

# Usability of Social Tags in Digital Libraries for E-Learning Environment

PhD Thesis

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**DEDICATION**

*To my mother's dearest soul,  
I am indebted to her for all what I know in my life and for making me the  
person that I am now 'the person that she would be proud of'. May ALLAH  
grand her paradise.*

*To my beloved husband,  
**Abdullah Bajahzar**, for his endless love, support and patience  
Without him nothing would have ever happened.*

*To my father **Ali** and my mother **Hyatt**;  
for all their prayers and unconditional love. Thank you for all what you  
have done for me.*

*To my lovely children **Mohammed, Sahar, Raiyd, Majed and Ali**,  
who filled me with happiness, joy and courage, especially during stressful  
times.*

*To my Dearest sisters **Salwa ,Khlood and Arwa** ,  
who believed in me and my ability to finish this study and supported me  
throughout the years.*

**DECLARATION**

I declare that the work presented in this thesis is original work undertaken by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degrees or qualifications. It is submitted for the degree of Doctor of Philosophy, at the Software Technology Research Laboratory, Faculty of Technology, at De Montfort University.

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## **ABSTRACT**

This study contributes to the academic literature concerning social tag systems for digital libraries, addressing the identified information gap from the user's perspective. It defines social tagging tools and tests users' perceptions about possible practices. Moreover, it evaluates the effect when using social tagging systems in digital libraries, to assess whether such a system enhances the search process, and to identify whether there is any significant relationship between using social tagging systems in digital libraries and user satisfaction.

Although developments in the field of social tags have been significant in recent years, there remains an open question regarding their usability, particularly in the context of digital libraries. Therefore, there is a need for further investigation, exploration and evaluation, and so this work contributed to this by exploring the usability of social tagging in digital libraries in terms of accuracy for research, user satisfaction and adoptability. For this study, Saudi students were given the opportunity to use the system in the United Kingdom, and their experiences, and opinions regarding ease of use and adoptability were then analysed to determine if they would assist digital libraries in Saudi Arabia to achieve their educational goals and to ensure user numbers would not decrease.

A quantitative approach and a qualitative approach were combined to collect and analyse the data used in this research. The two approaches were conducted in sequential phases. In the first quantitative phase, assessment measures were administered to Saudi students using library websites while studying in the UK. Data was collected from 175 participants, and statistical analysis was conducted using SPSS. Cross tabulation was also used to describe the numerical data and a chi-square analysis was conducted to determine the relationship between the various study variables. In the follow-up

qualitative phase, semi-structured interviews were undertaken with 15 Saudi students, to explore the proposed hypothesis in depth. This data was then thematically analysed.

Results concerning the usability of social tagging in digital libraries obtained in western universities cannot be generalised to Saudi Arabian universities, because the context of Saudi Arabia differs culturally and academically (Alsurehi & Al Youbi, 1014). To address this, the study utilised a sample of Saudi Arabian students, who had had the opportunity to experience using social tags while studying abroad, specifically in the United Kingdom. Their experience might potentially be very important and this research could be considered a first attempt to examine the usability of social tags in digital libraries. Since to date few empirical studies have directly addressed the usability issues raised here in Saudi Arabia, this research also offers a contribution in this area. In addition, although this study relates to the Saudi perspective, the findings can also be considered valuable to Arab countries sharing similar cultural and academic traditions.

## PUBLICATIONS

1. Baslem, A. and Bajahzar, A., ‘Social Tag System in Digital Library’, the 8th Saudi International conference, in *proceedings of ICT Workshop in Imperial College*, London UK, 2015.



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## **CHAPTER 1**

### **INTRODUCTION**

This chapter provides an overview of the study, explaining its significance and the researcher's motivation to conduct it. It explores the scope of the thesis and the research questions, outlining the research methodology and the thesis structure.



## 1.1 PROBLEM STATEMENT

Traditionally, a library contained many books stocked on shelves in a large venue, and the reader was personally expected to examine shelves manually to search for a specific book. Movies were also stocked in libraries and accessed manually. The traditional structure of libraries meant that library users encountered a number of challenges, which were exacerbated by the need for authentication for various library based services, linguistic pluralism, and the growth of higher education.

Library based services were swiftly improved and adapted as advancements in technology offered options to do so; this reduced the need for manual searches, replacing them with easier and more reliable options. The introduction of digital libraries has also resulted in significant improvements. In order to provide excellent retrieval services at minimal cost, digital libraries rely on efficient and accurate diagnostic processes. Indisputably, such processes should not be overly difficult for the user to employ. To facilitate user access, a new interactive approach to information retrieval is the application of data tags to sources in the digital library environment by library users themselves; this is a form of so-called 'social tagging', and forms the subject of this thesis.

The second problem that had to be overcome was linguistic pluralism. While English is historically the language of libraries, especially in the UK and other English-speaking countries this reality poses problems to some non-English speaking international students. A reasonable estimate suggests that at least 20% of UK university students, such as those at De Montfort University, are non-native speakers of English, which inhibits their access to and utilisation of library services. To address this issue, this research hypothesises that social tagging could be introduced at libraries to meet the needs of non-English speaking users.

The third problem that libraries have encountered has been the increased uptake of higher education. As elsewhere internationally, in Saudi Arabia there has been an increase in the levels of student enrolment. In many cases, the growth in numbers has not been effectively matched by a growth in infrastructure, which has resulted in congestion in physical libraries. This research contends that not only can social tagging alleviate authentication problems and linguistic pluralism, but it can also help manage the demands on infrastructure proceeding from the expansion of the higher education sector.

Although enormous strides have been made in recent years in the field of social tags, there remains an open question regarding their usability, particularly for accessing digital libraries. Therefore, there is a need for further investigation, exploration and evaluation. The work described in the following chapters explores the usability of social tagging in digital libraries in terms of the accuracy of research, user satisfaction and adoptability from the user's perspective. Some Saudi students have had the opportunity to use this system in the United Kingdom, and so their experiences and views regarding the adoption of the system will be analysed to determine if their knowledge could assist digital libraries in Saudi Arabia to achieve their educational goals, and to manage the fall in user numbers.

## **1.2 BACKGROUND**

Over the past two decades, libraries have reacted rapidly to the enormous changes to the information landscape, as Seaman (2003) argued. Libraries have willingly adopted technological developments; the first such adoption being the use of typewriters instead of handwriting when recording the details of books. Later, photocopiers and mimeograph machines were adopted, with the result that access to books improved. After this, faxes were used in order to send and receive documents. Seaman (2003) further explained that, once available, the option of creating online catalogues on

mainframe computers was widely preferred, leading to the facilitation of networked technology to transfer information from one place to another. Based on this description of the adoption of technologies by libraries, it is reasonable to conclude that libraries are flexible, open to change, and willing to adopt useful developments to facilitate ease of use.

According to Borgman (1999), the introduction of computers and the Internet transformed the world extensively, with important consequences for libraries. It facilitated the creation of newer more modern libraries and enabled the modernisation of current libraries. It also led to scholarly and professional interest in the concept of the digital library, which developed rapidly throughout the 1990s (Borgman, 1999). During the 1990s, and at the beginning of the 21st century, multiple conferences were held regarding the digital library, and associated topics were introduced at these meetings (Fox et al., 2002). Some of the new digital libraries are vertical (holding collections associated with a specific research topic), whereas others are horizontal (holding collections on multiple topics).

A digital library is essentially an information retrieval system, comprising collections of articles, documents, images, video files, audio files, and eBooks, all in digital format (Cornell University, 2010). The rapid increase in the volume and accuracy of the information required by library users and researchers continually poses new challenges for those managing libraries. There is a requirement to not only provide an easy and effective way of retrieving information, but also to guarantee a reliable and trustworthy method for knowing where a particular piece of information is and how it can be safely accessed and collected. This leads to the foregrounding of digitalisation.

Digital libraries can provide computational results to help make information retrieval more efficient, so that library users can search for terms in any part of an article. Normally, search terms can be observed in titles, abstracts, or in the bodies of an article. Thus, digital libraries can significantly conserve users' time and efforts (Cornell

University, 2010). Typically, digital libraries afford users unsurpassed results for accessing digital content, by linking content requests to metadata. Metadata is a data about an information resource, and can be used to explain, describe, manage, and prepare resources that are easy to retrieve, as demonstrated by the National Information Standards Organisation. Digital libraries link content metadata in logical relationships, to facilitate searches for digital information content and databases (Chowdhury, 2010).

Collaborative social tagging system is a kind of classification system mechanism that has been introduced in some places alongside the digitisation of libraries. However, it is a relatively new development and has only been used in some digital libraries, such as that at the University of Pennsylvania, which incorporated one of the most successful social tagging systems into their academic library: the PennTags system (University of Pennsylvania, 2004). The case of the University of Pennsylvania (2004) has further revealed that collaborative social tagging provides new avenues and processes for both users and librarians to relate to the library catalogue. Social tagging can complement subject headings with controlled vocabularies (the traditional library search mechanism), to enhance access to knowledge.

The novelty and potential value of the system motivated this author to investigate the use of social tagging in libraries critically.

### **1.3 THE PURPOSE OF THE RESEARCH (AIMS AND OBJECTIVES)**

Creswell (2002) espouses the view that the categorisation incorporated within research incorporates three research methods: exploratory, descriptive and explanatory. Emphasising the principle of the research purpose, Denscombe (2010) explained that research should have clearly stated aims and questions, providing a suitable platform from which to conduct an investigation.

Creswell (2002) identifies an exploratory study as an insightful way in which to identify changing practices and develop a fuller understanding of their adoption, by asking a number of questions to assess these occurrences from a different perspective. Israel and Hay (2006) espouse the view that the utilisation of exploratory research is effective in cases where one seeks a clearer understanding about a particular issue, or when one is unaware of the exact nature of the problem.

Israel and Hay (2006) further explain that descriptive studies provide an exact profile of individuals, events, or situations, providing a basis and grounding for exploratory research. Descriptive studies offer a clear understanding and prognosis about an issue, assisting an individual to collect data before starting the data collection process.

Explanatory studies provide a better understanding of questions pertaining to efficacy than descriptive ones do. Questions focused on ‘how’ and ‘why’ are of an explanatory nature and utilise case studies, histories, and experiments as the most viable research strategies. This is because these questions contain operational links that need to be traced over certain periods.

This study seeks to achieve the following:

1. To conduct an exploratory study and provide additional information about digital libraries and tools, emphasising social tagging;
2. To evaluate the influence when using social tagging systems in digital libraries to assess whether they enhance the search process; and
3. To identify whether there are any significant relationships between the use of social tagging systems in a digital library and user satisfaction. This will fill in the missing parts and expand our understanding.

To achieve the above aims and objectives, and to ensure as much information is collected as possible to help predict the future of social tagging systems in digital

libraries a mixed method approach has been deemed appropriate, because according to Denscombe (2010: 134),

[T]he distinctive feature of this paradigm [mixed methods research] is its belief that the choice of research questions and research methods should not be judged by how well they fit with the ontology or epistemology of the quantitative paradigm (positivism) or the qualitative paradigm (interpretivism).

Therefore, a mixed methods approach was selected based on how useful the methods would be for addressing particular questions, issues and or problems relating to the usability of social tags in digital libraries for the e-learning environment.

