to get what was done in Ethiopia. We don't have access to local journals. It is very easy for us to get what is done in America rather than having access to what is done in Ethiopia, in Hawassa, or Jimma. For the time being, Haramaya University has one journal, "East African Journal of Science", and currently they have made it online. Previously, even it was not."

"I expect the library system will be full of reliable research outcomes obtained from the research institute at Bahir-Dar University. That is my expectation."

"Actually, it depends on the language. For example, for international languages, like English we can access resources in different perspectives, but in our own local languages there are no digital resources."

Improvement of the existing network infrastructure is what has been expected by some users. This includes expansion of the network infrastructure to all campuses, offices, and student centers, having well-experienced and responsible manpower in network implementation and maintenance to facilitate fast, reliable, and uninterrupted internet access which all are mentioned under network

access, speed, and interruption problems with the challenge's theme that are also the usual problems encountered in resource constrained countries like Ethiopia. Supporting quotations of these ideas follow.

"When I was in England, nearly for five years, I didn't see any interruptions of the Internet and power even in my room. I wish our university would produce such a system. Because, as I told you, there is no Internet now. I was looking for a thesis for MSc and try to correct it, but there is no Internet connection."

"The other thing is, in order to get access to the DLs, we need Internet access, the infrastructure. But, in contrast with other universities, it is ok."

"What I wish is also to have a better network accessible and stable networking system in our country so many people will benefit and increase knowledge and skills of different academic staff and health personnel."

The sustainability issue which is associated with availability and coverage properties was also one of the expectations of users.

Sustainability refers to a system's ability to provide robust management of collections and services over time (Xie and Matusiak 2016). Digital library sustainability is a complicated topic with related issues ranging from the longevity of digital information, including the stability of digital formats and storage medium and flexibility to incorporate new items to funding for digital libraries (Xie and Matusiak 2016).

The DL resources which are now accessible and available freely may not be accessed in the future due to the subscription issue. Since some of the publishers or providers are restricting their publications to be accessed only on payment, stakeholders in the DL environment, like the Ethiopian Government and the universities should be in a position to pay for the resources to maintain their sustainability. Again, since the resources are too expensive, there should be a national initiative that works on establishing and strengthening a consortium among university DLs that enables them to share subscription costs. The following quotations talk about the matter.

"So in the future, things should be changed. Even at macro level the government should be involved and at the organizations level the university should subscribe the resources."

"But if you ask me whether it is sustainable, that is the big issue. Sustainability is an issue. Because, each database, these days academic databases are damn expensive and for a single resource they ask about more than 20,000 USD. So it is expensive for individual universities. The national initiative should come

together and handle this payment together. But still this has its own challenges and in the future Ethiopian universities should come together and find ways to settle these kinds of problems, because increasingly some publishers are starting to withdraw from providing free access, for example, INASP want to stay independent."

"Up-to-date, comprehensive, and rich resources with easy access."

"Top level management commitment is mandatory for the improvement of the digital library. Unless, top level management is committed to support the digital library in the operational level, it is not that much effective."
"The user coverage of digital library must incorporate all users in the belonging organizations, like disabled people/ users."

"Digital libraries can play a major role in e-learning and distance education system. So the impacts of digital libraries in these sectors also need to be researched."

Expectations of participants have been examined based on their status. Instructors' expectations were high for availability of DL contents, followed by local emphasis (availability of locally published and produced documents), and then on redesigning the current system, and network improvement. It seems librarians are more concerned with the sustainability of currently accessed documents for accessing them in the future. Students' expectations were more towards availability of DL documents, followed by system redesign and timeliness of the collections.

Table 4.23 Expectation attributes relationships with other attributes

Expectation attributes	Relationship with other attributes
Expectation	Timeliness, Relevance, Reliability, Coverage, Network availability, Access restriction, Local content, Sustainability, Consortium, Commitment, Feedback, Awareness creation.

In conclusion, a number of relationships exist between expectation and other attributes as stated in Table 4.23. The majority of the expectations stated by participants were associated with the expected problems expressed under the "challenge" theme and can be used as a remedy or solution for the challenges. Some very important expectations are resources available, including restricted resources for payment reasons, availability of locally published materials, and ensuring the sustainability of already accessed contents possibly through establishing a national consortium. Redesigning the DL system to overcome the absence of user feedback and federated search problems, improvement of the network

infrastructure, speed, and providing timely or up-to-dated resources were the major expectations of participants which related directly or indirectly to properties of usability, usefulness, and challenge themes. These expectation theme research outcomes and also the relationships it has with other attributes have been used as an important input when constructing the DL components interaction evaluation framework.

4.2.7 Theme 7 Awareness creation

Awareness is defined as having knowledge of a situation or fact, well informed (Oxford dictionary of current English 2006).

Awareness creation entails providing training and education on how to use the DL system and promoting/marketing the available and newly arrived contents of the DL. The awareness creation category is divided into two dimensions, marketing (promotion) and training. Out of 50 quotations, 27 indicated the importance of marketing or promotion of the available DL services and contents to users, and the remaining 23 emphasized the necessity of user training for proper utilization of the DL system and content as stated in Table 4.24. AAU gave more attention to awareness creation than HU. User training dimension received more attention at GU, and marketing/promotion at AAU.

Table 4.24 Codes-primary documents table for awareness creation codes and location

	Location= AAU	Location= BDU	Location= GU	Location= HU	TOTALS:
awarness creation_marketing	17	7	2	1	27
awarness creation_training	4	5	10	4	23
TOTALS:	21	12	12	5	50

According Patil and Pradhanlib (2014) library services need library marketing,

- "to promote the use of available reading material in the library and create awareness among the users,
- to optimize the use of information within limited resources and manpower,
- limited budget for library needs to market services and generate funds for library,
- to improve the image of the library,

- due to information explosion, readers require precise and correct information for their research and study."

This study revealed awareness creation activity being very important in making the DL system easy to use and to properly know and utilize the available DL contents. Participants expressed the importance of awareness creation as follows.

"Even most of the staff is not aware of what are available in DLs. Awareness creation and giving training are essential".

"Users usually have to know how to download, how to access the research materials. They easily access the title or the material that they are looking for. But there is no simple way how to get these materials".

"First, knowing there is a digital library system is one thing. And it is surprising that most of the graduate students, including PhD and masters, and even the lecturers are not aware that there is a digital library system in AAU."

"So people are not aware of the DL and I believe that there is under-utilization of resources."

"If I don't have previous knowledge, I can't easily access. For anybody who is new for that interface, it is difficult to use."

"The other one is even some free digital libraries are not that much familiar to the staff. Even though they are simple to interact, we don't have information about them that is a marketing problem."

"There must be help service or support service. Before I started to use a particular digital library, I must have sufficient information. Even tools like manuals should be developed in order to easily use the materials."

"We believe that, at this time peoples are aware about different electronic tools which help them to get information from different sources. By having in mind this, I think it is not difficult to access e-resources, but it needs awareness and promotion."

As far as the relationship of awareness creation to users' information literacy skills is concerned, users with less than ten years of work experience needed more user training on the usage of the system than on the marketing or promotion of DL contents, while users with ten or more years of work experience preferred marketing or promotion services. From this, one can conclude that users with limited information literacy skills lack and so need more training on using the interface, navigation activities, used terminologies in the interface, and on learning and memorizing the DL system. On the other hand, users with more information literacy skills gave priority to promotion

or marketing of DL content activities than to train. This might be due to the fact that users with more information literacy skills have been familiar with the DL system usage through attending trainings provided by DLs or learning from colleagues. Therefore, being less information literate DL user is a condition for the necessary action of awareness creation, for users to have more information literacy skills and properly utilize the DL system and resources.

Table 4.25 Awareness creation attributes relationships with other attributes

Awareness creation attributes	Relationship with other attributes
Awareness creation	Ease of use, Aesthetics, Navigation, Learnability, Terminology, Relevance, Information literacy skills.

Finally, especially in the Ethiopian context, awareness creation is a category that has many relations with usability, usefulness, and challenge themes (see Table 4.25). Even though, sometimes they can overlap upon each other (Matusiak 2012) from the awareness creation dimensions, providing orientation and training services to users of the DL has more relationship with the system features of DLs. The relationship between the DL system and the DL user is more expressed within usability properties. This has been indicated in the network views of ease of use, aesthetic appearance, navigation, and learnability. On the other hand, promoting or marketing DL resources and services to its users (announcing and alerting users on the available and newly arrival materials) is tied with the content of the DLs. This relationship between the contents of DL and its users is expressed in terms of usefulness. Therefore, the Awareness research results and the relationships that exist between Awareness creation and other attributes of the study have been used as an input on the process of developing DL components interaction evaluation framework.

4.3 Chapter conclusion

In this chapter, a detailed analysis of the collected data, based on the created themes and their properties, and supported by user quotations, tables, figures, and thick descriptions to reach to specific findings and interpretations have been conducted. The analysis is based on the properties and dimensions of themes and the condition, action/interaction, and consequence techniques of analyzing qualitative data. The output of this analysis chapter has been used as an important input for the development of context based DL evaluation framework (see Section 5.10 for detailed

description). The next chapter attempts to discuss in detail the findings of this empirical research in relation to other similar or related study results found in the literature and construction of the proposed DL components interaction evaluation framework.

CHAPTER FIVE

5 DISCUSSION

5.1 Introduction to the chapter

This chapter is devoted to discuss the main findings of the study that were in particular stated in the analysis and interpretation part of this paper. The discussion is being made in-line with the identified themes and sub-themes. It emphasizes the essential process of constructing and proposing the DL components interaction evaluation framework under the Ethiopian context, which is the main objective of this study and as well the epicenter of the outcome of this empirical research.

5.2 Theme 1 Purpose of use

This study reveals that the purpose of use of the DLs in EHLI is mainly for teaching, learning and research, followed by self-updating. Librarians could also use the DLs to provide services to other DL users. This result corresponds with the qualitative research output of Hewitson (2002) at Leeds Metropolitan University, UK. The result of the present study has also found to be coherent with many other works in reporting the exploitation of electronic information or e-resources in the academia for teaching, research and self update (Ahmed 2013; Konappa 2014; Simon & Ogom 2015).

5.3 Theme 2 Usability

As far as the usability of DLs is concerned, all attributes/properties of usability have been perceived positively by the majority of the quotations of the respondents. Usability attributes have found to be associated with or influenced by developed awareness, i.e., training on the DL system use, promotion/marketing of the DL system and DL contents as well as the level of users' information literacy skills in using the DLs i.e., information use literate or not). According to the present study, some of the attributes of the usability theme are discussed hereunder.

5.3.1 Ease of use

Ease of use has been perceived positively by the majority of the participants. The respondents have appreciated the importance of implementing federated search engine in EHLI digital libraries to allow more comprehensive searching and browsing, so that the DL system is easy to use.

The idea of the importance of federated search service has been reasoned out by a number of studies. For instance, Ram et al. (2014) stated the use of several databases as being a frustrating and daunting task for users, so federated searching is a very new concept that is gaining importance in the digital library environment. Given the endless volume of information available today, digital library search services do not properly satisfy their users due to the absence of a single, simple, and comprehensive search service available to end-users to meet their needs of gathering information on alternatives from all information repositories accessible through the digital library.

As a solution for the above mentioned problems, many academic digital libraries have introduced federated search services to their communities to meet DL users' desire to simplify their searches across search engines, library catalogs, and subscribed databases (Xu 2009). Additionally, according to Ram et al. (2014) federated search technology is an integral component of an information portal, which provides interfaces to diverse information resources. Once users enter their search inquiry in the search area of the information engine, the system uses federated search systems to send the search series to each resource that is integrated into the gateway. The entity information resources, then send the information gateway a list of outputs from the search inquiry. Users can analyze the number of papers retrieved in each resource and link to each search result.

Therefore, federated search service should get important attention and be implemented by the EHLI digital libraries. This suggestion is in line with the previously reported study results of (Buczynski 2005; Kiondo 2008; Kumar et al. 2008; Wu & Chen 2011), that revealed the importance of implementing federated search service that allows more comprehensive searching and browsing in order to boost usage levels and to overcome confusions of DL users due to the growth of different types of databases produced by different suppliers, with numerous interfaces, and logins that end up with confusing DL users attempting to access. Federated search services also bridge the gap between DL searchers and today’s digital libraries.

5.3.2 Aesthetics

Participants of this study perceived aesthetic appearance of the DLs positively. This study also found that an interface congested with several unrelated and irrelevant information can divert users' attention, affect their taste and interest in using, and decrease attractiveness.

It was also found that some users do not give due attention to aesthetic appearance being attractive or user friendly, rather their concern or priority is for the availability of the contents they need in the DL collection. This point supports the statement of Greenberg and Buxton (2008) on the usability and usefulness of DLs. "While usability remains an important criterion in DL evaluation, it is also true that a usable system may not be always useful for the user, i.e., systems could prove to be usable, but functionally useless."

5.3.3 Learnability

The current study also found that the practice of awareness creation (providing users with training and marketing or promotion) is an important factor in making the DL system more learnable and memorable to the user. This finding corresponds to the statements by Nelson et al. (2014) that indicate the importance of awareness creation or user education on how to use the digital library for DL users as being the main contributor to the good performance of the digital library in terms of learnability (learning and memorizing the DL), and lack of adequate user training is the main hindrance on learning how to use the digital library.

Overall, participants' perception of the learnability of the DL system was positive. For some respondents, learnability has a strong association with users' information literacy skills. Users with more information literacy skills found the DL system easier to learn than those with less information literacy skills. For some users learnability of the DL system is dependent on the type of the database. Since different DL databases have different features and characters, some of them may be easily learnable while others may remain hard to learn.

5.3.4 Navigation

Aitta et al. (2008) observed that navigability relates to how aware users are of their current location and the ease with which the user can traverse the interface using the navigation tools available.