#### **1.4 QUESTIONS AND STUDY HYPOTHESES**

After presenting the aims of the research, Denscombe (2010) recommends that research questions should be clearly specified to explain what is to be investigated. ‘Specific things that are to be observed, measured, interrogated in order to shed light on the broader topic,’ (Denscombe, 2010: 15). The research questions posed in this thesis are as follows:

1. Is there a significant relationship between using a social tagging system in a digital library and user satisfaction?
2. How does social tagging provide additional information about digital libraries and tools?
3. How does using social tagging system in digital libraries enhance the search process?

The following are the primary hypotheses proposed in this project.

1. The accuracy of the research can be improved using social tags in a digital library.

2. Social tags are better than traditional research parameters. Better = more adaptable for users.
3. User satisfaction can be increased using social tags in a digital library.

### **1.5 SCOPE OF THE RESEARCH**

The study is limited by its aims and objectives to investigating the usability of social tags in digital libraries from the perspective of students from Saudi Arabia studying in the United Kingdom and to evaluating the usability of such a system to assist their study activities. The aspects of usability tested are accuracy of search, user satisfaction and adoptability of social tags in terms of efficiency, ease of understanding and utility. Thus, the research may be of benefit beside digital library to departments responsible for planning and discharging information retrieval systems to users (Maness, 2006).

### **1.6 RESEARCH APPROACH**

The methodology of the work can be summarised according to the following steps:

Literature search: Background data was collected by reviewing literature covering many areas including digital libraries, social tagging systems in digital libraries, and the usability aspects of such systems, with emphasis on particular aspects. These included gathering background data regarding an appropriate approach to conducting studies that address some of the pre-existing shortcomings that affect researchers, in relation to the use of tagging systems in digital libraries' e-learning environments.

Mixed-methods approach: This combines the quantitative and qualitative approach to collecting and analysing data. These two approaches are conducted in two sequential phases. The design and implementation of each phase is introduced in detail in chapter

3. In the quantitative phase, data was collected from 175 participants, and statistical analysis was conducted using SPSS. Cross tabulation was used to describe numerical data, and chi-square analysis was conducted to determine any relationship between the various study variables. In the follow-up qualitative phase, semi-structured interviews were undertaken with 15 Saudi students, to explore the hypotheses in depth. The data was subjected to thematic analysis. The study began with an on-line questionnaire, in order to generalise results to a broad population, then research questions were articulated and focused, in the second phase, as a basis for detailed qualitative, in depth interviews.

Surveys and interviews were conducted: These targeted respondents of different ages and different educational levels, to assess the level of utilisation of digital libraries, and to investigate the adoption of the tagging technique to support the research process, and the reasons for preferring or refuting the use of such a technique.

Guidelines for implementation: Recommendations and guidelines are introduced to explain how to implement the system in most efficient way. Moreover, these will aim to ensure whether digital libraries will benefit from all the potential features of the system.

### **1.7 IMPORTANCE OF THE STUDY**

The research aims to explore and evaluate the use of collaborative social tagging systems within digital libraries as tools for retrieval information, and to determine whether such a system has a positive impact on the usability of libraries in terms of accurate retrieval, facilitating the search process, and encouraging the user to show their opinions and sharing information. Specifically it considers whether the system appeals to and is perceived as valuable by Saudi students.



Eden and Steele (2009) stipulated that it is the duty of the digital library to ensure that people can manage their information well when using a tagging system; otherwise social tagging would not be beneficial, becoming just another ‘information closet’ like bookmarks. The digital library has to implement additional methods to ensure patrons participate in the adoption of tagging by encouraging collaboration, self-expression, and play. In other words, making tagging fun as well as useful (Eden and Steele, 2009).

Unfortunately, despite the frequently reported shortcomings of collaborative tagging systems, there has been relatively limited research exploring the user’s perspective to learn from practices. Failure to consider users’ experiences and needs could lead to difficulties implementing the system, and therefore to taking full advantage of its features. Moreover, it some digital libraries might then not adopt it, resulting in interference in future developments (Eden and Steele, 2009; Alsurehi and Al Youbi, 2014).

According to Alsurehi and Al Youbi (2014: 84) ‘the usage and effectiveness of social networking applications in the Arab world remain unexplored.’ Currently, available research in this area is limited. There is currently no research available in Saudi Arabia demonstrating the user’s view of collaborative tagging systems within digital libraries.

Alsurehi and Al Youbi (2014: 68) further state, ‘there is a need for research to explore the use of social networking applications among higher education institutions and students in Saudi Arabia.’ This study can therefore be considered a first attempt to cover this context, since there have been no investigations conducted to date regarding social tagging use in digital libraries in Saudi Arabia. Large digital libraries like Oxford already have a fully integrated social tag system as part of their information retrieval strategy, but for most digital libraries the difficulty is not only where to begin, but how to use the system. It is anticipated that this project will significantly affect the extent to which digital libraries use collaborative social tag systems. As Noorhidawati et al. (2013: 45) asserted, ‘a better understanding of users’ knowledge, habits and interactions

with the social tagging application can help to improve the design, development and eventually the usage of digital library.’

## **1.8 THESIS STRUCTURE**

### **❖ Chapter one:**

Provided an introduction to this research, the research aims and objectives, research methodology, the research problem and the importance of conducting this research, and the research questions and hypotheses.

### **❖ Chapter two:**

Reviews the literature regarding several digital library systems; focusing on some related works regarding digital library systems and social tagging.

### **❖ Chapter three:**

Discusses previous studies regarding the usability of digital libraries and the social tagging systems in digital libraries. It also offers a review of the three main research hypotheses.

### **❖ Chapter four:**

Concentrates on the research methodology: how the present study was conducted, including research approach, research strategy, the design and implement of data collection and data analysis.

### **❖ Chapter five:**

Presents the results analysed for the first phase of the study; quantitative strands by using SPSS.

**❖ Chapter six:**

Presents and analyses the results of the second phase of the study, which includes qualitative strands and thematic analytic.

**❖ Chapter seven:**

Critically discusses the results of the study, comparing quantitative data with qualitative data to verify the hypotheses. In this chapter, the approach will be justified and the results and research questions will be answered.

**❖ Chapter eight:**

This chapter concludes the research, offering recommendations for further studies.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter offers background data, and a brief description concerning the main principles, concepts and definitions of digital libraries, and social tags, combining them with the e-learning environment.

## **2.1 INTRODUCTION**

According to Murray and Beglar (2009: 160), a ‘literature review is primarily a summarising task [...] critical synthesis [...] summarises previous papers in a way that is easily understandable to readers.’ Furthermore, Murray and Beglar recommend highlighting major themes, areas of agreement and disagreement, paradoxes and gaps. Denscombe (2010) concurs adding that any literature review should place new research in the context of already published knowledge regarding the subject under investigation.

Based on Murray and Beglar’s (2009) and Denscombe’s (2010) recommendations, the following section demonstrates the relevance of this research, illustrating how it addresses those questions that remain after carefully evaluating previous studies. In addition, it uses existing materials as a basis for demonstrating what current research offers (Denscombe, 2010).

## **2.2 DIGITAL LIBRARY**

Due to developments that have occurred in technology and the increase in the volume of online information, digital libraries have become increasingly in demand in the modern era. Digital libraries comprise part of the vision of global infrastructure, which seeks to integrate computer networks and multiple forms of information technology the worldwide. At present, digital libraries are more rigidly organised and structured than the Internet, and, to date, millions of dollars have been spent by Educational institutions, governments, and corporations on researching, developing, and implementing digital libraries worldwide (Theng, 2004).

Throughout the 1990s, universities and professionals in the United States prompted rapid growth in digital libraries (Borgman, 1999); indeed, devising a digital library was

described as a national challenge. During the 1990s, and at the beginning of the 20th century, multiple digital library conferences were established and digital library topics introduced (Fox et al., 2002). Multiple digital libraries came in to existence as a result.

In its simplest form, the digital library can be understood as an information retrieval system. The term ‘digital library’ is relatively new (Lawrence et al., 1999), but researchers observing the growth and volume of searches conducted on digital collections have become highly motivated to develop straightforward and effective information retrieval tools. As stated in the introductory chapter, digital libraries have supported the move from the printed form of publications and books in traditional libraries to digital forms. A digital library collection typically includes articles, documents, images, video files, audio files, and eBooks, all in digital format (Cornell University, 2010).

According to Chowdhury (2010), digital libraries provide effective access to digital content, when they utilise information organising tools and services to attain the best content to serve digital information databases. Digital libraries are considered a confluence point for different multidisciplinary areas; such as, web services, information retrieval, the management of documents, digital duration, image processing, interaction of humans and computers, and library sciences. In addition, these libraries have a multi-faceted nature, which encourages researchers to provide different definitions of the digital library based on their disciplinary backgrounds. For example, the digital library is recognised as a networked information system by computer scientists, whereas it is defined as merely an extension of the traditional library by librarians (Chowdhury and Chowdhury, 2002).

According to Jeng (2005), the digital library is a database, via which digital content and library collections are made available over networks; it also includes services to facilitate users in dealing with this content. Confirming this, Singh (2003) highlights that users require digital library services to access the huge number of digital

information collections effectively. Certainly, definitions of the digital library cannot be limited to the digital information held in collections, but can be seen as environmental elements that combine digital information collections and information organising tools to support the creation, dissemination, use, and preservation of information. Soergel (2008) agreed with Singh (2003) that digital libraries cannot be effective unless they combine information organisation tools and digital information because of their vast size. Any system that affords the ability to link digital information content with the services offered by digital libraries will facilitate the search process, making it quick and effective.

Muqueem and Ambedkar (2005) considered digital libraries as an innovative form of the traditional library, offering functions that enable the library to keep pace with technological developments in the digital information age. However, Muqueem and Ambedkar (2005) also established the digital library as merely a technological function of the traditional library, enabling the extension of library functions and services.

In this study, the digital library is defined as an extension of physical academic libraries, which have expanded their web-based online digital libraries to supplement the traditional library services they offer in support of research, teaching, and learning (Soohyung et al., 2011). Academic digital libraries provide technology-based services, such as electronic journal access, online catalogues, and virtual referencing to support access to important information resources (Ding and Ming, 2000). Therefore, digital libraries should not be seen as a substitute for traditional libraries; rather, traditional libraries are pivotal components of digital libraries.

### ***2.2.1 ADVANTAGES OF DIGITAL LIBRARIES***

According to Kumar and Rao (2014) and Varatharajan and Chandrashekara (2007), digital libraries have a number of advantages: open access, unlimited availability and low cost. In terms of physical borders, users do not have to go to the location of the

physical library, but can access library information and services from everywhere, as they need. The unlimited availability of digital libraries means that users can access library information and services whenever they need to do so. Moreover, access is supported for multiple users; with the result that the same resource can be accessed by different users simultaneously. Furthermore, the digital library offers a structured approach to support access to the data in the library, allowing users to move between books and chapters in books readily.

Other advantages include the ability to retrieve information readily. The digital library offers a reactive interface, which allows users to seek out information using different methods such as words, terms, collections, and resource preservation. These resources are not affected when copied multiple times by different users or by limited space. Indeed, the digital library requires only a very small physical area, so the ability to add more resources is easier than in traditional libraries. Finally, digital libraries offer a low-cost option, as there is no need to pay salaries for staff, to rent space, maintain books, or acquire new physical books.

Three distinct researches focusing on the advancement of information retrieval are: Huang et al. (2013, 2014) and Zhao et al. (2015). Huang et al. (2013) researched the application of social tagging to manage cognitive load in a Web 2.0 self-learning environment. The researchers first identified whether web-based self-learning had received attention because of the huge body of diverse material available in the Web 2.0 environment, which resulted in the serious problem of cognitive overload, which degrades the efficacy of learning.