This study has found that participants' perception of ease of navigation being positive even though there are some negative perceptions associated with problems of absence of aids and exit back features on the interface. This finding is consistent with the research result of Roger (2011) and Nelson et al. (2014), held at the DTU digital library and Jokomo/Yamada digital library, respectively, that concluded system navigation of DL perceived as good by participants although there were some complaints. Therefore, EHLI digital libraries must have to improve their navigational tools so that users do not get lost anywhere, which will in turn improve user satisfaction.

5.3.5 Terminology

This study found that the terminologies used in the DL interfaces and information were standardized terms and with adequate guiding information about the screen. That is why the majority of the responses indicate terminologies used are standardized and easily understandable. These days, academic databases available in the DLs are from well-known producers and publishers who have their own specialists in interface design and used terminologies. The majority of respondents found the terminologies used are standardized and easily understandable. This finding concurs with the findings of other related studies done by Hattink et al. (2016), that indicated the use of simple and understandable language in the interface of the Digital Alzheimer Center where he made his study, has appreciated by the participants.

5.4 Theme 3 Usefulness

As far as usefulness attributes of the DLs are concerned, coverage is the only one that has been perceived negatively by the majority of respondent quotations. Timeliness and level of detail attributes are also in-question since their quotations are somehow equally distributed between positive and negative perceptions. The rest of the attributes of usefulness which are format, relevance, and reliability have been perceived positively. Next, some of the usefulness attributes are going to be discussed.

5.4.1 Format

This study revealed that most of the DL resources are represented in PDF format. The document format most preferred by respondents is again PDF. But the reason for the preference for a

particular format is dependent on the current need of users, that is, for what purpose, users need to use the document. Being easy to use (being easy to operate, magnify, print, edit, highlight), and compatibility (being easily used by different hardware and software platforms, converted to other formats, using with different media) are the reasons for preferring specific document format.

5.4.2 Timeliness

It was observed that timeliness or up-to-datedness of DL resources is in question since almost an equal number of quotation responses were collected for both up-to-date and outdated dimensions. An important point associated with the availability of outdated resources is that, if users did not find up-to date or timely content for their needs, they could tend to use other alternatives, like the World Wide Web (WWW). Samadi et al. (2015) emphasized the importance of timeliness or currency of DL information by stating users always need to know the latest developments in their field of interest, and accessing outdated information may result in users losing interest and trust in the DL collections. Timeliness is also associated with resource type the user needs to use since some users want to get documents published some years back, while others need up-to-date ones. Another perspective respondents forwarded is the problem of finding up-to-date locally published materials. Therefore, DL in EHLI should work hard on updating their resources through subscriptions and collecting recent locally published resources.

5.4.3 Relevance

The relevance of the available resources and services in a DL environment is a key issue for effective use of DLs. Respondents commented on relevance positively, indicating the DL resources were relevant for their information needs. This conclusion corresponds to the findings of Megersa and Mammo in Rosenberg (2008) in their study on evaluating PERI resource use done in Ethiopia. The majority of the respondents asserted that the resources were relevant to their subject interest. Since the purpose of use of DL resources was highly associated with teaching, learning, and research purposes, the relevancy of available resources in this regard is not questionable. But, in light of some respondents, DL resources were relevant, but limited in specific areas, especially not including locally published resources, which was also a problem mentioned under the timeliness attribute. Users' information literacy skills in searching DL content also influences the ability of users to get relevant resources. If users are well experienced in how to

search DL content through the DL system, they can get relevant information for their need and if not, they can fail to get the relevant information. Students associated relevance with information literacy skills and, therefore, DLs should be in a position to provide training to students, especially emphasizing how to use the DL system and access relevant information.

5.4.4 Reliability

Yang et al. (2005, 577) define reliability in terms of credibility, accuracy, dependability, and consistency of information. The reliability of DL collections has been positively addressed by the majority of participants as expressed in their quotations, owing the reputation of publishers and providers, especially of those commercial databases. This finding is in-line with Nelson et al. (2014) work concluded that the majority of users found the information contained in the DL reliable. Associating reliability with the reputation of publishers and providers, some users had mixed feelings, i.e., materials from reputable sources are considered reliable, while others like open accessed and some locally published materials are not reliable, because of being predatory or provided by less or not reputable publishers.

5.4.5 Coverage

Out of the properties/attributes of usefulness, coverage is the only one that has been perceived negatively by the majority of respondents' quotations. This result corresponds to the results of other studies (Megersa and Mammo 2008; Tsakonas & Papatheodorou 2008). When they evaluated PERI resources use and open access digital libraries respectively, they came up with results indicating users' appreciation for most of the usefulness attributes, except coverage attribute with which participants were not satisfied. Reasons mentioned by the participants for DL content coverage limitation were uneven distribution of resources among different disciplines (some disciplines had sufficient collections, while others had small or limited collections), subscription of resources being highly limited to freely accessed materials, restrictions imposed on resources such as copyright and payment, and inadequate budget and funds.

As Samadi (2015) indicated, when the contents of DL are regularly updated, current, and wide ranging in terms of their scope and coverage, its users will be satisfied; otherwise, if the content

coverage of DL is limited or restricted to a certain topic or discipline, then its users will lose their interest to use it.

5.5 Theme 4 Challenge

The challenges encountered and expressed by participants were many and vast in nature. Network problems were mentioned as major constraints expressed as accessibility problems at some university campuses and at home. Frequent network interruption, speed associated with limited bandwidth, and frequent interruptions of electric power are the others. Access restrictions imposed on some DL contents, such as password, payment and property right restrictions were also mentioned as serious challenges on the utilization of DLs. System design problems have also been stated in relation to the absence of user feedback mechanisms and federated search systems. Other access problems mentioned were problems with accessing locally published materials from DLs, and problems of accessing reliable and up-to-date publications.

All challenges or constraints found by the current study correspond with a number of other related studies' findings, specially held at African and Asian DLs. For instance, Chibini's (2011) study established that network delays are commonplace due to low bandwidth, especially when many users are trying to access the Internet at the same time. In addition to the limited bandwidth, power interruptions also had a negative effect on the utilization of electronic information. Gilbert (2015) in his study stated that power outages, network, and connection problems are very difficult in navigating through electronic information resources, and are also problems encountered in using electronic information resources by postgraduate students. Kumar and Singh (2011) in their study also mentioned that many scientists faced the common problems of poor network connectivity. When users do literature searches and/or try to download articles, they find the Internet slow; some of them give up, and this affects DL resource usage. Simon and Ogom (2015) and Konappa (2014) referred to constraints, like slow speed of Internet access, unstable power supply, or frequent power outage, and limited access to available resources, among other problems affecting DL usage. Other problems encountered by DLs as mentioned by Nazir (2014) were awareness, slow bandwidth, coverage, and quality of e-resources. Similarly, Ahmed's (2013) study identified a limited number of titles, limited access to back issues, difficulty in searching information, inability to access from home, limited access to computers, and slow downloading speed as users' major constraints in

using DLs which is also supported by the current study. Odiri (2011) also identified problems of power interruptions that limit students' use of e-resources. Additionally, he stated problems of access to electronic resources due to the cost incurred to access them. According to Musoke and Kinengyere (2008) the high cost of bandwidth remains a major challenge that hampers the full utilization of digital resources.

5.6 Theme 5 Benefit

Enormous benefits of DLs have been mentioned by its users. Easy access of DL content was expressed as a cause for other benefits, like enhancing teaching and research and minimizing resources interms of cost, time and space, and enabling easy sharing of accessed DL contents that correspond to the findings of Simon and Ogom (2015). Simon and Ogom pointed out the enormous benefits of e-resource utilization ranging from academic to social networking and keeping abreast with developments in any field under consideration. They also demonstrated sufficiently the added advantage of having quicker and multiple access to required information from a variety of electronic/digital formats, like e-books, e-journals, e-newspapers/magazines, as well as available platforms, like search engines and online databases.

5.7 Theme 6 Expectation

The majority of the expectations stated by participants were associated with the problems or constraints expressed under the challenge theme and can be used as a remedy or solutions for those challenges. Some very important expectations are resource availability and sustainability, including those resources, restricted for several reasons, availability of locally published materials and for those already accessed contents ensuring their sustainability. Redesigning the DL system to overcome the lack of user feedback and federated search problems, improve the network infrastructure and speed, and providing timely or up-to-dated resources were the major expectations of participants.

Participant expectations with regard to the availability issue were to have access to more resources in addition to currently available freely accessed ones. EHLI universities should subscribe for those resources which are accessible only on payment to cover collections of all disciplines. Some users highlighted the importance of creating a connection among Ethiopian universities DLs to

enable them to share their DL resources. Some other users emphasized the importance of the availability of resources in different formats, such as audio, video, and multimedia.

Giving more emphasis to locally produced and published materials and to materials written in local languages, like research works, project outputs, theses and dissertations done in Ethiopia and incorporating them in the available DL collections were the other participant expectations which support the findings of Lamont (2015) that focus on the importance of collections of local interest.

The sustainability issue was also one of the expectations of users. The DL resources which are now accessible and available freely may not be accessed in the future due to the subscription issue. Since some of the publishers or providers are restricting their publications to be accessed only on payment. Stakeholders in the DL environment, like the Ethiopian Government and universities should be in a position to pay for the resources to maintain their sustainability. Again, since the prices for the resources are too expensive, there should be a national initiative that works on establishing and strengthening a consortium among the university DLs that enables them to share subscription costs.

Other expectations of users are that digital libraries should be equipped with up-to-date and updated collections; the involvement and commitment of the Ethiopian Government and university top level management towards DL improvement is essential; DLs should hold different media collections for their various users, like audio collections to be accessible to disabled users.

5.8 Theme 7 Awareness creation

This study revealed that awareness creation activity is very important for making the DL system easy to use and to properly know and utilize the available DL contents. Gowda and Shivalingaiahs' (2007) findings, highlight the importance of awareness creation, especially for DL users in developing countries, and show that in advanced countries the libraries provide training programs varying from basic DL orientation to an advanced information access techniques is supported by this study. These days, Since DLs are new aspects in developing countries' scenario, awareness creation in relation to marketing/promotion and training on the use of these resources are very important. Therefore, in Ethiopia, each university should design effective marketing and promotion strategies and provide appropriate training to DL users (Hewitson 2002; Megersa and Mammo in Rosenberg 2008).

The importance of awareness creation stated in this study corresponds to several previously undertaken studies. The basic purpose behind promotion is to educate DL users in how to use it and its resources and to keep up their knowledge by providing information appended in various sources available in the DL (Patil & Pradhan 2014). Besides, based upon her research work, Matusiak (2012) advocated better promotion of digital collections and better strategies for gaining the attention of users. Simon and Ogom (2015) pointed out the importance of investment in DLs which has a tremendous impact on teaching, learning, and research. But they stress that effective utilization of available resources will depend to a large extent on awareness creation, that is, the provision of promotion/marketing and training to the user community by the DL staff. Adams and Blandford (2002), Madge (2013), Namugera (2014) also placed emphasis on the importance of awareness creation, on the promotion of DL resources among users, on a marketing approach to users, on their familiarization, and on their training for using the resources. These conditions can increase the degree of usage of electronic information resources considerably.

Therefore, in EHLIs further promotion and marketing of DL services using diverse approaches in order to enhance users' awareness and increase usage of all DL services are highly recommended. This could be done through planned public relation programs, library weeks, study tours, user education programs, library exhibitions, organization of seminars, symposia and workshops, library awards night, and librarians making contacts with the different users. As recommended by

Musoke and Mwesigwa (2012), continuous improvement of the end-user training program needs to be engaged in. Their study clearly showed that there was need to increase the number of regular end-user training programs services for DL users, in addition to the annual library freshman orientation programs. Library user training service is crucial because it is the starting point to orientate and introduce new users to available services, resources, and facilities (Namugera 2014).

5.9 Ethiopian context

This study revealed that awareness creation activity and user information literacy skills are very important issues in making the DL system easy to use and as well to properly understand and utilize the available DL contents and provided services especially in the Ethiopian context. The necessity of awareness creation and user information literacy skills services concepts should be understood in the context of the developing countries like Ethiopia, where lack of user education or awareness creation services and limited user information literacy skills prevails (Gowda & Shivalingaiahs 2007; Megersa & Mammo in Rosenberg 2008).

Access provision can be considered as providing users with free access, or with no user name, password and payment restrictions. In such a case, ease of use becomes simple for the users, otherwise, hardly possible. This statement has a direct relationship with one of the properties of the "Challenge" theme of this study that has been described as payment, password, and copyright restrictions on using the DL system, as being one of the main challenges faced usually in developing countries like Ethiopia (Musoke & Kinengyere 2008; Odiri 2011).

One of the reasons for having limited coverage is related to the library subscription policy, that is, limitation of subscription only to freely accessed resources. It may be the problem of budget and funds, especially for resource constrained countries like Ethiopia which ultimately leads to restriction on resources accessed through payment, making DL coverage limited, and raise the question of sustainability of DL resources.

One of the main challenges that users have mentioned is the network or Internet interruption problem. Network or Internet interruption problem is connected to the frequent electricity power interruptions; but it must also occur in the availability of electricity. This is a common and usual

problem encountered in resource constrained developing countries like Ethiopia. This in turn has a negative impact on enforcing users to use outdated hardcopy resources instead of the DLs. Such and other related problems in resource constrained countries like Ethiopia prompts the need of a framework for digital library evaluation. Therefore, on the process of developing the DL components interaction evaluation framework, (see Section 5.10) the Ethiopian context has been considered and used.

5.10 The proposed conceptual framework

The main objective of this study is to propose contextual conceptual framework for digital library evaluation. This section, therefore, deals with discussing how the framework has been developed, components and attributes of the framework have been formulated, and relationships or interactions of components has been operated.