Based on social tagging, which is used to visualise the relationships among materials and assist learners in facilitating learning, Huang et al. (2013) examined feasibility when managing cognitive load. An experimental model was designed to implement the adoption of cognitive load theory as the theoretical framework. In total, this study surveyed 60 participants and the research results showed the information graphics



method had a positive impact on three types of cognitive load: intrinsic, extraneous and germane. The research established intrinsic and germane cognitive load have a positive influence on perceived learning effectiveness, while extraneous cognitive load has no significant influence. Although the research did not offer clear details about the research participants (e.g. age, gender, nationality and academic level) the overall findings strongly indicated the use of social tagging can effectively manage cognitive load, connecting positively with perceived learning effectiveness (Huang et al., 2013).

Huang et al. (2014) shares some similarities with Huang et al. (2013); it researched the utilisation of user tag-based interests in recommender systems, employed by social resource sharing websites. According to Huang et al. (2014), collaborative tagging (also known as folksonomy) in Web 2.0 allows users to collaboratively create and manage tags to classify and categorise dynamic content for searching and sharing. The researchers argued that library users' interest in social resources usually alters with time in dynamic and information rich environments. They recommended that social networks offer some of the most innovative characteristics of social resource sharing websites. Therefore, according to Huang et al. (2014) information from social networks provides inferences about certain user's interests based on their neighbours in the network.

Huang et al. (2014), highlighted the problem of personalised interest, as changing gradually over time, and modelled personalised user based Internet incorporating frequency, recency, and the duration of tag-based events. The study examined the performance of the model, using an experimental database collected from a social bookmarking website. The results strongly suggested hybridisation of user's preferences with frequency, recency, and duration playing an important role, providing better performance than traditional collaborative recommendation systems (Huang et al., 2014). Therefore, the researcher concluded that friend network information (this is other user terms and suggestions present on social websites) can be cooperative, thereby improving recommendation processes.

The third research, Zhao et al. (2015) critically examined the problem of personalised tag recommendations in social tagging services by generalising the traditional manifold ranking idea. The study first hypothesised that the majority of social websites allow users to annotate resources with keywords (tags). The researchers then argued that collaborative tagging data reflects the semantic perceptions of users, thereby providing valuable information to support related recommendations. Although the research did not spell out the methodology fully, based on the modelling provided, the experimental results appear credible. Zhao et al. (2015) modelled a complex relationship in tagging data as a heterogeneous graph, proposing a novel ranking algorithmic framework for heterogeneous manifolds called GRoMo (Graph-based Ranking of Multi-type interrelated Objects). The two results indicated that the tag-based model's interactive GRoMo solutions converge quickly, and can be used as the database expands; thus, GRoMo can also be used to recommend resources.

By synthesising the evidence from the three studies, it is reasonable to suggest that social tagging can be used to solve real problems such as authentication, linguistic pluralism and growth in higher education. It is also reasonable to posit that the social tag system could contribute to resolving the problem of retrieval difficulty by evaluating some usability aspects, as explained in the following sections.

### *2.2.2 CHALLENGES DIGITAL LIBRARIES FACE*

Digital libraries encounter the following unique challenges:

- Concerns associated with the protection of copyright. Digital libraries can struggle to obtain the right to distribute resources, as it is problematic to protect authors' copyright, because unethical users can access the information without showing the acknowledgement;

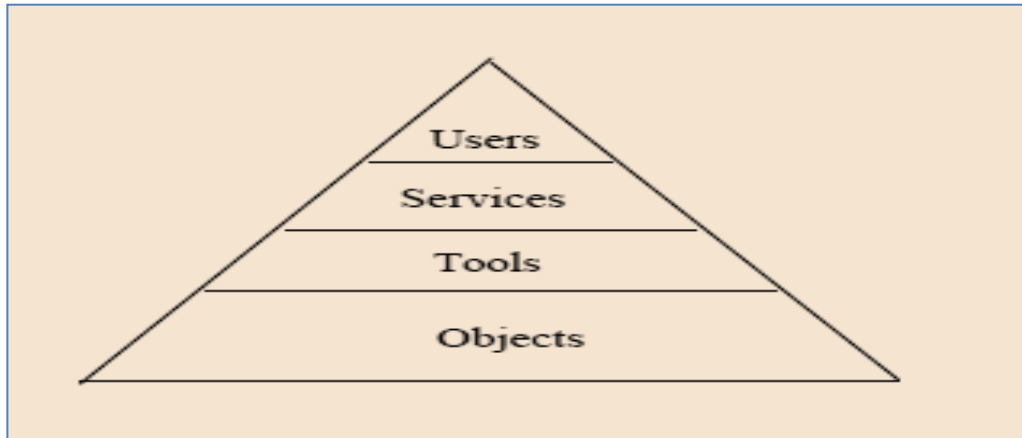
- The speed of access from a growing number of computers connected to the Internet limiting opportunities for access, demanding new and better technology to meet Internet based demand;
- Cost of set up, in particular the expense of attaining the appropriate software and hardware infrastructure;
- Bandwidth issues are also a concern, as some of the content of a digital library comprises multimedia resources, which require a high bandwidth (although bandwidth decreases as utilisation increases);
- Retrieval difficulties due to the ever expanding volume of data and information held in the digital library, which makes finding a specific text increasingly problematic; and
- Some readers prefer to read a hardcopy book to a soft-copy book, making it unlikely that digital libraries will ever entirely supplant traditional libraries.

### ***2.2.3 REASONS FOR DESIGNING AND USING DIGITAL LIBRARIES***

There are many reasons for designing and using digital libraries, according to Amato et al. (2004); such as to accelerate systematic development in order to organise, store and collect knowledge and information digitally, to endorse efficient and economical information delivery to entire communities, and to support collaborative efforts that influence large investment in communication networks, computing networks and research resources.

In addition to the above, other purposes includes supporting collaboration and communication between educational societies, researchers, the government and business leaders, to contribute to lifelong opportunities for learning for all. Furthermore, digital libraries provide a wealth of coherent information based services (involving persistence, distribution, access, organisation and selection), delivering data to users in an economical and reliable way. A collection of tools supports these services based on objects composed of management systems, approaches to services, associated metadata

and content packages. The figure below illustrates the service model for the digital library (Amato et al., 2004).



**Figure 1** Service Model of a Digital Library (Source: Amato et al., 2004).

#### ***2.2.4 DIGITAL LIBRARIES, WEB 2.0 AND WEB 3.0***

Web 2.0 has been central to developments in online service to support information sharing, communication and collaboration. In addition, this term describes the transformation of web pages with read only properties or passive content to web pages with write or read properties to support participatory experience. There is a huge data set embedded in Web 2.0 services, supporting applications as diverse as social bookmarking, blogging, immediate messaging, tagging, podcasting, RSS, social networking, wikis, podcasting and forums established within different life areas. Furthermore, Web 2.0 has been utilised within digital libraries around the world, allowing librarians to strengthen information services. The concept of Web 2.0 led to the development of hosted services and a community culture.

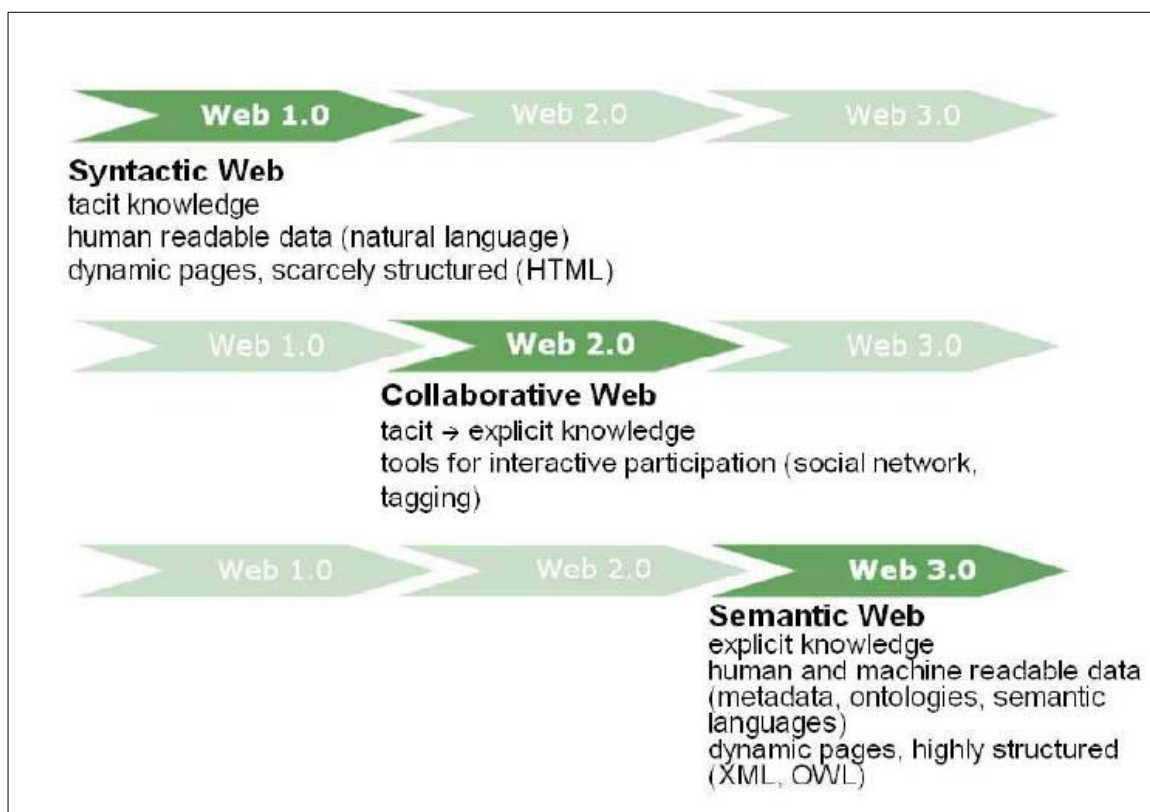
Web 2.0 rules have also been applied to libraries modifying the information itself, as well as users' and provider's behaviour. Information professionals and librarians have had to change their information and library services to fit these rules. Based on Web 2.0

data, users have become better able to generate additional content, knowledge and information (Amato et al., 2004).

According to Amato et al. (2004), the Web 2.0 environment provides the following beneficial utilities:

- Search: the Web 2.0 platform enables users to find information easily via a keyword search;
- Tags: content categorisation is performed using tags to prevent pre-made, rigid categories and to enhance searches;
- Links: providing evidence of significant pieces of information; and
- Authoring: this feature enables the user to generate continuously updating content throughout a shifted platform from few creations to continuously interlinked, updated work.

Furthermore, it is important to highlight that the new generation of the web: Web 3.0, will make it even more powerful, improving the structure of pages and content. The figure below shows an evaluation of developments from the semantic web to Web 3.0 (Ginger and Goger, 2011).



**Figure 2** The evolution of Web 3.0.

Web 3.0 technology has recently been recognised as essential to people's online lives. It can be integrated into modern applications, such as social media applications, improving information sharing and finding, even library 3.0 (digital libraries using the semantic web) are still in the development phase. Public libraries around the world are trying to integrate it into their services, using different methods, such as RDA tags, semantic web applications and metadata (Mazurek at el., 1999).

Semantic web technologies are crucial when building digital libraries. They depend on an 'information network overlay' to place objects from digital library into the architecture of the web (Rathi at el., 2012). Semantic web technology can increase the advantages of digital libraries by giving users the ability to retrieve data more efficiently

and effectively; supporting the accessibility of information and improving communications between users of digital libraries (Adams and Blandford, 2006).

Semantic web technology has become the most widely used and significant technique among researchers. It is commonly used as a mechanism to increase the efficiency of knowledge retrieval and representation. The main goal of semantic web is to define conceptual connections for machine based interpretation, which will support the efficiency of organisational mechanisms and information mapping, and ensure that digital libraries are the most relevant applications in the scope of information retrieval. Thus, the searching and retrieval techniques used by digital libraries will gradually begin to apply semantic web rules, to achieve better performance in terms of user-machine communication (Tramboos et al., 2012).

### **2.3 SOCIAL TAGGING**

The Internet has changed the patterns of daily life for both organisations and individuals. The possibility of readily accessing information with comparative simplicity has been the core factor behind the Internet's success. Certainly, the presence of information is of no significance without it being also retrievable and accessible. Consequently, the authors of information rely on appropriate information classification to guarantee it is conveniently accessible. The classification and categorisation of information is therefore, as important as the process of generation of information.

Classification and categorisation of information requires considerably money, time, and work. Additionally, it requires a skilled group, since the process involves the application of yet undetermined standards. Consequently, it is not practical to convey a large quantity of information via the Web, as a large number of consumers are prepared to use Web based content. At a specific point in the development of the Internet, websites

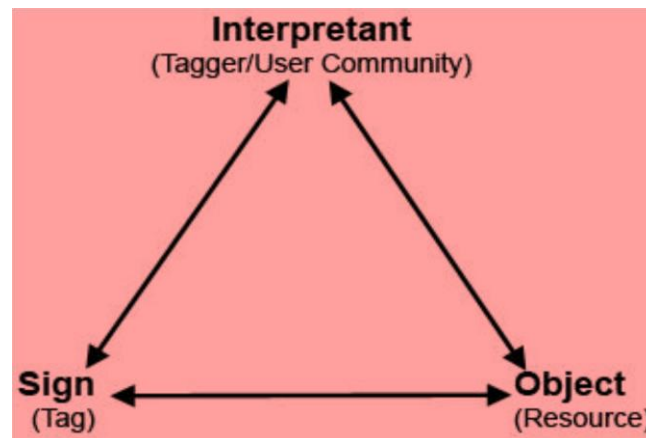
emerged opening up doors for consumers, to enable them to produce their own Web related content.

Users can create metadata using Web 2.0 technologies, also enabling the organisation of information resources. Uncontrolled keywords ‘tags’ have also been added to these resources, in order to implement the generated metadata. Moreover, collaborative tagging or social tagging phenomenon have become very popular, especially on social bookmarking sites, such as Flickr, CiteUlike, and Delicious among others. These resources, expressing the demands and vocabularies of users can be obtained as a cloud of tags (Kakali and Papatheodorou, 2010).

The tags, which are also called a keywords, offer a modern way of organising data for future filtering, navigation or searches. This method is not entirely new, although interested users have now allotted the epithet ‘tagging’ to the collaborative form of this process. Tagging can be implemented on the web, in digital libraries, or document warehouses. Documents are grouped according to an earmarked keyword; however, in the traditional setting, the categorising or indexing is accomplished through authentication. Similar to the role of a librarian defining material by author, social tagging gives anyone the authentication to attach tags to documents (Worrall, 2013).

Social tagging is a form of folksonomy (collaborative tagging) and can also include social indexing, which refers to feedback from users when they mark or comment on specific websites or digital objects they have found beneficial. The major aim is to facilitate future users’ access, by giving them the ability to search using tags marked as keywords. Social tagging information can be classified in such a manner as to communicate meaning to groups of other users; for example, users can add tags in their native languages (Golub et al., 2009).





**Figure 3** Peirce's triad of semiotics applied (Source: Huang and Chuang, 2009).

The above figure illustrates that any user can interpret the sign according to how they view it; however, not all individuals will interpret signs in a similar manner. Social tagging, therefore, enhances the opportunity of multiple users to access documents and create multiple index items. The development of multiple interpretations arising from the varied opinions of users enhances the incorporation of additional access points into the document.

### ***2.3.1 SOCIAL TAGGING IN DIGITAL LIBRARIES***

To date, many libraries have already implemented utilisation of social tagging services, following the extensive use and deployment of social tagging as part of Web 2.0 (Mufutau et al., 2012). The success of this type of tagging has grown over time, and many researchers have concluded that collaborative tagging can benefit users by uncovering links between resources. The results of social tagging might challenge the traditional classifications employed by digital libraries (Anday et al., 2012).

Social tagging offers new opportunities for both users and librarians to relate to the library catalogue. Social tagging can complement subject headings and controlled

vocabulary elements as it seeks to enhance the development and organisation of knowledge. Through the incorporation of subject headings within social tagging, it can support initial searching, as users are able to locate tags based on their native languages, which incorporate subject headings to enhance the retrieval of target documents.

Social tagging also offers a promising option to overcome the disadvantages of professional indexing, particularly because it is low-cost. Moreover, a huge number of users from any background can contribute to the creation of tags. Thus, users' tags might offer alternate terms with additional entry points for retrieval, which cannot be readily expressed using controlled vocabularies (Hayman, 2007; Quintarelli, 2005). Social tags are generally much more current than controlled vocabulary elements, since they are constructed as part of the process of 'sense making', enabling users to share their experiences in subject terms, reflecting their interests in various communities (Smith, 2007).

Moreover, the utilisation of controlled vocabulary and knowledge organisation systems can enhance the provision of additional tag suggestions, which will then deliver a broader vocabulary. This then limits the vocabulary problems commonly associated with tagging. Thus, the incorporation of social tagging enhances the development of a collaborative platform in the form of a catalogue; as various users incorporate their different opinions pertaining to the catalogues, thereby enhancing the creation of a highly informative and participatory process. In addition, the utilisation of social tagging within catalogues enhances ease of user navigation, rendering the library more welcoming to users.

Social tagging thrives on user participation, and enhances user access after incorporation within academic libraries, as the system renders tagging an easy, informative and fun process. Eden and Steele (2009: 76) stipulated:

[T]he library has to make sure the tagging system helps people manage their information well; otherwise it could become just another ‘information closet’ like bookmarks. Encouraging collaboration, self-expression, and play is another way to ensure patron participation. In other words, make tagging fun and useful, not just a chore.

Incorporation of social tagging systems within libraries enhances users’ ease of access to library resources, overcoming some of the difficulties encountered when accessing resources online. By adopting social tagging, libraries can become more user friendly and enhance users’ utilisation of digital archives. Moreover, the proposed system should encourage student participation, enhancing the provision of varied but informative viewpoints pertaining to various subjects.

Many pioneer libraries have launched new catalogues (OPAC) or web-based applications inspired by Web 2.0 technologies. These new systems, usually called OPAC 2.0, are either based on open source software, such as VuFind, Scriblio, AFI-OPAC 2.0 and SOPAC, or proprietary applications, such as Aquabrowser Encore and Primo. They all provide a set of key features, such as folksonomies (user keywords, tagging) and search term recommendations, to support users’ search strategies. Other libraries have enriched their indexing and search services by linking to social web cataloguing applications; e.g. Library Thing, a social cataloguing site that allows social tagging and annotations in bibliographic records used for organising personal collections of users (Kakali and Papatheodorou, 2009).

### ***2.3.2 BENEFITS OF TAGS IN DIGITAL LIBRARIES***

Social tagging encourages users to utilise the tagging process by providing them with the option to create tags in their native language. This encourages more users to utilise the system and seeks to limit the misinterpretation of vocabulary through the positive incorporation of the user’s natural language. This is illustrated by Spiteri (2007: 14),

who states, ‘an attractive feature of folksonomies is their inclusiveness; they reflect the vocabulary of the users, regardless of viewpoint, background, bias, and so forth.’

Social tagging enhances the user’s interaction with the information, eliminating any potential barriers between the user and the item. This benefit is realised, as the user becomes actively involved in the information sharing process through the provision of their own opinions and viewpoints regarding the information, which further enhances their control of the process. In this way, social tagging encourages user participation, creating a sense of community among users, and enhancing the incorporation of teamwork to enhance the organisation and dissemination of information. Through the creation of online communities, tagging not only enhances teamwork, but also encourages the development of information partnerships and friendships among individuals, thereby raising levels of knowledge sharing within the community. In addition, social tagging is more cost-efficient, as it reduces indexing costs, encouraging users to contribute toward adding value through interactions with formative services.

Finally, Magableh (2011) argued that the tagging system provides new principles, so that users can learn how to create their own search criteria. The tagging system also includes works that users created to classify their information. In addition, it is used to facilitate the connection between the user’s tags and the search process, the translation process, and the definitions of the users’ tags of within context (Magableh, 2011).

Users of the tagging system attempt to use it because it is very fast, low cost, wide spread, and easy to manage. According to Golub et al. (2009), a tagging system offers a simple way for users to enter and retrieve users’ information, because it does not require particular training; instead, users select their own words and information freely (Magableh, 2011).

### 2.3.3 CHALLENGES FACING INCORPORATING SOCIAL TAGS WITHIN DIGITAL LIBRARIES

Social tagging affords any individual the ability to add tags at any time, which can have a negative aspect, delimiting the aspect of authoritative control. Certainly, libraries can then lack any form of control over the tagging process. This concern is further espoused by Kakali and Papatheodorou (2010: 192), who comment that, ‘in contrast to traditional classification systems and thesauri, there are no authority controls, nor are there selection criteria and instructions for tag generation, and as a result many synonymous tags are generated.’

In addition, tagging encourages participation from all individuals within the online community. This may lead to the addition of ambiguous tags or synonyms, cases where a tag might be either too specific or too general, depending on the consequent utilisation of the word, and tagged words that convey a limited understanding. Spiteri (2007) observes that tagging systems do not provide guidelines to users, guiding the form of tags to be utilised; this results in non-conformity, and where tags are unclear, they can inhibit the main aim of communicating information.

Additionally, Huang and Chuang (2009) argue that social tagging can result in confusion, adversely affecting users’ understanding of the information, as the tags could be interpreted differently by different people, triggering varied meanings. However, this problem may be eliminated through the inclusion of various controls to manage the identified tags. Such controls would aim to regulate the tagging process, thereby rendering it effective and free from unintended interpretations.

Moreover, the incorporation of controls over the tagging process ensure that added tags benefit users. However, Eden and Steele (2009) observed that a balance should be sought between control and flexibility when adding tags, to enhance the tagging process. Eden and Steele (2009: 69) advocated that ‘users must be allowed to create their own tags, and not forced to choose from a selection. While the system can offer suggestions,

the option to add their own still must exist.’ Arguably, tags should balance rigidity and flexibility to ensure their proper and successful implementation.

#### ***2.3.4 EXAMPLES OF DIGITAL LIBRARIES USING A TAG SYSTEM***

The University of Pennsylvania has incorporated one of the most successful social tagging systems, within their academic library; it is known as the PennTags system. PennTags is a software program developed by the University that allows members of the University to tag and save catalogued books, journals, articles and images. The PennTags system addresses the needs of individuals who prefer traditional search methods and those who identify with the new approach to interacting with the catalogue. The system incorporates various features, such as the cloud, and identifying the scale of tags in terms of their popularity, requiring they are utilised more than 110 times prior to display within the tag cloud. The system also incorporates an area for recently tagged systems, together with a quick-access pane, showing tag groups and projects. Based on the system’s statistics, on average 27 bookmarks are posted daily, with every post-assigned four tags (University of Pennsylvania.PennTags, 2004).