5.10.1 Digital library components of the proposed framework

In spite of the fact that ITF has strengths and several important features, it has limitations in evaluation researches which are dealing with technical and social impacts of DLs towards the improvement of the daily works of the users. Indeed, the purpose at which ITF has been developed is different from the intention of the present research (the detail has been discussed in Section 2.5.7 of this work). A digital library typically has a social and environmental reliance because its success is influenced by the institutional and social practices and thus it should be well supported by the institution and society within which it exists (Xie and Matusiak 2016). The lack of ITF to support the socio-technical properties of DLs and emergence of new services and technological improvements since its inception (more than 15 years back) necessitated the importance of proposing a framework that emphasizes the social, institutional, and contextual aspects of digital libraries in addition to the ITF's components and their interaction.

As a second step of the study, some of the previously created themes through the lens of ITF were subjected to be described, understood, and classified from the socio-technical perspectives in supporting the realization of the proposed framework. This has been done taking into account the advantages of strong and key features of ITF, the empirical results of this research, and adoption

of bottom-up approach. Thus, Usability, Usefulness and Performance properties of the ITF along with other themes in the context of the developing world were used as diagnostic tools to appraise the proposed framework.

Based on the empirical results of this research and understanding the previously created themes in a socio-technical perspective, the following six broad components of a digital library have been found to be used in the proposed framework. According to the discussions made under Sections 5.3, 5.4, 5.6, 5.7 and 5.9 (Ethiopian context), the components and their attributes, relationships/interactions between the DL user and other components and their attributes are discussed hereafter. The definitions and descriptions provided for the attributes under each component are based on the empirical research results of this study, especially in the Ethiopian context, and according to the documents of the Encyclopedia of HCI (2006), Heradio et al. (2012), Tsakonas and Papatheodorou (2006), Xie and Matusiak (2016) and Zhang (2007).

The following six concepts are being considered as broad components of a digital library.

1 DL User
2 Content and Collection
3 System and Technology
4 User Interface
5 Services and Support
6 Context

Table 5.1: DL components with their attributes

DL component	Attributes of the DL component
DL User	Successfulness/Task accomplishment, Information literacy skills, Learning effects, Acceptance.
Content and Collection	Format, Relevance, Reliability, Timeliness/Currency, Level of detail, Coverage/Scope, Accessibility, Local contents availability, Appropriateness,
System and Technology	Connectivity, Server performance, Network speed, Network accessibility, Network and power interruption, Mobile/ Smart phone support, Interoperability/ compatibility between different systems, Relevance, precision, Recall, Response time.
User Interface	Ease of use, Aesthetic appearance, Learnability, Navigation, Terminology, Consistency, Help function and features.
Services and Support	User satisfaction, E-commerce/ online payment support, Technical support, Open source access support, Availability of DL staff, Follow-up services, Alternate/Offline search, User education, Awareness creation, Information literacy, System feedback, Federated /integrated search, Other special services.
Context	Government/University concern and support, Budget/ Fund, Fundraising/Sponsor, Sustainability, Attitude, culture and concern, Collaboration, Content sharing, Copyright, Staffs and Staff training, Information ethics complaint.

5.10.1.1 Digital library User

This sub-section discusses the DL User, as one of the DL components of the interaction framework as provided in Table 5.1. What and who the DL Users are also to be discussed together with the attributes of DL User.

DL User represents the actors interacting with the system (DELOS 2007). The human elements of DLs involve decisions about content, design, and modification of organizational structures. As stated under Sections 2.3 and 2.3.4, the categories of people in this component include students, instructors, researchers, librarians, repository managers, and system administrators (DELOS 2007, Fuhr 2007, Huang 2014). These groups are presumed to adequately witness whether the system works according to the mission and goals of the digital library. The librarians may choose the content they are concerned in making accessible based on the mission of the parent institution (Heradio 2012, Tsakonas and Papatheodorou 2008).

As stated in the previous paragraph and described under Section 2.5.6, the user concept covers various actors entitled to interact with digital libraries. Digital libraries connect users with information and support them in their ability to consume and make creative use of it in order to generate new information (Fuhr 2007). The user is an umbrella concept, that incorporate all the

ideas related to the representation and management of user entities within a digital library. It encompasses such elements as the rights that users may have within the system and the profiles of the users with characteristics that personalize the system's behavior or represent these users in collaborations (DELOS 2007).

Zhang (2007) has reported attributes of DL user as accuracy of task completion, acceptance, use or intent to use, and satisfaction. All these have been employed as DL User attributes in the formulation of the current framework. Details are discussed in Section 2.3.4 of this manuscript. User evaluation primarily measures the outcome of digital library use in terms of changes in human information behavior, cognitive, decision-making, problem-solving capability and any sentimental differences of a user or group of users. It has also been reported to measure the impact of the DL use on the beneficiaries in terms of tasks at hand, future researches, and an overall effect in work and life (Zhang 2007).

The attributes of DL User in the current framework are to be discussed hereafter. Based on the results of the empirical study discussed in Sections 2.3.1, 4.2, 4.2.2.1, 4.2.2.3, 4.2.2.6, 4.2.7, 5.7 and the referenced literature in Section 2.5, more particularly in 2.5.7 and cited under Section 5.10.1, the attributes for evaluation of DL User are the following:

- Successfulness/Task accomplishment: - the extent to which users complete their information search tasks successfully by using the digital library.
- Information literacy skills: - the extent to which users are able to improve their skills and analytical abilities to evaluate the validity and reliability of information sources after using a given digital library.
- Learning effects: - the extent to which users, who have used a given digital library, are able to have their learning interests increased, critical thinking skills improved.
- Acceptance: - the extent to which users express the willingness of using/reusing a given digital library.

5.10.1.2 Content and Collection

Content and Collection is one of the DL components used in the interaction evaluation framework as provided in Table 5.1. The attributes of this component are to be discussed in this sub-section.

The Content concept encompasses the data and information that the digital library handles and makes available to its users (DELOS 2007). It is composed of a set of information objects organized in collections and represents the available information from the digital library (Zhang 2007). Content is an umbrella concept used to aggregate all forms of information objects that a digital library collects, manages, and delivers (DELOS 2007).

According to DELOS (2004), the main function of any digital library is dissemination of the right content to its community. The dissemination of content in conventional libraries comes in the form of material objects such as books, journals, and audio and video tapes. These material objects are integrated into digital libraries either through conversion or creation of newborn digital objects of the old contents. The digital objects also come in diverse formats of data sets such as table of results, the genomic information for an individual or multimedia information (DELOS 2004).

Zhang (2010) has discussed attributes of Content and Collection to be accuracy, authority, clarity, cost, ease of understanding, informativeness, readability, timeliness and usefulness (details are discussed in Section 2.3.4). Likewise, Tsakonas and Papatheodorou (2006) as well as Heradio et al. (2012) have also described format, reliability, relevance, timeliness, level-of detail and coverage as attributes to be deployed to evaluate Content and Collection (Please, refer Section 4.2.3 for details).

In the present study, the following attributes were found to be used to evaluate the DL Content and Collection usefulness. A detailed discussion on the attributes, however, was made under Sections 4.2.3, 4.2.4, 4.2.5, 4.2.6, 5.4 and 5.7 of this manuscript.

- Format: - is a resource attribute that connects with the user's work practice and/or the available technological infrastructure expressed as being Text, PDF, HTML and RTF. It is

used to assess whether the format of collections in a digital library is compatible with a variety of software and systems for different purposes.

- Timeliness/ Currency: - investigates how current information resource is and how well it will satisfy information needs. It is the extent to which digital information has been kept away from being out of date.
- Relevance/Appropriateness: - denotes how topically content corresponds to the work task. It is the extent to which the digital content is suitable for the domain knowledge and cognitive status of the target users.
- Reliability/ Authority: - investigates how credible the resource is and how well it satisfies present and future aspects of the work task. It is the extent to which the digital content is created by field experts or officials. It is to assess whether the information provided by a digital library comes from trustworthy sources.
- Level of detail: - refers to the various representations of information provided, such as abstract, full text, summary and bibliography.
- Coverage/ Scope: - refers to the depth and extent of the information. It is the degree to which information and contents are presented according to various topics through the DL. It can use to assess the range of topics that are covered by a digital library.
- Accessibility: - entails to a problem of accessing complete contents of publications due to payment or copyright restrictions. It is the measure of whether a person can perform an interaction, access information, or do anything else. It is the extent to which users are free from barriers/restrictions (either physically, financially) to access a given digital service. The restriction could be in time, space, tool, copyright.
- Local contents availability:- assesses the availability of locally produced and published contents and materials written in local languages like research reports, project outputs, theses and dissertations which are produced locally or within Ethiopia.

5.10.1.3 System and Technology

System and Technology, another component of a DL system as provided in Table 5.1 will be discussed here with its attributes.

Digital Library System is a software system which is based on a defined architecture and provides all functionality required by a particular digital library. Users interact with a digital library through the corresponding digital library system (DELOS 2007). As stated in Sections 2.3, 2.3.4, and 2.3.5, System features comprises technology performance (response time, processing time, speed, capacity, and load); process/algorithm performance (relevance, clustering, similarity, functionality, flexibility, comparison with human performance, error rate, optimization, logical decisions, path length, click-throughs, and retrieval time); and overall system maintainability, scalability, interoperability, sharability, and costs (Huang 2014, Xie and Matusiak 2016, Zhang 2010).

Technology refers to technical progress in computing, networking, information storage and retrieval, multimedia and interface design. Digital library users can access DL contents from a number of locations (office, home, dorm or room) with a wide range of computing technology and connectivity such as wireless connectivity and mobile devices (Fox 2015).

The function of technology in a digital environment is to support other elements, including content and service. The utilization of appropriate technology in designing a DL system dictates the level of functionality of the system with respect to digital object processing, organization, protection and distribution. Diverse technologies have been employed to attain DL expansion. These technologies comprise locally created databases, network connections that help access to other databases, computer hardware with audio-visual capability and video conferencing kits (Parida 2004). Technology evaluation assesses how well hardware and software are developed as well as selected for supporting digital library searching (Zhang 2007). Moreover the DL technology supports network, hardware and software support and implementation. As discussed under Sections 4.2.4.1 and 4.2.5.3 of this work, some DL users have mentioned that they use their mobile/smart phones to search, download and store the DL contents they needed while they are in the university campuses when the Internet connection is available, so that they can use it when

they are away of campuses and stay at home where the university Internet connection is not accessible.

The attributes that may be used for evaluating DL System and Technology are described in Sections 2.2, 2.3.1, 2.3.2, 2.3.5, 2.5.6, 2.5.7, 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.3.2, 4.9, 5.7 and 5.10 of this thesis. These attributes are also discussed hereunder as instruments of evaluation or assessment.

- Connectivity: - to assess how stable a digital library system is when connected to other information systems.
- Server performance: - to assess the ability of a server to run a digital library.
- Network speed: - assesses the speed of the network. It is the available bandwidth allotted for the DL use. These have been discussed as network problems expressed in terms of accessibility problems at some university campuses and at home, frequent network interruptions, speed associated with limited bandwidth and frequent interruptions of power as common problems occurring in developing countries like Ethiopia.
- Network accessibility: - assesses the availability or accessibility of university network in all its campuses and also at offices and homes.
- Network and power interruption: - assesses how frequent network, Internet, and power interruption is occurring.
- Mobile/ Smart phone support: - assesses whether the DL technology support mobile/smart phones to access the DL content.
- Interoperability/ compatibility between different systems: - the extent to which a given digital library can work together smoothly with other systems in a technical (software/hardware) sense including federated search, with network facilities and with upcoming technologies. And also the extent to which a given digital library is capable of being integrated with other digital libraries and/or information retrieval systems within an institute in particular with respect to storing, editing and manipulating different contents.
- Relevance: - assesses the similarity between the query term(s) and the retrieved documents that is used to evaluate the performance of the information retrieval system.

- Precision: - assesses precision of the retrieval system. It is a division of the number of relevant documents by the number of those retrieved that also used to evaluate the performance of the information retrieval system.
- Recall: - assesses the recall of the retrieval system. It is a division of the number of relevant documents retrieved by the number of relevant documents that is used to evaluate the performance of the information retrieval system..
- Response time: - time needed to perform a query and to present the results to the user, used to evaluate the performance of the information retrieval system.

5.10.1.4 User Interface

This sub-section discusses and describes one of the DL components known as User Interface and its evaluation attributes that are mentioned in Table 5.1.

Interface is the way a user interacts with a product, what he/she does, and how it responds (Encyclopedia of HCI 2006). Interface is a surface-level representation with which a user interacts in order to use a piece of equipment or a software application with a view to engage in some purposeful task. The purpose of an interface is essentially to facilitate access to the tools functionality.

As stated in Sections 2.3, 2.3.5 and 2.3.6 of this work, Interface evaluation is considered as an evaluation of a software system, as well as a procedure intended to identify and propose solutions for usability problems that may be caused by specific software design. It can mainly evaluate how effective and efficient a DL is in terms of serving users to find the needed information; how well the interface fits the users' understanding, conditions and the information seeking behavior; and how well an interface is designed in relation to its design principles (Zhang 2007).

A digital library interface design has to consider both the needs of users and characteristics of digital collections. Among all the interface components, features to support collection selection, query formulation, results manipulation and evaluation, and help use are vital for digital library interface design (Xie and Matusiak 2016).

Usability evaluation is a critical component of user-centered design and an approach for improving the user interface. Easiness to understand and to use are the keys to the usability of a user interface. Usability of a digital library is associated with its accessibility, in particular how easily users can interact with the interface of the digital library (Chowdhury et al. 2006). Usability is also extended to other measures such as efficiency of interactions, avoidance of user errors, and the ability of users to achieve their goals, affective aspects, and the search context (Xie and Matusiak 2016).

Ease of use, Aesthetic appearance, Learnability, Navigation, and Terminology (collectively referred to as Usability); Consistency; and Help function and Features are found to be the attributes of the User Interface component of the proposed evaluation framework (the detail has been discussed under Sections 2.3, 2.3.2, 2.3.3, 4.2.2, 5.3.1, 5.3.2, 5.3.3, 5.3.4 and 5.3.5). The features and functions of those attributes are discussed here.

- Ease of use: - refers to how easy it is to use all functions provided by the system. It is the easiness to use the system features and processes as well as the extent to which the interface is designed in a way that users can use (or learn to use) it easily.
- Aesthetic appearance: - is the graphical and structural element of the system which may influence the users affectively. It is the extent to which a digital library interface is designed in a very pleasing manner aesthetically.
- Learnability: - is an intrinsic property of usable systems that delivers users from the process of self-instruction or attending structured courses. It is the intuitiveness of a system in learning the user to operate it.
- Navigation: - is the ease of navigation through the system, that is the ability to alter spatial states in an easy and uninterrupted way. It also uses to assess the ways and the extent that the interface supports a user's exploration in a digital library.
- Terminology: - refers to the comprehensibility of terms and phrases used to describe the functions or content. It is the employment of proper terms and phrases for describing screen elements and information.
- Consistency: - assesses whether the design and layout of the interface are coherent across a digital library interface. The extent to which the interface is designed in a manner that all necessary elements (e.g. color, layout, font, background, terminology use) are consistent across all sections and pages.

- Help function and features: - to assess what types of help functions are offered and how effectively, they support users in their help-seeking process.

5.10.1.5 Services and Support

This sub-section discusses and elaborates one of the DL components called Services and Support together with its attributes used for its evaluation as provided in Table 5.1.

Services to users in conventional libraries, such as reference services and selective dissemination of information (SDI), are designed to help users in their efforts to navigate library collections. In the DL system, distant users can also benefit from personalized services such as online reference services which are provided to digital library users in order to resolve their information search problem (DELOS 2004).

The service concept, from the understanding made in Sections 2.3, 2.3.5 and 2.5.5 of this study, consists of supports that a digital library offers to its different users, either in groups or individual users (Zhang 2010). While the expectation is that DLs will be rich in capabilities and services, the minimum functions would include such aspects as new information object registration, search and browse (Huang 2014). Beyond that, the system seeks to manage the functions of the digital library to ensure the functions that reflect the particular needs of a digital library user community and/or the specific requirements related to a DL content (DELOS 2007). Service evaluation also measures how well a digital library may offer extra on-demand assistances (reference, tutorial, term suggestion, and selective document dissemination) to users (Zhang 2007).

Based on the arguments made in Sections 2.2, 2.3.5, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7, 5.7, 5.8, 5.9 and 5.10.3 of this manuscript, the attributes of Services and Support component of a DL are to be discussed hereunder to indicate what they evaluate.

- User satisfaction: - to assess in what ways and to what extent users are satisfied with services provided by a digital library.
- E-commerce/ online payment support: - assesses the availability and capability of the DL system so as to order digital objects online under Ethiopian context.

- Technical support: - refers to the technical supports to be provided by the ICT team for DL and its users.
- Open source access support: - assesses the provision of information content, made freely and universally available through the Internet, usually because the publishers maintain online archives to which access is free or has deposited the information in a widely known open access repository.
- Availability of DL staff: - to assesses in what ways and to what extent a user can easily contact staff of a digital library for questions, feedback, and comments.
- Follow-up services: - to assess in what ways and to what extent adequate and timely continuing services are provided to users by a digital library when necessary.
- Alternate/Offline search: - refers to the availability of offline search services using the Intranet in case when Internet connection is not available.
- User education: - to assess the types of user education offered by a digital library. Especially concepts of awareness creation and information literacy skills should be understood in the context of the developing countries like Ethiopia, which suffers from shortness of awareness and information literacy skills of DL users.
- Awareness creation: - refers to provision of training and education on how to use the DL system and promotion of an arrival and availability of new DL contents.
- Information literacy: - to assess to what extent a digital library enhances users' information literacy skills.
- System feedback: - presence or absence of feedback mechanism or features for the DL user on the DL system.
- Federated /integrated search: - It refers to availability of simultaneous search of multiple online databases. Meta searching, enhances the capability of the users in searching many information resources from one platform. Federated search, thus, helps to assess whether a digital library offers an integrated search environment for different collections within a digital library system.
- Other special services: - assesses the availability and functionality of any additional services.

5.10.1.6 Context

Likewise to other DL components, Context has its own attributes (Table 5.1) wherein the in-depth discussion has been made in Sections 2.2.1.4 and 2.2.1.5 of this manuscript. The functionality of these attributes in evaluating a digital library are to be explained henceforth.

Context is the state of the user, state of the physical environment, state of the computational environment, and history of user computer- environment interaction (Lieberman and Selker 2000). In other ways, one can say the context of the system encompasses, Who is a DL user? When a user operates it? Where the user operates it? Why or under what conditions the user activates the system? or What stimulates the use (Encyclopedia HCI 2006).

It has also been discussed earlier in this study under Sections 2.3 and 2.5.8, that Context assesses a DL how well it fits into bigger institutional, social, cultural, economic and legal contexts or practices and what influences and effects the digital library may have on those contextual practices (Zhang 2007).

Based on the discussions made under Sections 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.2.7, 5.4.5, 5.7, 5.8 and 5.9, the following attributes were found to be used for the DL context evaluation.

- Government/University concern and support: - refers to the concern or attentions given by top leaders of universities towards the development and sustainability of DLs.
- Budget/ Fund, Fundraising/Sponsor: - it can be considered as allocation of substantial budget by top management and availability of fund for the DL. It is to assess the amount, arrangement and distribution of monetary resources to be used by a DL. It also includes assessing the efforts of DL management on preparing fundraising events to support a DL financially.
- Sustainability: - is the presence of sustainability plans. It measures the extent to which it is affordable for an institute to develop, subscribe, and maintain a digital library in financial and technical aspects, since the DL resources that are accessible now and freely available may or may not be accessed later in the future for many reasons including lack of subscription.
- Attitude, culture and concern: - refers to the attitude of the users towards the DL system and content use. The attitude may include the idea of “Google has everything” and using

google instead of DLs, and undermining the importance of contents because they are available freely. The culture of users including techno-phobia, computer addiction and accessing unethical sites can be considered as cultures and concerns of users.

- Collaboration: - to evaluate ways and extents to which DL stakeholders collaborate among themselves.
- Content sharing: - to assess in what ways and to what extent stakeholders of DL are willing to share their content.
- Copyright: - assesses the extent to which a given digital collection has no offense against copyright. It also helps to assess whether a digital library identifies and conforms to copyright issues.
- Staff and Staff training: - assesses the quantity, qualification and arrangement of human resources in managing DLs efficiently and providing trainings to DL staff.
- Information ethics complaint: - it is to assess whether a DL identifies and conforms to ethical issues related to its creation and use as well as presence of copyright policy. It also helps in assessing issues regarding plagiarism, privacy of users and virus attacks.

5.10.2 Description of the DL Interaction Evaluation Model

The interactions (relationships) that exist between the DL user and other DL components through their attributes are indicated in Table 5.2. The relationships expressed by the attributes are centered on the DL users, i.e. the relationship of attributes of the five DL library components to the DL user. DL Components Interaction Evaluation Model is depicted in Figure 5.1 and the detailed interaction of DL components with the DL User is explained in the subsequent paragraphs.

Table 5. 2: DL user interaction and relationship with other DL components and their attributes

DL component	Attributes of the interaction
Content and collection	Usefulness (format, timeliness/currency, relevance, reliability, level of detail, coverage/scope), accessibility, appropriateness.

System and technology	Connectivity, network speed, network accessibility, network and power interruption, mobile/smart phone support, Performance (relevance, precision, recall, response time).
User Interface	Usability (ease of use, aesthetics, navigation, learnability, terminology), consistency, help function and future.
Services and support	User satisfaction, e-commerce/online payment support, technical support, open source access support, availability of DL staff, follow-up services, alternate/offline search, user education, awareness creation, system feedback, federated/integrated search, information literacy skills, other special services.
Context	Attitude culture and concern, copyright, staff and staff training, information ethics complaint, budget/fund, fund raising.

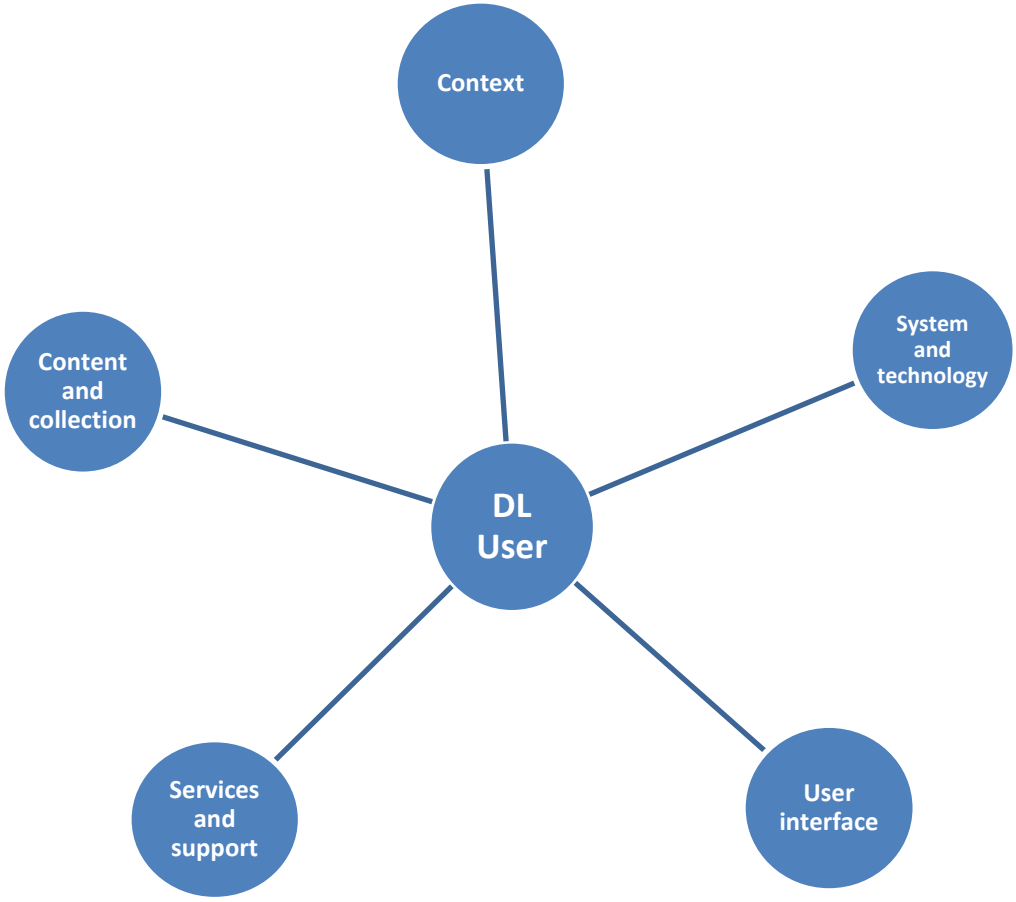

Figure 5.1: DL Components Interaction Evaluation Model

The DL Components Interaction Evaluation Model of the present study constitutes six components that are represented with circle shapes. The straight lines represent the existence of interaction/ relationship between the DL user and the other DL components. The texts that touch the straight lines entail us the interaction evaluation general criteria. As it can be observed from the interaction

evaluation model in Figure 5.1 and Table 5.2, the major components of the interaction process are: the DL user, Content and collection, User interface, System and technology, Services and support and Context. This study focuses on the evaluation of DLs from the DL users' perception of their interaction with other DL components and determines the relationships between the six components to be used for digital library evaluation. The proposed model is based on components interaction centered on the DL user. As it is depicted in the interaction mode, DL user interacts with all other five components that, intern, are expressed by five broad criteria, namely, Usability, Usefulness, Performance, Availability and quality and Influence. The model also provides evaluation attributes to each category. The interaction or relationship of the DL user to the User interface is expressed as 'Usability', to the Content and collection as 'Usefulness', to the System and Technology as 'Performance', to the Services and support as 'Availability and Quality' and to the Context as 'Influence'.

In general, the DL user is the first poll of the interaction process and its characteristics are complex and constantly growing. That is why the interaction modeling and evaluation is being considered as a difficult task (Heradio, 2012). The collapse of spatial and temporal barriers has made the extraction of sound user information difficult. Even in more specific evaluation projects, where research parameters are constrained, the number and the attributes of the users are several and complicated (Heradio 2012, Tsakonas and Papatheodorou 2008)

The DL user is a controversial entity, because it does not only include end users of a digital library, but also developers of a system (librarians, computer scientists). This difference is necessary since in modern digital library systems, these roles may overlap, and the end user may participate in the development process of a digital library content. However, the end users' involvement with a digital library evaluation process is dictated by the need that feeds the information seeking process. Developers on the other hand have a primary need of the completion of a set of tasks. Therefore, the DL user is subjected to be evaluated by his/her interaction with the other DL components.

5.10.3 Interactions between components of the DL model

Under this section and its subsections, the five interaction evaluation criteria are being discussed. As stated under Section 5.10.1 and depicted in the interaction evaluation model (Figure 5.1), the interaction criteria are Usefulness, Usability, Performance, Availability and quality and Influence.

The Oxford English Dictionary (2006) defines interaction as 'reciprocal action; action or influence of persons or things on each other' and includes the HCI definition limiting the scope to information processing and flow of information between computer interfaces and the people.