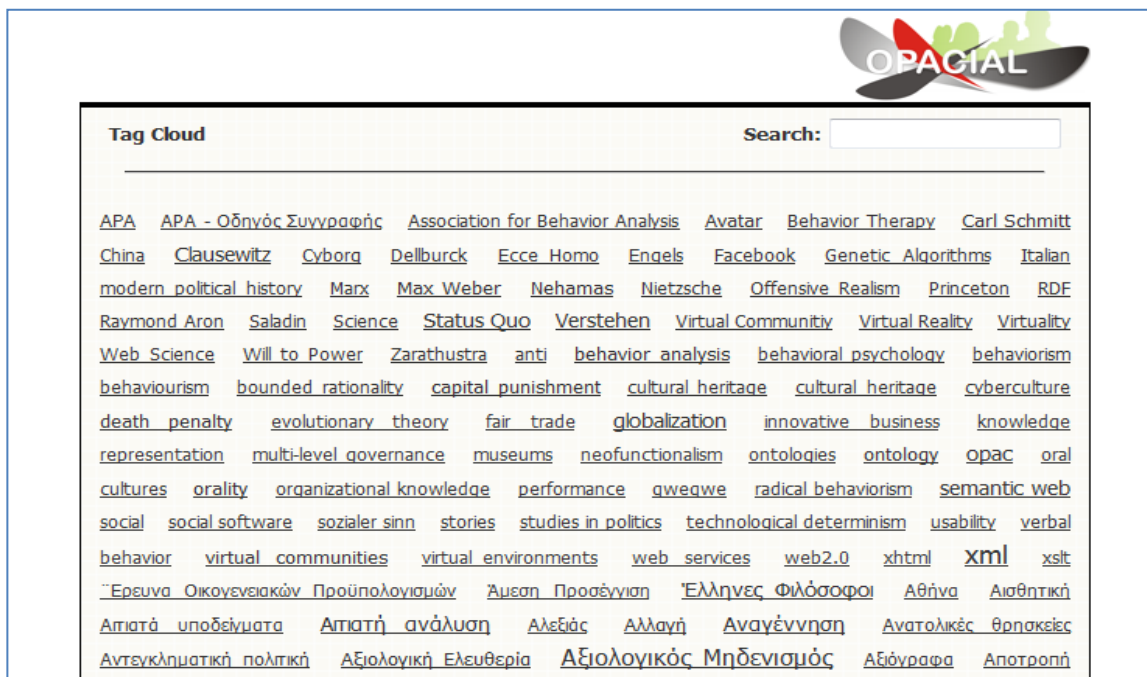
Moreover, a number of other libraries have also integrated applications such as Delicious, LibraryThing, PennTag, and Connotea to assist tagging in their library environments (Allen and Winkler, 2006; Furner, 2007).

## **2.4 RELATED WORKS**

The main aim of social tagging is to produce folksonomies developed through the collaboration of users. The primary motivation of Kakali and Papatheodorou (2013) was to manage libraries tendency to rely on the functionalities of social tagging, to provide a study about tag analysis that utilises a collection of social tags to service the topic based description of material for academic libraries. This study was based on tags inserted into

OPACIAL, which is an enhanced version of the OPAC system with features of Web 2.0, developed by Panteion University Library.

New features added to OPACIAL include tag searching, folksonomy and the functionalities of tagging. Consecutive selection of tags supports the retrieval of multi-faceted information. It also works to reduce the size of the records recovered. In addition, the OPACIAL system presented the reference tools used, ranking functionalities and user annotations. Thus, users can rank and annotate all resources on a scale from 1-5. Furthermore, site aggregators for social networking, such as Socialiser can be used to export records outside social networking sites (Kakali and Papatheodorou, 2013).



**Figure 4** Part of the OPACIAL tag cloud (Source: Kakali and Papatheodorou, 2013)

Two main issues relating to social tagging were raised by Kalamatianos et al. (2009), who reviewed the ‘ASK Learning Object Social Tagging 2.0 (ASK-LOST 2.0)’, which

is a tool based on the web and used in conjunction with different types of social tagging resources in the context of digital education. ASK-LOST 2.0, as described in this study and used in the ‘Open Science Resources Project (OSRP)’ framework, allows science students and teachers to add tags to digital science education resources provided by the Centre of European Science. In addition, it facilitates context-sensitive and effective retrieval and searches for science education material. The European Program of the Commission’s eContentPlus was also funded for OSRP.

The main goal of the study proposed in Worrall (2013), was to enhance collaborative, organisational, institutional, and cultural understanding. In addition, it helped to improve the behaviour of information communities and digital libraries according to social context. Furthermore, the study concentrated on two main systems: Goodreads and Library Thing, which are websites and digital libraries for books lovers and readers. An approach to case studies was also employed in this study. Combined quantitative and qualitative methods were employed to in order to benefit from the strengths of each, to enhance reliability and validity, reduce weaknesses and produce a comprehensive understanding of the uses of Goodreads and Library Thing.

In Golub et al. (2009), the project of ‘Enhanced Tagging for Discovery (En Tag)’ studied the retrieval and indexing effect when social tagging was used, only when the proposed tagging from the vocabulary standard list was integrated with social tagging. Thus, this study aimed to show how social tagging can be improved upon by applying proposals drawn from the vocabulary standard list. Digital collection tagging by readers and tagging according to authors in an institutional warehouse were investigated in this study. User studies were performed and independent demonstrators evolved for both types of tagging. Thus, this enabled the analysis of user societies, a vocabulary standard list, digital groups and interfaces for both contexts. Furthermore, the authors explored the ACM Scheme for Computing Categorisation and the Categorisation Scheme for the Dewey Decimal system. The results obtained demonstrated the importance of



vocabulary standard list suggestions for retrieval and indexing. These suggestions were employed to help generate tags and ideas to facilitate usage and to increase the number of access points, and to confirm the regularity with which these points emerged in the retrieval process.

Pirmann (2012) examined the utility of tags as a means of enhancing subject access and the discovery of items in library OPACs through usability testing with Library Thing for Librarian catalogue enhancements. In this study, data was collected from three sources: a usability test in which participants engaged in six searches and discovery tasks using an LTFL-enabled catalogue; semi-structured interviews conducted following a usability test; and a demographic questionnaire. While the results of this study demonstrated that tags can be a useful mechanism for finding materials in library catalogues, they also highlighted some of the difficulties users might encounter when navigating tagging systems (Pirmann, 2012).

An exploratory study by Noorhidawati et al. (2013) examined how users participate in social tagging activities in a scholarly digital library environment to learn about their motivations, behaviour, and practices. The study was conducted in two phases: a survey to investigate the usage of and attitudes towards the social tagging tool, and a task-based user study on tagging practices in Theses@UMalaya, followed by a post-task questionnaire and interview. The usability of the social tagging application was evaluated using SUMI and PLE constructs, and the participants indicated that the social tagging tool was relatively more usable as it allowed them to carry out the tagging process with less effort (Noorhidawati et al., 2013).

Kruk (2008) presented the results of the evaluation of the semantic and social information discovery features in digital libraries. They focused on the usability aspects of the user's interaction with a system, which were measured according to how easy the system is to learn, how flexible it is, and how adaptable to user preferences. They measured time to learn, rate of errors from users, and subjective satisfaction.

Questionnaires and interviews were conducted to attain results. After this, results were compared by participants using the classic digital library DSpace and the semantic digital library JeromeDL. The results gathered during this evaluation demonstrated the advantages enhanced information discovery features can offer to digital libraries. Not only was users' satisfaction higher than when using the non-semantic digital library; the quality of the knowledge they gathered and their capacity to use it was greater (Kruk, 2008).

**Table 1** Summary of related works

Studies	Aim	Methodology	Reviewed system	Findings
Kakali and Papatheodorou (2013)	To exploit a social tag collection for the benefit of the subject description of an academic library material	Interviewed Cataloguers.	OPACIAL, which is an enhanced version of the OPAC system with features of Web 2.0 and LibraryThing.	The library should (a) create new subject descriptors, (b) substitute the current subject headings with more appropriate ones and (c) create references between the subject descriptors of the local authority file.
Kalamatianos et al. (2009)	Discuss the issues	ASK-LOST 2.0 is used in the framework of	'ASK Learning Object Social	(a)enabling science education

	related to Social Tagging as a means for describing digital educational resources and present ASK Learning Objects Social Tagging 2.0.	OpenScienceResources Project.	Tagging 2.0 (ASK-LOST 2.0)',	practicing teachers and students to add tags to science education digital resources offered by European Science Centers, (b)facilitating also more efficient and context-sensitive search and retrieval of science education material.
Worrall (2013),	To improve the behaviour of information communities and digital libraries according to social context.	Combined quantitative and qualitative methods. Survey and interview.	Goodreads and LibraryThing, which are websites and digital libraries for books lovers and readers.	(a)The findings uncover certain elements and features of the two digital libraries  (b)Provision of services in and by digital libraries.  (c)How users can better collaborate and network with

				each other,
Golub et al. (2009),	To show how social tagging can be improved upon by applying proposals drawn from the vocabulary standard list.	User studies were performed and independent demonstrators evolved	An institutional warehouse.	The results obtained demonstrated the importance of vocabulary standard list suggestions for retrieval and indexing.
Pirmann (2012)	Examined the utility of tags as a means of enhancing subject access and the discovery of items in library OPACs.	(a) Usability test. (b) Semi-structured interviews. (c) Demographic questionnaire.	LibraryThing.	(a) Tags can be a useful mechanism for finding materials in library catalogue. (b) Highlighted some of the difficulties users might encounter when navigating tagging systems
Noorhidawati et al. (2013)	How users participate in social tagging activities in	Survey. Task-based user study on tagging	Theses@UMalaya	The social tagging tool was relatively more usable and allowed

	a scholarly digital library.	practices. Followed by a post-task questionnaire and interview.		users to carry out the tagging process with less effort.
Kruk (2008)	Evaluation of the semantic and social information discovery features in digital libraries.	Questionnaires and interviews.	Classic digital library DSpace and the semantic digital library JeromeDL.	(a) Demonstrated the advantages enhanced information discovery features can offer to digital libraries.(b) users' satisfaction higher than when using the non-semantic digital library.(c) the quality of the knowledge was greater

## 2.5 THE DIGITAL LIBRARY AND THE E-LEARNING ENVIRONMENT

The education system is one of the most important structures within contemporary societies. The role of the system is not only to display information and resources to students, but also to explain information and support evaluations of it. Educators are constantly searching for better ways to provide an interactive learning environment, to motivate learners and encourage them to exchange their views and learning experiences.

The advent of the technological revolution in information technology, which has created the so-called 'global village', has increased both the necessity and opportunity to share experiences with others, also providing environments rich in multiple resources. Indeed, technology has increased access to an extensive body of information, as well as numbers of students, overcoming the need for teachers and increasing the distances across which knowledge can be shared. These changes have led to the emergence of new patterns and methods of teaching. Information technology, as represented by computers, the Internet, and multimedia resources, offers one of the most successful ways to provide a rich educational environment. Thus, as new technologies emerge, the learning process changes. Today, new and powerful e-learning systems (referring to learning using electronic media) are being developed to support new methods of teaching and diverse learning contexts.

The value of the Internet lies in its capacity to connect people across vast distances to sources of information. This affordance of online technology has generated new opportunities for education that extend beyond the scope of the school context. Increasingly, the use of the Internet to enhance e-learning has become a trend in modern higher education institutions. Increasingly, e-learning platforms are becoming a significant component of the strategy for delivering flexible online training and education across large distances (Ajlan, 2004).