The term interaction is the situation in which the entities do participate in several cycles of action that in turn induce changes in those entities. More practically, when human information interaction is discussed in the information and computer science literature, humans do something typically repetitive (e.g., click, read, respond, and click again). Humans practice use of different information each time regardless of changes in the object used (Ju and Albertson 2018). The process that users search or collect information in DLs is fundamentally an interactive process. Previous studies have shown that user interaction plays an important role in DL evaluation (Fuhr et al 2001; Tsakonas, Kapidakis, & Papachristopoulos 2004; Fuhr et al. 2007). Users' perception of their interaction with DL components also affects their subsequent evaluation of DL performance. Therefore, it is necessary to examine the relationships between user interaction and DL evaluation from the users' perspective.

5.10.3.1 Usefulness: Interaction between DL user and Content and collection

As stated under Section 4.2.3 of this work, Usefulness is the degree to which a specific information item will serve the information needs of the user. Usefulness answers the questions whether DLs support users' information needs and work completion. In general, usefulness refers to the quality of being useful or to what extent something is useful. It is the quality that makes a thing useful or suitable for a given purpose, advantage, worth, and utility. It is actually the act of using or the state of being used to satisfy required needs (Tsakonas & Papatheodorou 2006).

The definition of a digital library's collection is context based (topic, format), that may be dictated upon local conditions and the individual digital library's policy. In addition, when considering collection use in various environments, the quality of the collection is very essential to information

access and locating digital library materials through the networked information retrieval environment (Zhang 2007).

Digital libraries host and manage different kinds of resources, and simultaneously create and administer surrogate formats for the finding and retrieval of those resources. The main responsibility of digital libraries is to enable users to interact with available contents. Content is the main reason for interacting with a digital library. This component addresses the user's information needs decision. The relation that maintains with the user is strongly dependent on higher level needs, an informational one (Heradio 2012, Tsakonas and Papatheodorou 2008). The interaction of the DL user with the content is mainly expressed and evaluated by the contents' usefulness to the user. The appropriateness of content to the users' information need is striking, so the perceived usefulness of content is the first selection criterion for the user. Other attributes that arise from the nature of the content are, the level of information, type of resources and quality of resources (Ju and Albertson, 2018).

Xie (2006) has developed user-centered evaluation criteria for digital libraries and has also introduced the importance of collection quality and usability to be the most important evaluation criteria and considerations of users. Xie (2008) in her subsequent study has reconfirmed her previous findings through user testing and identified collection quality as epicentral to digital libraries and to be important criteria for user-centered evaluation. Collection quality is conceptualized as the extensiveness, comprehensiveness, credibility, currency, and lack of bias of a digital library collection.

In general, the interaction of the DL user with Content and collection component is expressed as Usefulness, that is to say, as discussed in Sections 2.5.6 and 4.2.3 of this study and also stated in Figure 5.1, the usefulness of the Content and collection of the DL remains to be the main reason for its utilization by the DL user in order to satisfy the user's information needs so as to accomplish her/his task. Usefulness of the Content and collection is expressed by Relevance, Timeliness, Coverage and Reliability, and its quality for the DL user. Therefore, Usefulness can be used as criteria for the DL Content and collection evaluation through the stated attributes under it.

5.10.3.2 Performance: Interaction between DL user and System and technology

The system is the well known components of the interaction activity, because it is governed by the underlying principle of the developer. It consists of a variety of subsystems that perform diverse operations. The main important subsystem, certainly, is the information retrieval (IR) mechanisms which is the essential functionalities that permit the user to interact with the system and retrieve the preferred contents. The evaluation of IR mechanisms is expressed as performance of the system and is under the well-known terms of precision, recall, relevance and response time. All of them are influencing the interaction process, not only on a task completion, but also on a point of user satisfaction (Sastry and Reddy 2009).

A digital library system includes individual characteristics that may affect users' intention to adopt and use of particular technologies. A fundamental purpose of any interactive information retrieval system is to enable users to fulfill their information needs and accomplish tasks. Accordingly, features and functions of a given system, as provided to users, and the usefulness and supportiveness of the system's characteristics include key components of the user-to-system interaction experience. Moreover, the relevance and significance of retrieval functionality are necessary in order to fully examine users and the influences they made on their use of retrieval systems in digital libraries (Ju and Albertson 2018). Other subsystems include set of supplemental functionalities like networks that let the DL user to access the available contents, that may be evaluated in terms of network accessibility, interruption, bandwidth and speed.

In conclusion, the DL user interacts with the System and technology component and the interaction can be best expressed as Performance of the System and technology that is used as criteria for its evaluation. The DL user must interact with the System and technology component of the DL to retrieve, access and use the Contents and collection of the DL. If the DL information retrieval system, networking and other software and hardware parts perform well in the process of user’s searching and browsing activities, then the DL user is likely in need of using it repeatedly. As discussed in Section 2.5.6 of this work and indicated in Figure 5.1, System and technology Performance can be evaluated in terms of Relevance, Precision and Recall of the IR system, among others. Performances of other System and technology parts are subject to be evaluated in terms of

Network performance, Network speed, Network and power interruption and Mobile phone support.

5.10.3.3 Usability: Interaction between DL user and User interface

As discussed under Section 2.3.2 of this work, Usability is a quality attribute that assesses how easy user interfaces are to use. Usability is defined the "capability in human functional terms to be used easily and effectively by the specified range of users, given specified training and user support, to fulfill the specified range of tasks, within the specified range of environmental scenarios" (Chowdhury 2012). Furthermore, usability of a digital library is related primarily to its accessibility. In other words, it relates to how easily users can interact with the interface, how easily they can find useful information and how easily they can use the retrieved information to accomplish their specific tasks (Silva and Wijayaratne 2015).

Digital libraries are not used in isolation, rather they are built up with many components. User Interface is one of major component that affect the use of it. The user interface system has gained much consideration due to the fact that it influences the usability, which in turn is a key factor for the success of a digital library. Digital libraries are essentially interactive systems with a stable growth of the number of end-users. They must not only rely on effective and sophisticated retrieval mechanisms, but also provide efficient interaction with the end users (Sastry and Reddy 2009).

The user interface of a system should support different tasks. Most users perform a variety of tasks and they may be experts or novices. In addition to providing assistance when requested, the system should recognize and predict the user's goals and offer assistance to make the task easier. Preferably, assistance should improve the user's knowledge that could allow to accomplish the tasks quickly (Sastry and Reddy 2009). Among supportive technologies, user interface is most closely connected to users' information-seeking activities. According to Saracevic (2001), it is the place where the user and system conversation takes place. Moreover, through the interface, users can interact with the DLs for the purpose of accessing and using the DL Content and collection.

User interfaces' usability facilitates the needed interactions of users as per their own physical, social, and cultural environments and needs (Ju and Albertson 2018). Regarding the user interfaces

of digital libraries, Xie (2008) identified interface usability as the most important evaluation category which is based on users' own self-perceived ratings. She has further included wider concepts such as interface usability, search and browse functionality, navigation, help features, view and output options, and accessibility.

By and large, the DL user interacts with the interface of the DL. The DL interface enables the user to access the contents and collection and use the available services and support of the DL. As discussed in Section 2.5.6 of this thesis and shown in Figure 5.1, this interaction can be expressed as Usability. Under Section 5.10.3 of this work, Usability of the DL interface for the user, i.e., the easiness of using it to access the needed information on the way to satisfy the DL user, is vital to evaluate the DL through attributes of Usability such as, Ease of use, Terminology, Learnability and Aesthetics.

5.10.3.4 Availability and quality: Interaction between DL user and Services and support

This interaction criterion is understood as evaluating the available DL Services and support and the quality of the Services and support provided to the DL users that enable users to access and use the DL Content and collection ultimately satisfy their information needs.

According to Bernard (2006) relationships among producers, users, documents, and technologies are key elements for better DL services and supports, since the basic principle of digital library services is to satisfy users' needs. Identifying user needs to provide new services and extend the existing ones are important. Research on digital library and services are being conducted frequently to upgrade the services and start new ones (Roopa and Krishnamurthy 2017).

The advent of digital resources available in varied forms such as e-journals, e-journal databases, e-book databases, web-blog, information on websites, institutional repositories and information on the Internet, have raised challenges to digital libraries to manage the information resource potentially customized to the needs of users. In order to meet these challenges, digital services need to be provided in the shortest possible time. As it is stated under Section 4.2.7, research and practice in digital libraries have made way for modern services and exploded many issues in digital library, including infrastructure, creating awareness, providing training to the user community. All

can be evaluated by the availability of those services (Sastry and Reddy 2009). Services provided for users are those functions of the digital library in which users have direct interaction either with the resources in the library or with the librarians (Roopa and Krishnamurthy 2017).

Lastly, as discussed in the above paragraph, another DL component users interact with is the Services and support provided by the DL to the DL user. If the DL user has decided to use the DL, then, s/he should interact with and utilize the services and supports provided by the DL. As stated in Figure 5.1, this DL component can be evaluated through Availability and also Quality of the services and supports provided to the DL user. Means, the availability of different services and also the quality of the services that the users interact with are used as criteria for evaluating the DL through the stated attributes under Section 5.10.1 of this thesis as User satisfaction, E-commerce/ online payment support, Technical support and Open source access support.

5.10.3.5 Influence: Interaction between DL user and Context

The Influence interaction criteria is understood and used to evaluate how and to what extent the social, environmental and technical contexts of the DL influences the DL user when interacting and using it.

As discussed under Section 5.10.1.6 of this thesis, Context refers to the situation within which something exists or happens, and that can help explain it. It is a special situation or condition where the research is practiced. It can be seen with regard to societal, organizational, or institutional situations. It is to assess the extent to digital libraries fitting into, responding to and following larger context, such as institutional, economic, legal and cultural (Xie and Matusiak, 2016). This study focuses on social and technical context of the members of an organization who use digital libraries and how the context influences digital library user in an interaction process (Li and Liu 2019). Context is what people experience and influenced by while interacting with the digital library. DL users may not be able to label that experience as context, but they can certainly experience the forces at play in all of their interactions with the social world and try to respond to

those forces by some taken-for-granted actions (Li and Liu 2019). In this work, the following two sub-themes of context were identified and explained hereunder.

- Technical context: refers to the technological situations or conditions of a country, organization, or institution that should be considered in undertaking the research (Xie and Matusiak, 2016). Technical context is used to collect data from system users in relation to the status of the network in the DLs including network accessibility, network interruption, power interruption, and network speed and DL system design features such as availability of system feedback features to collect information from DL users and system's implementation of federated search engine, availability of E-commerce, technical support from the IT staff and open access or open source service support were used for evaluating the technical aspects the DLs.

- Social context: looks for societal conditions, including social, organizational, or institutional related issues where the research is undertaken (Xie and Matusiak, 2016). It is important to gather user data in relation to resources access restrictions (associated with property right, budget/funds availability); collection sustainability; availability of locally produced information resources; influence or impact of users' attitude and culture on DL use, and the top managements concern for DLs; unethical threats on using the DLs; awareness creation practice by DL staff for DL users in terms of providing training or user education and marketing or promotion; staffing and staff training; information literacy skills of users on using the DLs; collaboration of the DL with other stakeholders and DLs and content sharing among them.

In general, Context is another DL component that is essential for DL evaluation. The DL user interacts with and also influenced by the specific contexts of the DL on the process of utilizing it, that can be expressed as a social and technical context and Influence is the interaction criteria for its evaluation. The DL user can be influenced positively or negatively by the context where the DL exists and therefore, this interaction can be seen and evaluated through the influence of the social and technical context of the DL on the DL user as discussed in Section 5.10.1.6 above and depicted in Figure 5.1. The evaluation can be performed using the attributes of Influence of the

context on the DL user as: Government/University concern and support, Budget/ Fund, Fundraising/Sponsor, Sustainability, Collaboration and Content sharing.

5.11 Chapter conclusion

This chapter has discussed on the findings of the study in detail in relation to other similar and related study results available in the literature, which increases the trustworthiness of the study. The second part of this chapter has been dealt with constructing and proposing a conceptual framework suitable for the context of developing world DL evaluation. The DL Components Interaction Evaluation Framework was developed based on the combination of findings of the empirical usability and usefulness research, specifically provided under Sections 5.10.1.1 to 5.10.1.6, 5.10.2, 5.10.3.1 to 5.10.3.5, Table 5.1, Table 5.2 and Figure 5.1 of this manuscript. The proposed DL components interaction evaluation framework has been discussed in detail in terms of the DL components, their attributes, the interaction of the components and their criteria of evaluation. The next chapter states the importance and contribution of the current study, the study limitations, forward important recommendations to be implemented in the future and a general conclusion.

CHAPTER SIX

6 CONCLUSION

6.1 Introduction to the chapter

This chapter summarizes the purpose of the study, empirical study results especially from the perspective of answering each and every research questions, possible contributions of the study in filling the gaps on existing knowledge as well as IS and DL evaluation researches, limitations encountered in the study, forwarded recommendations towards future researches and effective implementation of DL, and an overall conclusions made on this work, consecutively.

The main objective of this research was to propose a conceptual framework after evaluating the usability and usefulness dimensions of the Ethiopian Higher Learning Institutes DLs from the users' perspective in the Ethiopian context. Accordingly, the framework has been established from

the outcomes of the empirical research of the study. This empirical research, in its turn, was maintained by employment of an ITF model and considering the Ethiopian scenario or context. Moreover, the process of conceptual framework realization has involved on: the background of the researcher's technical, research, and experiential knowledge; existing literature on the DL evaluation; and frameworks used in DL evaluation.

Research questions of this study have been prompted so as to infuse a novel knowledge in the area of DL evaluation. Led by those critical research questions, the present study has come up with the following results that served as the basis for the construction of the proposed DL components interaction evaluation framework.

6.2 Answers to research questions

The main research question of this study was: **what is an appropriate evaluation framework for digital libraries in the context of EHLI?** It is worth, however, to answer research sub-questions before answering the principal research question. The following section is thus summarizes the answers or findings of every sub-questions that are analyzed and interpreted in depth in chapter four.

6.2.1 Answer to the first sub-question

Research sub-question 1. For what purpose do EHLI digital library users use the digital library resources, whose outcomes support the construction of the proposed evaluation framework?

Based on the collected data and discussed under Sections 4.2.1 and 5.2, this study has found out that the DL is mainly used for teaching, learning, and research, followed by self- updating purposes. A single respondent may mention multiple purposes or reasons for using the DLs. For instance, an instructor could use DLs for teaching or research purposes and for self-update purposes. Self-update was found to be highly related to teaching and research because after updating oneself in DL contents of respective fields of study, an instructor would update his teaching deliveries and research works. Librarians use the DLs for providing services to other DL users. One of the services provided by librarians is educating users how to use the DL system

simply known as “awareness creation” expressed as provision of training and marketing or promotion. Therefore, user education or awareness creation has a strong relationship with DL use, that is, users can use the DL system and services for their different purposes. Awareness creation and user education were found to be vital for DL users in developing countries like Ethiopia, wherein the experiences of trainings and marketing or promoting DL uses are little.

6.2.2 Answer to the second sub-question

Research sub-question 2. What is the composition of users’ views on the usability of digital libraries, which are essential to develop an evaluation framework in EHLI context?

As provided under Sections 4.2.2 and 5.3 of the current study that is based on the collected data, as far as the usability of DLs is concerned, all its attributes/properties have been perceived positively by the majority of the quotations of respondents. Ease of use as one of the attributes of usability, has been perceived positively by the majority of the participants. Another attribute of usability that has been perceived positively by respondents was Aesthetic appearance. Usability properties “ease of use” and “aesthetics” have a relationship or overlap with each other on evaluating user friendliness of the interface.

Participants perception towards the learnability of the DL system was positive. Ease of use and learnability were related to each other through Federated search engine dimension since it can be

used to evaluate both. It also was found that participants' perception of Ease of navigation is positive even though there are some negative perceptions associated with problems of absence of aids and exit back features on the interface. Majority of the participants had also shown positive feelings about the terminologies of DL interfaces, as being standardized and easily understandable terms by the users, and having enough guiding information about the screen. Task accomplishment which is another property properties of usability, has also been expressed positively by respondents in terms of the provision of different search options. The majority of the usability attributes have been found to be associated with or influenced by awareness creation , i.e., training on the DL system use and promotion/marketing of the DL system and contents, level of users' information literacy skills in using the DLs (being information literate versus illiterate user), and implementation of Federated search engine. Awareness creation and information literacy skills, in particular, require contextual understanding in the developing countries where in user education or awareness creation and user information literacy are deficient.

6.2.3 Answer to the third sub-question

Research sub-question 3. What is the composition of users' views on the usefulness of digital libraries, that are essential to develop an evaluation framework in EHLI context?

Based on the collected data and discussed under Sections 4.2.3 and 5.4 of this research, Coverage was found to be the only attribute of usefulness to be negatively perceived by the majority of respondent quotations. The given reason behind DL content coverage limitation include uneven distribution of resources among different disciplines (some disciplines may have sufficient collections while others are having little or none); limitation of resource subscription to the freely accessed materials only; imposed restrictions on copyright and payment materials and inadequate budget and fund problems. Remarkably, most of the DL resources were observed to be found in a PDF format. The most preferred document format by respondents was also a PDF type. But the reasons for a preference for a particular format/s are dependent on the current needs of users, that is, for what purposes users need the document. Timeliness and level of detail were among the attributes in-question since the quotations are somehow equally distributed between

the positive and negative perceptions. An important point mentioned on the availability of outdated resources was that if users did not find updated content for their needs, they tend to use other alternatives, such as World Wide Web (WWW) that decreases utilization of DL resources. Timeliness was associated with the resource type as the need of some users could be for dated-back publications while others go for recent ones. Another perspective that respondents put forward was the problem of finding locally published updated materials. Respondents expressed relevance positively referring the relevance of DL resources for their information needs. Based on reputations of the publishers and providers of commercial databases, reliability of DL collections has been witnessed positively by the majority of respondents. The level of detail or availability of resources in different depths (abstract, summary, full text, bibliographic) in DLs has been perceived as dependent on restrictions imposed on the resources and the importance of the specific details for the user. In addition, usefulness attributes were found to have several relationships with other attributes of the study.

6.2.4 Answer to the fourth sub-question

Research sub-question 4. What are the challenges users experienced while using the digital libraries and how are the challenges unique for EHLI digital library users, whose results are used as an input for coming up with the proposed evaluation framework?

The challenges encountered and expressed by participants were many and vast in their nature. This issue has been discussed under Sections 4.2.4 and 5.5 of this manuscript. Network problems expressed in terms of accessibility problems at some university campuses and at home, frequent network interruptions, speed associated with limited bandwidth, and frequent interruptions of power were the common problems encountered in the study areas as in many developing countries. These hassles compel the DL users to look for other sources including www.

Imposed restrictions such as password, payment, and property rights so as to access some DL contents were reflected as a serious challenge for DL users. The access restrictions can be observed in relation to several properties of usefulness theme. For instance, if the current contents are denied due to those restrictions, users will be obliged to use outdated resources which, in turn, affect the up datedness property of the collections. Again, if the documents from well reputed journals, publishers, and providers happen to be restricted, this can enforce the users to use materials from less or non-reputed sources that directly affects the reliability and relevance of the resources. Due to imposed restrictions, users may be limited to access only abstracts or other fragmented parts of resources and this conversely affects the level-of detail and coverage properties of the DL collections. The access restriction problems lead users to use other available online resources with a consequence of under-utilization of the DLs. Finally, the payment restriction has a negative association with the sustainability of DL resources. If the user or the DL fails to pay for those resources, the sustainability of the resources becomes questionable~~;~~ unless and otherwise the resources are accessed freely.

System design problems were also stated as the absence of user feedback mechanisms and federated search systems. The mentioned system problems have relations with some properties of

usability theme like ease of use as the absence of federated search and feedback features, navigation through lack of alternate search and help in the interface, decrease the attractiveness and user friendliness of interface affecting the aesthetic appearance, and as a result of the above problems unsatisfactory task accomplishment may happen. Attitudinal (concerns given to DLs) and cultural problems were the other challenges pointed out by participants. Challenges like plagiarism, privacy, and the spread of viruses were problems rarely mentioned.

6.2.5 Answer to the fifth sub-question

Research sub-question 5. What benefits do EHLI digital library users gain by using their digital libraries, that are helpful for constructing the evaluation framework?

Many benefits of DLs have been mentioned by participants as discussed under Sections 4.2.5, and 5.6 of this study. Easy access of resources is an important benefit of using DLs, especially; free access to DLs can be seen as a special privilege for developing countries like Ethiopia where budget limitation is not uncommon. The DL resources being easily sharable among researchers, instructors, and students are also dependent on the ease accessibility of the resources with an ultimate benefit of enhancing teaching, learning, and research. Other advantages or benefits of DLs are their capacity of minimizing resources in terms of cost, space and time. Minimizing cost refers to accessing DL contents for free or with least cost from any part of the world, which is an important benefit for developing countries like Ethiopia encounters scarcity of hard currency for subscribing resources of a DL system. Space minimization did rule out the need for a big room or physical space of the traditional libraries. Saving the time of the user is another benefit of DLs since there is no need of going to the library physically because a user may access materials from any parts of the world in minutes. The benefit of enhancing teaching and research has an association with one of the usefulness categories called relevance. Relevant DL documents for users can enhance their teaching, learning, and research activities. Easy access of DL contents was expressed as a triggering factor for other benefits including enhancing teaching and research, minimizing resource and enabling easy sharing of the accessed DL contents. Benefits of easily accessing DL resources in its turn may induce other benefits. For instance, a DL resource should

primarily be easily accessible before it is going to be shared. Moreover, this minimizes resource in terms of time, cost, space and ultimately enhances researches and teaching processes.

6.2.6 Answer to the sixth sub-question

Research sub-question 6. What are the specific and contextual expectations of EHLI digital library users from their digital libraries, whose outputs can be used as an important ground for constructing the proposed evaluation framework?

A number of relationships have been observed to exist between expectation and other attributes of the study. The expectations are discussed under Sections 4.2.6 and 5.7 of this manuscript**.** The majority of the expectations stated by participants were associated with the problems expressed under the "challenge" theme and can be used as a remedy or solution for the challenges. Improvement on an existing network infrastructure was key among the expectations of some users. This include: expansion of network infrastructure to all university campuses, offices, and student centers; having well-experienced and responsible manpower in network implementation; and an immediate maintenance in order to facilitate fast, reliable, and uninterrupted Internet access. More important expectations were found to be resources availability including payment bailouts for unrestricted uses, availability of locally published materials, and sustainability of already accessed contents possibly through ~~a~~ national DL consortium. Redesigning DL system to overcome the absence of user feedback and federated search problems; improvement of network infrastructure and speed; and provision of timely and updated resources were the major expectations of participants that were related either directly or indirectly to properties of usability, usefulness, and challenge themes.

6.2.7 Answer to the seventh sub-question

Research sub-question 7. What are the components of the digital library evaluation framework?

The main goal of this study is to develop and propose a digital library evaluation framework suited for developing world context. Accordingly, DL Components Interaction Evaluation Framework has been developed based on the findings of the empirical usability and usefulness researches, specifically discussed and provided under Sections 5.10.1, 5.10.2, 5.10.3, Tables 5.1 and 5.2; and Figure 5.1 of this manuscript. The framework consists of six DL components, named as; DL User, Content and Collection, System and Technology, Services and Support, User Interface, and Context. The interaction of the DL User with the remaining five components have been used to construct the envisaged framework which became an interactive DL evaluation framework. As it has been discussed in Section 5.10.3, Usefulness, Usability, Performance, Availability and Quality, and Influence were found to be the results of the interaction of the DL User with Content and Collection, User Interface, System and Technology, Services and Support, and Context, respectively.

Coming back to the beginning of this chapter, **What is an appropriate evaluation framework for digital libraries in the context of EHLI?** was the main research question and answered in the established contextual DL evaluation framework, that has been discussed in detail on the basis of the results of the empirical researches or aforementioned answers of research subsections (please, refer Section 5.10, Tables 5.1 and 5.2, and Figure 5.1 of this manuscript), indeed, aided with consulted literature that were dictated by the Ethiopian context.

6.3 Contribution of the research

Keeping in mind that the prime objective of the study in designing a contextual framework to the developing world, the established digital library evaluation framework would serve as an indispensable tool in evaluating digital libraries in those parts of the world where in the service is juvenile and with lots of impediments compared to the developed world. This evaluation framework, thus, can be considered as a step forward in enhancing the quality of digital library services in the developing world. This entails to the capacity development of universities and other service providers in those parts of the world towards their effort in building up of knowledge, which is an ultimate weapon to attain in their journey to alleviate development bottlenecks. Infusing a digital library evaluation framework tool to the DL system in countries similar to Ethiopia, by and large, enormously supports their effort towards development.

It enriches the scanty literature source of resource constrained countries including Ethiopia. Subsequently, helps to fill the knowledge gap in the process of digital libraries system evaluation schemes to put in place the quality of digital library services. It is also doubtless that it helps to lift up the satisfaction level of the users, service providers, and all the stakeholders.

The established framework in this study provokes scientific interest among the researchers in the subject area. It provides information to the developed world researchers who are unaware of the true scenario of the study area. Apart from bridging the information gap, such a contribution would help in exchanges of experiences, especially with the developed world. It provides scientific information to all who are involved in the domain of Information System.

Not only the output of this research but also the adopted methodologies and approaches would give an insight and serve as a reference for young researchers to make similar efforts in the context of their respective countries across the developed world, for both qualitative and quantitative researches. It also initiates formulation of research problems, helps in extracting research questions that were not answered in this work, and serves as cross-reference for academicians and researchers in the discipline.

Besides the general advantages, this study contributes in introducing techniques that may be explained in terms of the expanding and contextualization of the Interaction Triptych Framework

(ITF) which has been used as initial research framework in this study. As discussed under Section 2.5.7 of this study, ITF does not try, however, to understand and evaluate DLs as socio-technical systems with their technical and social perspectives. The lack of ITF in supporting the socio-technical properties of DLs as well as emergence of new services and technological improvements did necessitate the importance of constructing contextual evaluation frameworks that would address the social, institutional, and contextual aspects of digital libraries. Accordingly, the present study has established and forwarded a digital library evaluation framework that considers the social and technical perspectives of the developing world digital libraries. It takes and uses some important features of ITF by expanding and contextualizing it to fit the socio-technical perspectives of those parts of the globe.

The information and experiences to be gained from the present study could provide useful knowledge concerning user perceptions, needs, expectations, and behaviors regarding EHLI digital libraries. This in turn would enhance an efficient utilization of digital resources, assist vendors and practitioners, and improve or update services. Apart from efficient utilization of resources, the outcome of this study helps users, donors, sponsors, librarians, managers, and other relevant stakeholders in making decisions for the betterment of the service.

By and large, the outcome of this research along its methodologies contribute in building up of knowledge and thus help in propelling efforts of development; providing tool for quality digital library service; satisfying DL users, service providers and all other stakeholders; providing and filling information and its gap; serving as cross-reference for academicians and researchers in the discipline; introducing techniques that may be explained in terms of the expanding and contextualization of the Interaction Triptych Framework (ITF); making decisions and solving managerial issues in DL system of the developing world; and providing an overall scientific interests and merits for the advancement of Information System.