The challenge facing educators today is to use transformative technology to create environments that encourage lifelong learning and equip students with 21st-century skills and capacities. Global awareness, creativity, collaborative problem solving and self-directed learning are among the most important skills for the future, and learning environments can have an important role in developing them (Ley, 2010).

The importance of e-learning proceeds from its ability to support large operations and processes, which include virtual classrooms, computer learning, Internet learning, and digital libraries. Digital libraries utilise a variety of e-learning utilities, such as LAN, the

Internet, CD ROMs, audio and video tapes, and satellite broadcasts. Thus, the digital library supports e-learning by providing access to computer based resources.

Modern digital libraries not only contain a wealth of digital resources, they are also required to provide an environment that integrates the collection provision of information services, and academic activities to support effective learning. The digital library has become a fundamental component in the field of education, offering a primary means to provide information for users.

Digital libraries that provide e-learning services have different aims: offering access to information resources (such as references and texts); accessing information services in combination with distance education programs belonging to particular teams or faculty members; identifying the most appropriate media to provide e-learning services (such as tapes, videos, and audios) to learners; and, recognising the most appropriate library setting to offer services within the e-learning environment. According to Sheyin (2009), digital libraries can augment e-learning educators' outcomes and learners' performances. As a development based on traditional libraries, digital libraries are more complicated, but also more accessible and user friendly than traditional libraries. There is huge relevance afforded to e-learning strategies in the field of education, and so teachers are very aware of the importance of integrating e-learning into their materials, as the impact of technological development is being felt worldwide (Sheyin, 2009).

Today, Web 2.0 tools have become popular in the e-learning field and their use is growing among teachers who have the knowledge and skills required to use them (Chen and Lin, 2014). The latest generation of Web 2.0 applications (blogs, wikis, Rss, etc.) permits (even encourages) the average Internet user to collaborate and share information online. Web 2.0 involves a major shift in thinking, fostering collaborative work, not only among students, but also among colleagues, and community members from around the world (Munos et al., 2009)

Digital libraries have evolved in response to the need to manage the vast quantities of electronic data that we produce, collect, and consume. The architects of such systems have adopted a variety of design approaches. However, to explore how digital libraries effectively support e-learning and enhance learners' performance, the interaction between learners and digital libraries during the learning process must be clearly understood. Due to the vastness of the digital resources available, designing information architecture that effectively supports learning is very challenging for any digital library (Chen and Chen, 2010).

In the case of the digital library, it is essential that resources are managed by organised systems that include labelling systems, navigation systems, and search systems, using information based architecture to support learners' search and retrieval of information. Dong and Agogino (2001) also argued that well-organised information can help learners create, integrate, and manipulate knowledge, rather than simply accepting information passively. Beiers (2000) considered the conformity of information architecture to learner demands and the provision of a user-friendly environment for learners concentrating on specific subjects as essential to minimise obstacles to the critical use of information.

Two main issues need to be considered when evaluating or designing any digital library architecture. These are:

Firstly, to overcome the problems with usability and effectiveness encountered by websites generally. Moreover, as complex and advanced forms of information systems, digital libraries must support collaboration, distributed database management, hypertext, multimedia information services, information retrieval, information filtering, selective dissemination of information, intellectual property rights management, question answering and reference services, and resource discovery, among many other elements. Digital libraries can be expected to serve very large user populations, composed of different stakeholder groups with different information needs. Improvements in design,



development and evaluation can have major organisational, national and international impact (Theng, 2004).

Secondly, the universities that support learners and digital libraries now need to respond to a generation of students born into the digital era, in possession of long-held high standards of digital literacy: reading and writing. Digital libraries and other digital tools used by the new generation are part of the new digital 'knowledge society'. Students are already heavily immersed in Web 2.0 technologies (i.e. blogs, Twitter, podcasts, wikis, social network sites, virtual worlds, video sharing and photo sharing) (Munos et al., 2009).

For the first time, the digital generation is entering college; these youngsters live in a perceived global economy, and face global competition for jobs and innovation, which brings a new set of expectations, demands, and visions of what the educational system should look like now and in the future. These students are increasingly controlling their own educational choices, and are basing their decisions about universities on their digital proficiency (Munos et al., 2009). Rolla stated that Today's library users, who are increasingly comfortable with searching on the Internet, have certain expectations about how they will be able to search for information and how that information will be displayed. These expectations vary significantly from the format of traditional library catalogues. In addition to the reliance on keyword searching, today's users increasingly use interactive websites that allow them to upload their own data or content and to connect with other users of the site (Rolla, 2009).

To respond to these user expectations, we need better theories, tools and techniques to support designers in designing, developing and evaluating digital libraries to improve usability and effectiveness, and to enhance their experience of digital library collections and services. Digital libraries are increasingly a part of the digital learning setting and they must offer users' positive and successful learning experiences (Koohang, 2004).

## 2.6 SUMMARY

Digital libraries can be defined as systems that integrate software demands, extend communication and storage, digital computing and content, to advance the dissemination of information, searching, cataloguing, and collecting the services provided by conventional libraries that largely depend on paper. Furthermore, when effective, these libraries offer coherent access to users, enabling them to navigate organised, large digital warehouses of knowledge and information. This chapter has demonstrated the important aspects of the digital library, demonstrating that they can support digital information navigation, browsing and searching using metadata components and social tagging systems. In addition, it has observed that many studies have been performed to enhance the performance of digital libraries and social tagging. However, there has been little to no research examining the user's perspective regarding the employment of social tags in a digital library. Thus, there is a need to explore and evaluate the usability of tagging systems in digital libraries as part of the e-learning environment.

## **CHAPTER 3**

### **METHODOLOGY**

This chapter introduces the main research methodology and strategies for this thesis in detail, describing the design of both the quantitative method and the qualitative method, and explaining both the data collection and analysis processes.

### **3.1 INTRODUCTION**

This chapter concentrates on the research methodology employed for this study, explaining how the present study was conducted. Research methodology refers to procedures for collecting, analysing, interpreting, and reporting data in research studies (Fidel, 2008). Denscombe (2010) has explained that to uphold the principle of accuracy, researchers should produce valid data based on reliable methods. In addition, to accord with the principle of accountability, researchers should provide explicit descriptions and justifications of the methodology used.

This chapter fulfils the researcher's obligations as outlined above, and is divided into nine sections. The study's research strategy is first explained, after which, the research methods for the present study are identified, and subsequently the data collection process is discussed. After this, there is a description of the design and implementation of the quantitative study method (web-based survey). Then follow details of the qualitative method (interviews). There is then a section concerning the ethical considerations raised when conducting the research. Finally, the process of integrating the data is explained in the last section.

### **3.2 RESEARCH STRATEGY**

According to Israel and Hay (2006), the quantitative approach entails the search for knowledge in the form of measurements that can describe and explain real word phenomena. Creswell (2002) identifies how far the constructive objectives of the quantitative approach aim to establish the relationships among measurable variables. According to Creswell (2002), the quantitative research approach enhances the provision of objective and representative results not influenced by the researcher.

Quantitative methods place greater emphasis on numerical results, as they seek to minimise the influence of the human factor. For instance, when distributing large-scale and formal questionnaires impersonally, responses are coded through the incorporation of statistical analysis. Israel and Hay (2006) assert that quantitative research seeks to enhance the direct retrieval of primary data from a research sample, thereby supporting the development of inferences pertaining to a larger population. Additionally, any data that is retrieved can be utilised to validate or disprove hypotheses. Quantitative research methods of data collection assist the researcher by delivering valid and reliable statistical data.

However, quantitative methods have shortcomings, as the rich details in the complex information retrieved can be eliminated by reducing results to summative findings. Moreover, a key disadvantage of quantitative research is that it often fails to provide data that can be readily synthesised to produce a useful summary. These characteristics can result in the neglect of minute details and the failure to fully quantify participants' behaviour (Israel and Hay, 2006).

In contrast, qualitative research focuses on the words of participants, and involves the analysis of data using interpretative methods (Bryman and Bell, 2007). The main aim of a qualitative strategy is to develop an understanding of social phenomena in natural settings (Pope and Mays, 1995). This approach has many advantages, enhancing the development of direct contact between the researcher and participants, and emphasising the understanding of phenomena in their own right (rather than from an external perspective).

According to Creswell (2002), the qualitative approach demands the researcher's proximity to the object of their research. It seeks to discover information to enhance the investigative process, focusing on understanding phenomena through the provision of an insider perspective. It also offers scope for open and exploratory research questions, which can deliver detailed answers. Creswell (2002) identifies the main disadvantages

of qualitative research as the difficulty generalising findings, and the variation in reporting them as analysis depends on the unbiased extraction and interpretation of the data.

Mixed methods research combines qualitative and quantitative methods, integrating quantitative and qualitative data in a single study (Fidel, 2008). Usually, the motivation to combine research methods is the belief that the quality of a study can be improved if the biases, limitations, and weaknesses of a method are counterbalanced by utilising another approach (Fidel, 2008).

Mixed methods research is a methodology for conducting research that provides a better understanding of a research problem or issue than either approach could achieve alone. The essential goal of mixed methods research is to generate new knowledge by addressing research questions from a variety of angles, to develop multiple perspectives regarding the data (Bulsara, 2014). It can involve either concurrent or sequential use of quantitative and qualitative methods, to follow a line of inquiry (Bulsara, 2014). Since the mixed methods approach utilises both open- and closed-ended questions to follow either quantitative or qualitative methods; multiple forms of data exist, drawing on all possibilities statistical and text analysis. This means the final database represents both quantitative and qualitative information.

From the discussion above, regarding research approaches and strategy, and conforming to the intentions of this thesis, a mixed research method was chosen to ensure the generation of evidence that independently conducted qualitative and quantitative studies could not achieve alone (Creswell et al., 2003). Certainly, according to Bryman (2006), mixed methods improve credibility, as the use of both approaches enhances the integrity of findings. Therefore, the findings reported were achieved by cross-checking the responses from the survey method with the more detailed responses from the interviews.

Another benefit is also highlighted by Bryman (2006); that is, that mixed methods can be applied to use one method to explain the findings generated by the other. Exploratory results gained from the survey conducted in this study need to be further examined through interviews. This is because the survey does not provide all the information required to test the hypotheses. However, the survey analysis revealed key topics to serve as focal points for further investigation, providing a focus for the interviews. Furthermore, as this study is exploratory in nature, one data source alone is insufficient.

Creswell (2002) illustrated that a mixed methods design is useful for capturing the best components of both quantitative and qualitative approaches. In other words, a mixed methods design can generalise research findings to a population and develop a detailed view of individuals. In this study, an on-line questionnaire was distributed to a large number of individuals, prior to arranging and conducting in-depth interviews. Thus, it aims to deliver both generalised findings and a detailed view of the usability of social tags in digital libraries.

This study begins with an investigation into the use of social tagging applications in a digital library, as a means to improve document organisation and retrieval through multiple phases of research including multiple methods. The main aim when following up qualitative research in the second phase is better understood by explaining quantitative results.

Triangulation is among one of the main objectives of mixed methods research Creswell (2002). Triangulation is the act of combining several research methods to study one thing. This has the effect of balancing each method out and giving a richer and hopefully truer account. Creswell explains the idea of data validation by saying that triangulation is the process of corroborating evidence from methods of data collection such as documents and interviews.

This study implemented Methodological triangulation which involves using more than one option to gather data, such as interviews, questionnaires, and documents.