6.4 Research limitations

Because of resource and time limitations, this study has not included private EHLIs. Instead it has selected and carried out its work on four public universities in the study country. It would have been worth including private universities and more number of public universities, resource had not been a limitation. Similarly, focus group discussions were not held due to resource constraints and time inconveniences of the respondents.

According to the Interaction Triptych Framework (see figure 2.2) that classifies DLs into three components (user, content, and system), this study has been confined in evaluating specific components of the DLs, that is, the interaction between system and user as usability evaluation, and the interaction between user and content as usefulness evaluation. The interaction between system and content as performance evaluation has been dropped out because it requires a laboratory based research on information retrieval.

6.5 Recommendations

It is recommended that Federated/integrated search should be given important attention and be implemented by EHLI digital libraries to allow more comprehensive searching and browsing in order to boost usage levels and to avoid confusions of DL users that may possibly arise from the growth of different types of databases which are produced by different suppliers that can come with numerous interfaces and logins. This can ultimately fill the existing gap between DL users and today's digital libraries.

EHLI digital library designers need to improve their navigational tools that help users not to get lost, enhance their satisfaction, and encouraging them to work hard. They also should make an effort on updating their resources through subscription and collecting locally published recent materials, thereby widening the coverage of their collections to accommodate a variety of disciplines on their universities.

For solving network related problems, university ICT staff should be on standby status to troubleshoot the problems and provide power supply units for their routers and servers. The network infrastructure problem, in case of some campuses not yet connected to the university network, the problem of accessing the DLs being outside of the university campuses, controlling

the use of social media and other unwanted sites, and the local network interruption and speed problems should be handled by the universities ICT staff through improving the network infrastructure, creating and updating access and restriction policies i.e., imposing controlling and security mechanisms on unnecessary or unethical sites by giving priority to DL usage, and maintaining the local network interruption and speed problems. Universities should also possess their own power generators to overcome power interruption problems. Strengthening the infrastructure of the telecommunication system, leasing high bandwidth for university networks from service providers (Ethiotelecom in this case) are some of the measures that need to be taken to deal with the problems.

To overcome the subscription problems, especially in developing countries like Ethiopia, the top level managements of the universities should give due attention to their DLs and assign a reasonable budget to enable DLs subscribe the most important but restricted for payment documents or publications. Secondly, universities should be able to establish and strengthen collaboration among themselves and with national library consortium that could enable them to an organized subscription to be shared later after arrival. This would help avoiding repetition of subscriptions, encountering the problem of an ever increasing cost of publications and maintain their sustainability..

It is recommended that DLs in countries like Ethiopia should meet the requirements of the order of the day. To equip the digital libraries with updated collections and enhance their services, an involvement and commitment of the government and university officials is of paramount importance. Digital libraries should hold different media collections, like audio collections to be accessible by disabled users. Besides, DLs in the higher learning institutes of Ethiopia should step up the promotion and marketing of their services and resources in order to enhance user awareness and increase utilization of their facilities.

In conclusion, this work hardly claims that it has exhausted all digital library evaluation issues of the developing world. However, it recommends further studies to explore the issues of accessibilities and utilizations of DLs in relation to disabled users, distance education or continuous adult educations, and private higher learning institutions. As it has been stated under

Section 1.5, the primary objective of the study is to provide a conceptual framework for user centric DL evaluation that best fits the context of Ethiopia as a developing country, with an assumption of the importance of the findings of the usability and usefulness study with regard to their implications in the Ethiopian context. Furthermore, implementing the proposed evaluation framework and assessing its functionality will be a duty left to be accomplished by succeeding researchers. Therefore, researchers who need to undertake digital library evaluation study in the developing and resource constrained countries are recommended to take this work as a corner stone for an efficient implementation of this proposed contextual DL evaluation framework.

6.6 Conclusion

The purpose of this study was proposing a DL evaluation framework that will be implemented in the context of resource constrained countries like Ethiopia. To come up with contributed knowledge, "the evaluation framework", first, an empirical research on evaluation of usability and usefulness in EHLIs DLs was held. Based on the combination of findings of the evaluation study and the information provided under Sections 5.10.1.1 to 5.10.1.6, 5.10.2, 5.10.3.1 to 5.10.3.5, Table 5.1, Table 5.2 and Figure 5.1 of this manuscript, the DL components interaction evaluation framework has been realized and proposed.

In this work, it was tried to fill the knowledge gap that exists in IS and DL research arena through developing a contextual DL evaluation framework, which has not been done before and can be used by DL evaluation researchers. The study is also essential to be used as a reference for other scholars who wish to do similar or related research in different contexts especially through implementing the proposed framework. Finally, from the outcome of this empirical study, users, donors, sponsors, and librarians can make different decisions on using the resources, sponsoring the initiatives, and improving the rendered services.

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APPENDESIS

APPENDEX- A

Participant information sheet and informed consent form

Dear participant,

My name is Newayneh Ketsela Gilats. I am a PhD research scholar in the field of Information Systems at the University of South Africa (UNISA). Currently, I am an instructor in The University of Gondar, Department of Information Technology. I am doing qualitative research entitled 'User-centered usability and usefulness evaluation of digital libraries in Ethiopia' as a requirement for my PhD study.

The purpose of this research is to evaluate the usability and usefulness of the Ethiopian Higher Learning Institutes' digital library resources from the users' perspective in the Ethiopian context in order to get a clear idea of how they are benefiting research and academia. Insight gained from such a study can provide useful knowledge that would supplement the best utilization of e-resources, to help vendors and practitioners implement the acquired knowledge to improve and update services, and prioritize management and implementation decisions.

You have been selected purposefully as one of the study participants since I believe your participation and contribution for the research will be significant.

Your participation in the study will involve an interview with estimated length of an hour or an open ended questionnaire with similar questions as included in the interview. You can choose which of these techniques you would prefer.

As a participant, please be informed that:

You are encouraged to ask questions or raise concerns at any time about the nature of the study or the methods used. Please contact me through the following addresses.

E-mail knewayneh2@gmail.com
Tel. +251924469410

With your permission, the interview will be audio recorded to help me accurately capture your insights in your own words and will be used for transcription purpose only. The recording will only be heard by me for the purpose of this study. If you feel uncomfortable with the recorder, you may ask that it be turned off at any time.

Participation in the study is completely voluntary. If you don't wish to continue, you can stop the interview. You can also refuse to answer any interview and open ended questions you are not comfortable with.

Your data will be handled confidentially. When results of this study are published or presented, individual names and other personally identifiable information will not be used. Instead, pseudo names and codes will be used to minimize the risk of identification.

A copy of this consent form should be provided to you.

Thank you for your participation.

By signing this consent form I certify that I _____ agree to the terms of this agreement.

_____ _____

Signature Date

APPENDEX- B

Interview guide

Good morning. How are you?

My name is Newayneh Ketsela. I am a PhD research scholar in the field of IS at the UNISA. I am also an instructor in the University of Gondar, Department of IT. I am doing qualitative research entitled 'User-centered usability and usefulness evaluation of digital libraries in Ethiopia' as a requirement for my PhD study.

The purpose of this research is to evaluate the usability and usefulness of the EHLIs' DL resources from the users' perspective in the Ethiopian context in order to get a clear idea of how they are benefiting research and academia. Insight gained from such a study can provide useful knowledge that would supplement the best utilization of e-resources, to improve and update services, and prioritize management and implementation decisions.

The interview will take an estimated length of an hour.

Before we begin the interview, I would like to confirm that your participation in this study is entirely voluntary, that you don't have to speak with me if you don't want to, that you may refuse to answer any questions, and that you may withdraw from the study at anytime.

All the information that you share with me today will be kept confidential. Nobody will know that it was you who said these things.

I am going to record our discussion so that I can be clear — later on — on what we talked about. Nobody will be able to recognize your voice, and your words will be written onto paper without your name on it. Is that all right with you?

Here is a copy of an information sheet and informed consent form that explains the reasons for the study. You can go through it right now if you like.

In that case, when this type of research project is done, the participants are always asked to sign a consent form so that the information from the interview can be used in the study.

Do you have questions about the research before we proceed?

Now, for the record, my name is NK. We are sitting in the xxx, on today May xx, 2015 and the time is xx AM. The first thing I would like to talk to you about today is:

1 Please briefly introduce yourself in terms of your name, gender, background, work experience, and position in the university.

2 For what purpose do you use the digital library resources?

3 Questions on the usability of the digital library system.

3.1 How do you feel about the ease-of-use of the digital library in general? (The easiness to use system features and processes).

3.2 How do you perceive the aesthetic appearance of the interface of the digital library? (The graphical and structural elements of the system).
Is the main menu a clear list of all the functions available?
Is the interface easy to use, intuitive, and simple?

3.3 How do you perceive the learnability of the system?
The easiness of a system to the user in learning to operate it,
Memorizing the system when reusing it after a certain period of time.

3.4 What is your opinion on the ease of navigation through the system? (The ability to traverse a site using available navigation site tools like back button and links).

On intuitiveness of navigation,
Provision of aids to navigation,
Easiness to get back to the 'home page' to a search screen if you have been lost anywhere,
Easiness to log off or exit.

3.5 How would you describe the terminology used in the system? (The comprehensibility of terms and phrases use to describe screen elements, functions, information content etc.)
Does it use standardized terms or any jargon?
Does it describe the functions of screen elements (screen tips)?

3.6 How do you feel about accomplishment of your task effectively using the digital library?
Enabling different types of search for different skill levels and preferences,
Various options for searching like A – Z list, search by subject, or general search.

4 Questions regarding the usefulness of the digital library system.

4.1 What do you think about the availability of the digital library contents in an adequate format like text, pdf, rtf, etc. (The availability of content in an information medium)?
What format/s do you prefer?
Why do you prefer these formats?

4.2 How do you perceive the timeliness (up-to-datedness, currency) of content of the digital library resources? Are they updated regularly?

4.3 How would you describe the contents of the digital library resources in terms of relevance to your information need? (The subject proximity of the resource to the information needs; how the content corresponds to the work task).

4.4 What do you feel about reliability of the content of the digital library resources?
How do you trust it?

How do you believe the reputability of the content creators, i. e publisher or provider? Are they clearly identified?

What about the authority of the resource or its academic credentials?

4.5 What is your opinion on the level of detail of the information, i. e. the various representations of information provided such as abstract/summary, full text, bibliography, etc?

4.6 May you tell me please, about the coverage of the DL resources? (The temporal aspects of information resources in the digital library).

How do you perceive the digital library resources being wide, deep, complete, sufficient/full information relating to a particular topic?

5 What are the major challenges (problems) you have experienced in accessing and using resources of the digital library system?

6 In your opinion, what are the positive and negative aspects of the digital library system?

7 Tell me about your general expectations (what you expect) from the digital library system?

8 Do you have any other comments that have not been mentioned yet?

Well, thanks for taking your time to talk with me today. I really appreciate it.

END OF INTERVIEW

APPENDEX- C

Interview field note

1 Date and time of interview_____

Interviewer_____

Site/location of interview_____

Interviewee code_____

Interviewee gender_____

Interviewee background_____

Interviewee work experience_____

Interviewee status/position _____

Duration of interview_____

2 Overall impressions about each interview

Does the interview take longer than expected?

Do any questions need to be clarified or reworded?

3 Notes on usability questions

3.1

3.2

3.3

3.4

3.5

3.6

4 Notes on usefulness questions

4.1

4.2

4.3

4.4

4.5

4.6

5

6

7

8

APPENDEX- D

Open-ended questionnaire

Participant information sheet and informed consent form

Dear participant,

My name is Newayneh Ketsela Gilats. I am a PHD research scholar in the field of Information Systems at the University of South Africa (UNISA). Currently, I am an instructor in The University of Gondar, Department of Information Technology. I am doing qualitative research entitled 'User-centered usability and usefulness evaluation of digital libraries in Ethiopia' as a requirement for my PhD study.

The purpose of this research is to evaluate the usability and usefulness of the Ethiopian Higher Learning Institutes' digital library resources from the users' perspective in the Ethiopian context in order to get a clear idea of how they are benefiting research and academia. Insight gained from such a study can provide useful knowledge that would supplement the best utilization of e-resources to help vendors and practitioners implement the acquired knowledge to improve and update services and prioritize management and implementation decisions.

You have been selected purposefully as one of the study participants since I believe your participation and contribution for the research will be significant.

Your participation in the study will involve answering an open ended questionnaire for estimated length of an hour.

As a participant, please be informed that:

You are encouraged to ask questions or raise concerns at any time about the nature of the study or the methods used. Please contact me through the following addresses.

E-mail knewayneh2@gmail.com

Tel. +251924469410

Participation in the study is completely voluntary. If you don't wish to continue, you can stop it. You can also refuse to answer any open ended questions you are not comfortable with.

Your data will be handled confidentially. When results of this study are published or presented, individual names and other personally identifiable information will not be used. Instead, pseudo names and codes will be used to minimize the risk of identification.

Thank you for your participation.

Open-ended questionnaire

1 Please, may you briefly introduce yourself in terms of your

Name:_____

Gender:_____

Background:_____

Work experience:_____

Position in the university:_____

2 For what purpose do you use the digital library resources?

_____

_____

_____

_____

_____

3 Questions on the usability of the digital library system.

3.1 How do you feel about the ease-of-use of the digital library system in general? (The easiness to use system features and processes).

3.2 How do you perceive the aesthetic appearance of the interface of the digital library? (The graphical and structural elements of the system).

Is the main menu a clear list of all the functions available?

Is the interface easy to use, intuitive, and simple?

3.3 How do you perceive the learnability of the system? (In terms of operating it, and memorizing it when you reuse after a certain period of time).

3.4 What is your opinion on the ease of navigation through the system? (The ability to traverse sites using available navigation site tools like back button, links, and exit).

3.5 How would you describe the terminology used in the system? (The comprehensibility of terms and phrases use to describe screen elements, functions, information content etc.)

Does it use standardized terms or any jargon?

Does it describe the functions of screen elements (screen tips)?

_____

_____

3.6 How do you feel about accomplishment of your task effectively using the digital library?

_____

_____

_____

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_____

Enabling different types of search for different skill levels and preferences,

_____

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Various options for searching like A – Z list, search by subject, or general search.

_____

_____

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_____

4 Questions regarding the usefulness of the digital library system.

4.1 What do you think about the availability of the digital library contents in an adequate format like text, pdf, rtf (The availability of content in an information medium).

What format/s do you prefer, and why you prefer the format/s?

4.2 How do you perceive the timeliness (up-to-datedness, currency) of content of the digital library resources? Are they updated regularly?

4.3 How would you describe the contents of the DL resources relevancy to your information need? (The subject proximity of the resource to the information needs; how the content corresponds to the work task).

4.4 What do you feel about reliability of the content of the digital library resources? (in terms of trust, reputability of the content creators, publishers, and providers).

4.5 What is your opinion on the level of detail of the information, i. e. the various representations of information provided such as abstract/summary, full text, bibliography, etc?

4.6 May you tell me please, about the coverage of the digital library resources? (In terms of being wide, deep, complete, sufficient/full information relating to a particular topic).

5 What are the major challenges (problems) you have experienced in accessing and using resources of the digital library system?

6 In your opinion, what are the positive and negative aspects of the digital library system?

7 Tell me about your general expectations (what you expect) from the digital library system?

8 Do you have any other comments that have not been mentioned yet?

APPENDEX- E

Observation field note

Project: User centered usability and usefulness evaluation of digital libraries in Ethiopia

Date and time of observation_____

Duration of observation_____

Site/ place of observation_____

Observer _____

General information on the physical description of the setting.

Check the availability of:

Internet services

Number of devises

Number of users

Ergonomic matters

Staffing

Summary on the usability of the system as observed

Narrative on what has been observed (observer comments)

APPENDEX- F : Ethical clearance

UNISA | college of science, engineering and technology

Dear Mr Newayneh Ketsela Gilats (49118900)

Date: 2015-03-03

Application number:
022/NKG/2015

REQUEST FOR ETHICAL CLEARANCE: (User-centered usability and usefulness evaluation of digital libraries in Ethiopia)

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your research study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CRIC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:
http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that the ethical clearance is granted for the duration of this project and if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Prof Ernest Mnkandla
Chair: College of Science, Engineering and Technology Ethics Sub-Committee

Prof IOG Moche
Executive Dean: College of Science, Engineering and Technology

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Abstract

This thesis evaluates Ethiopian higher learning institutes' digital libraries (DLs) for their usability and usefulness. The outcome contributes knowledge by helping to propel development efforts; satisfy DL stakeholders; provide information and fill information gaps; serve as cross-reference for academicians and researchers in the discipline; make decisions and solve managerial issues in DLs of the developing world; and provide scientific interests and merits for the advancement of information systems.

When undertaking usability and usefulness evaluation research in DLs, there is no agreed-upon established conceptual framework that guides researchers in the developing world. Therefore, the overall objective of this research is to propose a framework for DL evaluation that fits into the context of developing countries. As the study is concerned with users' internal attributes, the interpretive research paradigm is applied. A qualitative research approach is employed and a case-study research design is followed. Multiple data-collection techniques, namely semi-structured interviews (17 respondents), open-ended questionnaires (17 respondents) and observations (4 observations) are employed. The study encompasses four public university DLs in Ethiopia.

The participants have a positive perception of all attributes of usability. Most of the attributes of usefulness are also perceived positively, except coverage. The major challenges encountered by participants are network accessibility, interruption and speed, and access restrictions imposed on some DL content. DL benefits include easy access to the DL content, enhanced teaching and research, lower cost and easy sharing of contents. The expectations of users are ensuring resource availability and sustainability, overcoming the absence of user feedback and federated search problems, and improving network infrastructure and speed.

The interaction triptych framework (ITF), which is used in the current study, is a well-known framework that is commonly implemented by researchers. However, since it does not incorporate the contextual situation of developing countries, ITF has some limitations. Therefore, based on the output of this empirical research and considering the usability and usefulness themes of ITF and its relationships with other socio-technical and contextual themes, a contextual DL evaluation framework is proposed. The proposed framework emphasises the social, institutional and contextual aspects of DLs. The proposed framework has six DL components, namely: DL user; content and collection; system and technology; services and support; user interface; and context. The proposed framework is called a digital library components interaction evaluation framework.

KEY TERMS:
Contextual digital library evaluation, digital library evaluation, digital library evaluation framework, digital library evaluation in Ethiopia, evaluation framework for digital libraries, framework for digital library evaluation, information system evaluation, usability evaluation, usefulness evaluation, user-centred evaluation.

<<TRANSLATION – 2 PAGES- IsiZulu >>

OKUCASHUNIWE

Lo mqondo uhlaziya imitapo yolwazi yedijithali (i-DLs) yezikhungo zokufunda ephezulu zase-Ethiopia ngokusebenziseka kwazo nokuba wusizo. Umphumela unikela ngolwazi ngokusiza ukuhambisa imizamo yentuthuko; ukwanelisa ababambiqhaza be-DL; ukuhlinzeka ngolwazi nokugcwalisa izikhala zolwazi; ukusebenza okubhekiswe kukho kwezifundiswa nabaphenyi emkhakheni; yenza izinqumo futhi ixazulule izingqinamba zokuphatha kuma-DL wezwe elisathuthuka; futhi unikeze izintshisekelo zesayensi kanye nokufaneleka ekuthuthukisweni kwezinhlelo zolwazi.

Lapho wenza ucwaningo lokusebenziseka neliwusizo okuhlaziya kuma-DL, akukho luhlaka lomqondo okuvunyelwene ngalo oluhola abacwaningi ezweni elisathuthuka. Ngakho-ke, inhloso ephelele yalolu cwaningo ukuphakamisa uhlaka lokuhlaziya kwe-DL oluhambisana nomongo wamazwe asathuthuka. Njengoba ucwaningo luphathelene nezimpawu zangaphakathi zabasebenzisi, inqubo yocwaningo ehumushekayo iyasetshenziswa. Indlela yokucwaninga esezingeni elifanele iyasetshenziswa bese kulandelwa ukwakheka kocwaningo lwesifundo. Kusetshenziswa amasu amaningi wokuqoqa imininingwane, njengezingxoxo ezihlelwe kahle (abaphenduli abayi-17), imibuzo evulekile (abaphenduli abayi-17) kanye nokubhekwayo (okubhekwayo oku-4). Lolu cwaningo luhlanganisa ama-DL amane wemfundo ephakeme yomphakathi wase-Ethiopia.

Abahlanganyeli banombono omuhle wazo zonke izici zokusebenziseka. Iningi lezimpawu eziwusizo zibonwa kahle futhi, ngaphandle kokumbozwa. Izinselela ezinkulu ababambiqhaza abahlangabezana ngazo ukufinyeleleka kwenethiwekhi, ukuphazamiseka nejubane, nemikhawulo yokufinyelela ebekiwe kokunye okuqukethwe kwe-DL. Izinzuzo ze-DL zifaka ukufinyelela okulula kokuqukethwe kwe-DL, ukufundiswa okuthuthukisiwe nocwaningo, izindleko eziphansi nokwabelana okulula kokuqukethwe. Okulindelwe abasebenzisi ukuqinisekisa ukutholakala kwezinsiza nokusimama, ukunqoba ukungabi bikho kwempendulo yomsebenzisi nezinkinga zokusesha ezihlanganisiwe, nokwenza ngcono ingqalasizinda yenethiwekhi nejubane.

Uhlaka lokusebenzisana lwe-*triptych* (ITF), olusetshenziswa ocwaningweni lwamanje, uhlaka olwaziwa kakhulu olusetshenziswa ngokuvamile ngabaphenyi. Kodwa-ke, njengoba lungafaki isimo somongo samazwe asathuthuka, i-ITF inemikhawulo ethile. Ngakho-ke, ngokuya ngokukhishwa kwalolu cwaningo olunamandla kanye nokubheka ukusebenziseka nosizo lwezindikimba ze-ITF kanye nobudlelwano bayo nezinye izingqikithi zomphakathi nezobuchwepheshe nezingqikithi zomongo, kuhlongozwa uhlaka

lokuhlaziya lomongo lwe-DL. Uhlaka oluhlongozwayo lugcizelela izici zenhlalo, zesikhungo nezingqikithi zomongo zama-DL. Uhlaka oluhlongozwayo lunezingxenye eziyisithupha ze-DL, okuyilezi: Umsebenzisi we-DL; okuqukethwe neqoqo; uhlelo nobuchwepheshe; izinsizakalo nokwesekwa; isikhombimsebenzisi somsebenzisi nomongo. Uhlaka oluhlongozwayo lubizwa ngohlaka lokuhlaziya kokusebenzisana kokuqukethwe komtapo wolwazi wedijithali.

KEY TERMS:

Contextual digital library evaluation

Ukuhlaziya komongo womtapo wolwazi lwedijithali

digital library evaluation

Ukuhlaziya komtapo wolwazi lwedijithali

digital library evaluation framework

Uhlaka lokuhlaziya umtapo wolwazi lwedijithali

digital library evaluation in Ethiopia

Ukuhlaziya komtapo wolwazi e-Ethopia

evaluation framework for digital libraries

Uhlaka lokuhlaziya lwemitapo yolwazi

framework for digital library evaluation

Ukuhlaziya uhlaka lomtapo wolwazi

information system evaluation

Ukuhlaziya uhlelo lolwazi

usability evaluation

Ukuhlaziya kokusebenzeka

usefulness evaluation

Ukuhlaziya kokuwusizo

user-centred evaluation

Ukuhlaziya okugxile kumsebenzisi

<<TRANSLATION – 2 PAGES- Afrikaans >>

Opsomming

Hierdie proefskrif evalueer Ethiopië se hoër leerinstellings se digitale biblioteke (DBe) ten opsigte van hulle bruikbaarheid en nuttigheid. Die uitkoms dra by tot kennis wat kan help om die ontwikkelingspogings aan te dryf; om belanghebbers van digitale biblioteke tevrede te hou; om inligting te verskaf en inligtingsgapings te vul; deur te dien as kruisverwysing vir akademici en navorsers in die vakgebied; om besluite te neem en bestuursaangeleenthede in digitale biblioteke van die ontwikkelende wêreld op te los; en om wetenskaplike belange en meriete vir die bevordering van inligtingstelsels te voorsien.

Wanneer bruikbaarheids- en nuttigheidsevalueringsnavorsing in digitale biblioteke onderneem word, is daar geen ooreengekome, gevestigde raamwerk wat leiding aan navorsers in die ontwikkelende wêreld kan gee nie. Die algehele doelwit van hierdie navorsing was derhalwe om ’n raamwerk vir die evaluaering van digitale biblioteke voor te stel wat in die konteks van ontwikkelende lande pas. Omdat die studie gemoeid is met gebruikers se interne eienskappe, is die vertolkende paradigma gebruik. ’n Kwalitatiewe navorsingsbenadering is gebruik en ’n gevallestudie-navorsingsontwerp is gevolg. Veelvuldige data-insamelingstegnieke, naamlik semigestruktureerde onderhoude (17 respondente), oop vraelyste (17 respondente) en waarnemings (vier waarnemigs), is ingespan. Die studie sluit vier openbare universiteite se digitale biblioteke in Ethiopië in.

Die deelnemers het ’n positiewe persepsie van al die eienskappe van bruikbaarheid. Die meeste van die eienskappe van nuttigheid word ook as positief waargeneem, met die uitsluiting van voorsiening. Die grootste uitdagings wat die deelnemers ervaar het, was netwerktoeganklikheid, -onderbrekings en -spoed en die toegangbeperkings wat sommige digitale biblioteke oplê. Voordele van digitale biblioteke sluit die volgende in: toegang tot digitalebiblioteekinhoud; beter onderrig en navorsing; laer koste; en die maklike deel van inhoud met ander. Die verwagtings van gebruikers verseker hulpbronbeskikbaarheid en -volhoubaarheid, en om die afwesigheid van gebruikersterugvoer en gefedereerde soekprobleme en die verbetering van netwerkinfrastruktuur en -spoed te oorkom.

Die interaksietriptiekraamwerk (*ITF*) wat in hierdie studie gebruik is, is ’n bekende raamwerk wat algemeen deur navorsers geïmplementeer word. Omdat dit egter nie die kontekstuele situasie van ontwikkelende lande inkorporeer nie, het ITF sekere beperkings. Gebaseer op die uitset van hierdie empiriese navorsing en met die inagneming van die bruikbaarheids- en nuttigheidstemas van ITF en sy verhouding met ander sosio-tegniese en kontekstuele temas, word ’n kontekstuele digitalebiblioteekraamwerk derhalwe voorgestel. Die voorgestelde raamwerk beklemtoon die sosiale, institusionele en kontekstuele aspekte van digitale biblioteke. Die voorgestelde raamwerk het ses digitalebiblioteekkomponente, naamlik: digitalebiblioteekgebruiker; inhoud en insameling; stelsel en tegnologie; dienste en ondersteuning; gebruikerkoppelvlak; en konteks. Die voorgestelde raamwerk word ’n interaksie-evalueringsraamwerk vir digitalebiblioteekkomponente genoem.

SLEUTELTERME:
Kontekstuele digitalebiblioteekevaluering, digitalebiblioteekevaluering, digitalebiblioteek-evalueringsraamwerk, digitalebiblioteekevaluering in Ethiopië, evalueringsraamwerk vir digitale biblioteke, raamwerk vir digitalebiblioteekevaluering, inligtingstelselevaluering, bruikbaarheidsevaluering; nuttigheidsevaluering, gebruiksgesentreerde evaluering