Triangulation facilitates validation of data through cross verification from more than two sources.

### 3.3 RESEARCH METHODS

This study is based on the assumption that collecting different types of data should provide a clearer understanding of the usability of social tags in digital libraries. Qualitative data was also used to explain the quantitative results in greater depth. Two separate data-collection phases were also entered into. The study began with an on-line questionnaire, to generalise the results to the study population before focusing, in the second phase, on detailed, qualitative, in-depth interviews to gather more detailed views from participants.

Mixed methods studies include at least one quantitative strand and one qualitative strand (Fidel, 2008). Each strand is a component of a study that encompasses the basic process involved in conducting quantitative or qualitative research; i.e. posing a question, collecting data, analysing data, and interpreting results based on that data (Teddlie and Tashakkori, 2009).

The level of interaction describes the extent to which the two strands are mutually independent or interactive (Fidel, 2008). The same author further argued that ‘this decision is the most salient and critical’ one, when designing a mixed methods study:

1. **Independent:** When a study is independent; the researcher only combines two strands when drawing conclusions as part of the overall interpretation at the end of the study (Fidel, 2008).
2. **Interactive:** Through a process of interaction, the two methods are combined before any final interpretation. Interaction can occur at different points in the research process, and in many different ways (Fidel, 2008).

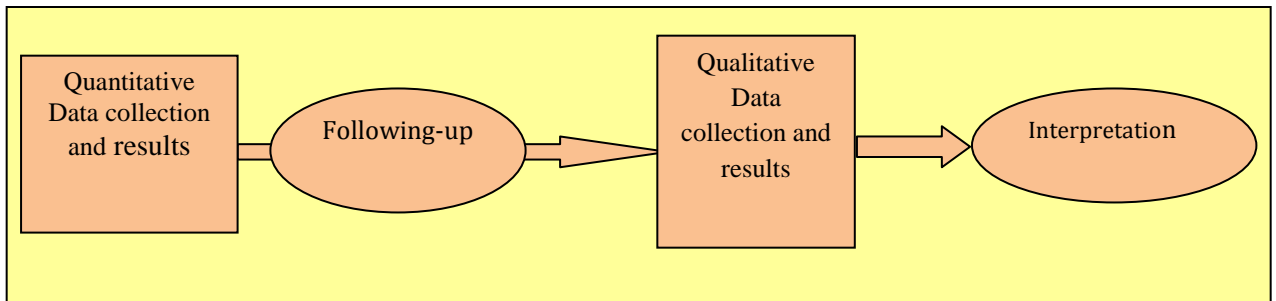


In this study, the analysis of each data strand will be performed separately, and the two strands mixed when drawing conclusions at the end of the study.

Both the quantitative and qualitative methods are given equal priority, such that both play an equally important role in addressing the research problem. Indeed, both strands have been implemented in two distinct phases, first through the collection and analysis of survey data, and then through the collection and analysis of the interview data based on sequential timing.

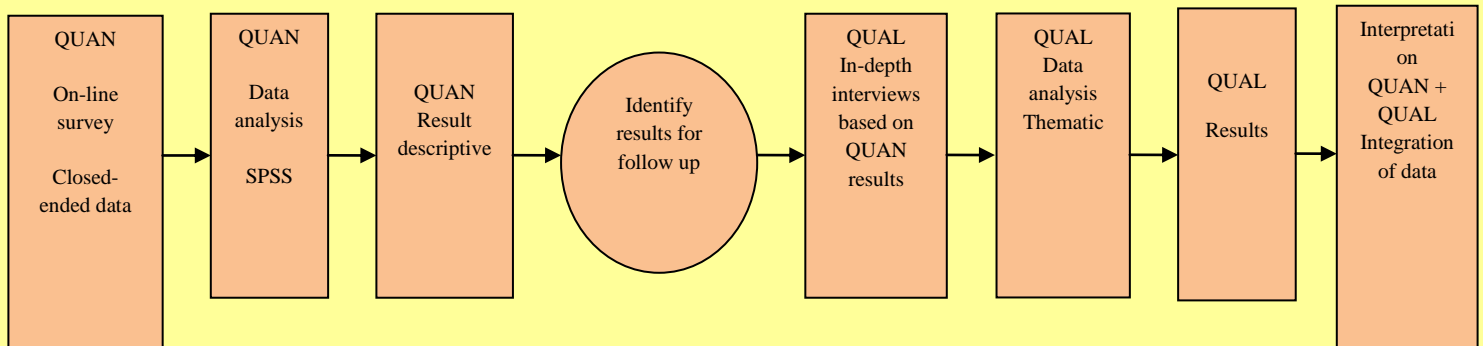
Mixing or integrating can happen at four possible points during a study: interpretation, data analysis, data collection, and design (Fidel, 2008). Mixing during interpretation occurs when the quantitative and qualitative strands are mixed during the final step of the research process once the researcher has collected and analysed both sets of data (Fidel, 2008). In this study, the conclusion reflects what was learned after combining the results. This was the only point in the research process where a mixing of methods occurred.

Fidel (2008) argued that when selecting a typology-based design, the researcher offers a framework and logic to guide the implementation of the research methods that can ensure the resulting design is rigorous, persuasive, and of high quality (Fidel, 2008). There are four basic mixed method designs, which are the convergent parallel design, the explanatory sequential design, the exploratory sequential design, and the embedded design. This study utilised the explanatory sequential design. The explanatory design is a mixed methods design in which the researcher begins by conducting a quantitative phase and then follows up specific results with a second (qualitative) phase (Fidel, 2008).



**Figure 5** Explanatory diagram showing sequential designs (Fidel, 2008)

Quantitative research hypotheses address the research issue during an initial step; while a survey that includes the collection and analysis of quantitative data is being designed and implemented. After this, an information survey will be explored further in interview by identifying specific quantitative results that call for additional explanation, and then using these results to guide the development of the qualitative strand (interview). As a third step, the qualitative phase is implemented by collecting and analysing qualitative data from interviews. Qualitative data collection will be used to explore important quantitative results with only a few participants. Finally, interpretive findings will be generated to illustrate to what extent, and in what ways, the qualitative results explain and add insight to the quantitative results, and what is learned overall in response regarding the study's purpose.



**Figure 6** Depiction of a mixed method sequential explanatory study to measure the usability of social tagging in a digital library in an e-learning environment

### ***3.3.1 DATA COLLECTING***

For this study, secondary and primary data was collected. According to Creswell (2002), primary and secondary data can complement each other efficiently and effectively. These two data collection components are explained in detail below.

### ***3.3.2 SECONDARY DATA***

Secondary data is essential as it enhances the provision of valuable insights into the area being researched and the development of a foundation aimed at generating more ideas (Creswell, 2002). Secondary data refers to material published in various forms, containing data collected by previous researchers (Israel and Hay, 2006). This study has obtained sources from academic journals, textbooks, and the Internet, which are also available from De Montfort University and through online access to the library website.

### ***3.3.3 PRIMARY DATA***

According to Israel and Hay (2006), primary data refers to data collected from researchers especially for research purposes, aimed at addressing specific research problem(s). To fulfil the aims of this study, primary data was collected using an online questionnaire and interviews, as will be explained in detail in the following sections. The quantitative and qualitative phases supported one another and were intrinsically connected with the success of the study.

## **3.4 DESIGN AND IMPLEMENTATION OF THE QUANTITATIVE STRAND (WEB-BASED SURVEY)**

### ***3.4.1 QUESTIONNAIRE DESIGN***

The focus of the quantitative questionnaire was on the identification of social tagging frameworks, with specific usability aspects, and identified by the role played by the

social tagging system in the digital library. Research pertaining to social tagging is identified as exploratory in nature, and the majority of the variables measured using the survey questions dealt with the users' perceptions and intention. The study also sought to incorporate a survey strategy.

Surveys are commonly used strategies. They are commonplace and enhance the collection of large amounts of data from a sizeable population in an economical manner. Moreover, questionnaire based usability test techniques are widely used to test the usability of digital library website designs (Alsalem, 2013).

Online surveys provide various benefits over traditional mail surveys, as they incorporate greater turnaround times and reduced costs in terms of postage and printing (Andrews et al., 2003). The Internet provide the opportunity for the distribution of surveys to the entire online population. The result is that it is possible to conduct an online survey easily from anywhere, at any time.

An on-line survey extends the benefit of allowing researchers to communicate directly with potential respondents. Furthermore, it is identified as superior because it enhances the automatic verification and storage of survey responses through the utilisation of database technology. Similar to other types of surveys, online surveys are limited by shortcomings proceeding from self-selection and self-reporting (Creswell, 2002). Self-reported data within surveys is subject to the fallibility of people's memories, idiosyncratic use of scales, and deliberate alteration resulting from social desirability biases. Self-selection enhances the identification of non-probability sampling errors or bias when collecting data.

The online questionnaire for this study was administered to students who utilise the digital library system as part of their study activities. All the respondents issued with a questionnaire were expected to complete it. The questionnaire was carefully designed using close-ended questions. The reason for choosing close-ended questions was that

they are speedy, accurate, and easy to quantify (Maylor and Blackmon, 2005), enabling the researcher to compare key variables. Some of the questions were open ended, to ensure the collection of sufficient data to fulfil the study objectives.

Questionnaire links were sent to the respondents via emails and social media sites (Facebook and Twitter). The questionnaire was active for a period of approximately ten months, from June 2014 to April 2015. It comprised of 23 questions of different types: category type (CT) questions close ended type (CT) questions, continuous and open-ended (COE) questions, all was divided into sections according to question type.

The questionnaire collected demographic information and measured the social tagging statistics retrieved from the sample. Data included age, level of educational attainment, and types of users based on their experiences using digital library websites, and the social tagging system in particular.

The aim was to measure the level of adoptability of the system according to users of the digital library, using a scale developed by Oulanov and Pajarillo (2001): the Software Usability Measurement Inventory. The scale consists of five items: affect, learnability, efficiency, helpfulness, and control of the social tagging application. The efficiency of the scale was verified separately to obtain accurate results. The items were also restructured to ensure they would be understood by students from Saudi Arabia.

The scale measures the level of accuracy performance, which is the efficiency of the system, using self-evaluation questions consisting of a 3-point scale (agree, undecided, and disagree). In addition, it also sought to determine how satisfied users were when using social tags in digital libraries using a 3-item scale (agree, disagree, and undecided).

### **3.4.2 VALIDITY AND RELIABILITY**

To enhance the validity and reliability of the questionnaire, questions were asked simply, to limit the occurrence of unwanted interpretations. Initially, pilot tests were conducted with 8 taggers in four phases. The first phase involved two participants with the aim of improving on unclear definitions (leading to definitions of digital libraries as university library websites, and social tags as keywords developed by users). In addition, ambiguities were identified, as with question 4: *what kind of information do you look?* (explained as referring to material not subject), and question 5: *how do you access the information?* (explained as the process of searching for information).

Following improvements, the questionnaire was re-tested with two different academics as the second phase. More improvements were then incorporated into the questionnaire, including supporting a format with more multiple-choice questions, and creating a layout by separating the questionnaire into sections depending on the type of information required, and the contents by adding questions 11 and 12.

In the third phase, two more individuals were consulted to enhance the question flow and to determine the time required to complete the questionnaire. In Phase four, the questionnaire was again tested with two participants but no more changes were found to be required. This limited the occurrence of problems during the administration of the questionnaire to respondents (Creswell, 2002). The measures of the various constructs were identified from previous literature, and adapted within the context of social tagging within digital libraries.

### **3.4.3 SAMPLING**

There are two types of sampling technique: probability sampling and non-probability sampling. Probability sampling refers to a non-zero opportunity relating to the selection of each population element (Creswell, 2002). However, for this study a non-probability sample was utilised. According to Creswell (2002), non-probability sampling limits the

occurrence of randomness; however, it is convenient and appropriate where there are budgetary and time constraints.

Convenience sampling is an easy, quick and inexpensive method of collecting data, in which 'sample elements are selected for the convenience of the researcher' (Black, 2009: 231). A mixed process was incorporated when determining the target sample. Additionally, a mixed process was applied, incorporating the distribution of surveys online, together with distribution to students on social media (Facebook and Twitter).

The population selected for the study includes postgraduate and Undergraduate Saudi students, who would be expected to have used the library's website to explore students' knowledge of the use of social tagging in digital library. To assess the usability of any system, users are required to add their experience and opinions. For social tagging system most of the users are students and librarians. In this study, the sample used is students for two reasons: the number of Saudi students who are studying in uk way higher than the number of Saudi librarians. Secondly, it is more reasonable to ask students than librarians as they are represent the highest amount of users where every academic digital library serves thousands of students while the number of librarian are way less than that.

The aim when utilising a mixed process is to enhance the collection of empirical data based on principles of convenience and time. In total, 175 responses were collected. All of the questionnaires were completed and deemed valid; therefore, the final sample was 175 completed questionnaires.

#### ***3.4.4 DATA ANALYSIS***

For the purpose of this study, quantitative and natural data collected using a questionnaire was analysed using the SPSS (Statistical Package for the Social Sciences), which is a statistical software package used to quantify data. SPSS 'organises quantitative research data into various statistical formats to determine the relevance of

variables associated with the research topic' (Holiday, 2009: 78). The demographic variables and variables associated with the research hypothesis were analysed using descriptive statistics, and frequencies, percentage, measures of central tendency (mean) and dispersion (standard deviation) were obtained. Cross tabulation in the form of a chi-square analysis was also conducted to determine whether there was any relationship between the study variables.

### **3.5 DESIGN AND IMPLEMENTATION OF THE QUANTITATIVE STRAND (INTERVIEW)**

#### **3.5.1 INTERVIEW DESIGN**

Guided by the data collected using the quantitative approach, issues and topics identified formed the basis for more in-depth interviews and further exploration. In-depth interviewing is a qualitative research technique that involves conducting interviews with a small number of respondents to explore their perspectives. Creswell and Plano Clark (2007) illustrated that the in-depth interview method is appropriate when there is a need to gain insight into individual evaluations of specific material, or when exploring new issues in depth, as applies to this study specifically. This method was appropriate, because the primary objectives were specified using the survey.

In-depth interviews were useful for obtaining detailed information about individuals' thoughts and behaviours. They can produce very precise and specific answers, as well as varied knowledge about personal experiences, opinions and motives, which studies based on solely quantitative methods cannot convey. In-depth interviews were used in this study to provide a context for the quantitative data, offering a more complete picture of how social tags can be used in digital libraries in e-learning environments.



The in-depth interviews were semi-structured, and the interviewer's aim was to offer an open relaxed approach when interviewing (Creswell and Plano Clark, 2007). Semi-structured interviews are a simple, efficient and practical means of collecting data (Creswell and Plano Clark, 2007).

An interview guide was developed concentrating on four main topics: (1) background and general information about users; (2) measurements for the level of adoptability of social tags by users of the digital library, by investigating the affect, learnability and helpfulness criteria associated with the social tagging application; (3) testing how accurate search results are when relying on social tags; and (4) determining whether social tags have an impact on user satisfaction in digital libraries. Each topic area includes a number of questions. When necessary to enhance the quality or depth of the conversation, the guide was deviated from. The interview guide contains an introductory statement, information regarding the aims of the study, the interview procedure; including the length of time, type of recording, type of questions and statements reaffirming the anonymity and confidentiality of the interviewee. In addition, information regarding the demographic characteristics of the interviewees, including, age, sex, and years of study was included.

Face-to-face interview questions were designed to be simple, clear, direct, and brief, as they were for students who are not native English speakers (Saudi students). When necessary, the questions were translated into Arabic to become more understandable to convince interviewees. Questions posed during the interview were intended to be. Each interview lasted about 50 minutes and written notes were kept for all interviews, and key data noted down immediately following the interview.

Interviews were conducted between the 10 and 31st of April 2015. It should also be noted that all the questions in the interview guide were included as part of the analysis for this study. Finally, follow up letters of thanks were submitted by hand to all participants after the interviews had been completed (See appendix III).

### ***3.5.2 THE VALIDITY AND RELIABILITY***

According to Anderson (2010), the validity of research findings refers to the accurate representation of the subject they are aimed to represent, while the reliability of a study refers to the reproducibility of the findings. The validity and reliability of interviews is sometimes questioned. However, some researchers argue that semi-structured interviews have high validity, because they allow participants to speak in detail, elaborating on the meaning informing actions, with little or no input from the interviewer (Tashakkori and Teddlie, 2003).

Anderson (2010) further explained that validity can be substantiated using a number of techniques. To enhance the validity of this study, respondent validation and constant comparison techniques were used. Respondent validation refers to allowing participants to read through their data and provide feedback about the researchers' interpretations of their responses.

To enhance the reliability of the interviews, Pilot testing of the interview guide was performed with two students; one an Undergraduate and the other a postgraduate. According to Connelly (2008), extant literature suggests that a pilot study sample should be 10% of the sample projected for the study. While my sample for the interview is 15 students, so, choosing two as pilot test were enough. Modifications were made to the interview guides based on the interviewer's experience while piloting and the feedback from pilot participants.

### ***3.5.3 SAMPLING***

All the students who completed the web survey (the phase one data measuring tool) were approached to participate in the interview stage, to explore social tagging usability in digital library websites. Fifteen students were chosen for interview. The students who participated in the interview were Undergraduates and postgraduates (both Master's and PhD students). Moreover, the interview was conducted with students from different

universities to ensure a variety of experience and suitable access to information. The participants were chosen based on their experience using social tags when accessing the digital library.

#### **3.5.4 DATA ANALYSIS**

In this study, the data collected from the interviews was analysed thematically. Thematic analysis is a method of, identifying, analysing and reporting themes or patterns within data (Braun and Clarks, 2006). Thematic analysis involves identifying themes from collected data. A theme captures important points, which relate to the research question and inform overall understanding of the data set (Braun and Clarke, 2006).

For this study, the data was reviewed; notes recorded and arranged into categories. After this 'codes' were developed (codes are words or phrases that serve as labels for each category) (Boyatzis, 1998). Thematic analysis uses codes to move closer to the collected data and develop in depth understanding of content. According to Boyatzis; a code should be clear and concise, and able to offer a foundation for themes that are will be raised during the analysis of the data (Boyatzis, 1998).

#### **3.6 ETHICAL CONSIDERATIONS**

Denscombe (2010) concurring with Bryman and Bell (2007) recommended that research should be guided by a system of moral principles, and that it should be conducted in an ethical manner. Guided by that basic principle, the respondents were well informed and guaranteed that the information they provided would be retained confidentially and anonymously. The respondents were not required to supply their names or any piece of data that could identify them uniquely. This was done to protect their identities, and is consistent with Bryman and Bell's (2007) recommendations regarding informed consent and avoids misrepresentation or deception.

Furthermore, the research was ethically approved by De Montfort University, and strictly followed British Educational Research Association (2012) guidelines. Therefore, the researcher was ‘committed to discovering and reporting things as faithfully and as honestly as possible without allowing [own] investigations to be influenced by considerations other than what is the truth of the matter,’ (Denscombe, 2010: 62).

### **3.7 SUMMARY**

This chapter has provided a detailed explanation of the methodology employed to achieve the aim and objectives of the study. The research strategy employed, data collection methods and ethical considerations have all been presented. As this study was conducted in two phases, first quantitative and then qualitative, the design and implementation of each was explained in detail. The following chapter will address the findings from the study.

## **CHAPTER 4**

### **RESEARCH DESIGN**

This chapter reviews some related works on the subject of usability in digital libraries, focusing on the usability of social tags in digital libraries. It also describes and explains the development of the three study hypotheses.

## **4.1 INTRODUCTION**

This chapter endeavours to discuss previous studies detailing the usability of digital libraries in general, and the usability of social tagging systems within them. It will review the main three hypotheses to be addressed by digital library's users, to identify the influence of social tagging for searching for and identifying information.

## **4.2 USABILITY IN DIGITAL LIBRARIES**

Users of the library are also interested in the services that activate them, rendering them more than mere passive recipients, as long as the traditional values of the library are preserved (Connaway et al., 2008).

The users of digital libraries also require services, to manage the huge volume of digital information collections effectively. In this regard, the definition of the digital library should not be limited to digital information collections, but to how the library as an environment combines digital information collections and information organising tools, to support the creation, dissemination, use, and preservation of information. Due to their enormous scale, digital libraries cannot be effective unless they integrate effective information organisation tools into their digital information collections. The ability to connect digital content with digital libraries' services, will facilitate the search process, making it quick and effective.

To assess the level of services provided by digital libraries, the usability concept has emerged in studies and projects relating to digital libraries. The usability of digital libraries can be defined as determining the system's capability to satisfy users' needs. Usability describes the extent to which users describe using a system to achieve specified goals with effectiveness, efficiency, and satisfaction (Nielsen, 2000).

The usability of a digital library is an important element of all digital libraries projects. It also plays a vital role in users' acceptance of the system (Nielsen, 2000). Blandford and Buchanan (2002b) argued that subsequent possibilities are influenced by every important design decision. Thus, appropriate usability properties must be incorporated when planning and designing digital libraries (Koohang, 2004). Usability must not be 'added on' as an afterthought when creating a digital library; rather, users' needs should be taken into consideration from the earliest stages onwards to manage the design phase effectively (Blandford and Buchanan, 2002b). One key challenge here is to understand users' difficulties when working with digital libraries, to equip developers with ways of thinking about users and their needs to help guide development and evaluation in digital libraries.

The usability of digital libraries is a broad topic, which focuses on different views and multiple attributes, some agreed upon by researchers and others not. Nielsen (1993) points out that usability has five attributes: learnability, efficiency, memorability, low error rate, and satisfaction. Brinck et al. (2002) share a similar perspective, asserting that usability criteria for a system include that it should be functionally correct, efficient to use, easy to learn and remember, error tolerant, and subjectively pleasing. In addition, Booth (1998) outlines four factors of usability: usefulness, effectiveness (ease of use), learnability, and attitude (likeability).

Usability in a digital library can be described according to the following items (Oohing, 2004: 55):

- Simplicity: use of the digital library should be simple, reflecting attributes such as satisfaction, efficiency, and learnability;
- Ease of use: use of the digital library should be easy reflecting attributes such as satisfaction, efficiency, learnability, and attractiveness;

- Adequacy of information: the information obtained from digital library should be sufficient and appropriate, and efficiency, effectiveness and satisfaction are key attributes that linked with item; and
- Comfort: use of the digital library should be comfortable, ensuring user satisfaction, efficiency and learnability.

Accordingly, the commonly applied usability attributes, as reported in different studies are, effectiveness, efficiency, satisfaction, and learnability. Effectiveness relates to the user's ability to achieve specified goals comprehensively; efficiency refers to the resources used when completing a task; and satisfaction refers to positive attitudes towards using the system (ISO, 1997). Finally, learnability measures detail how easy it is for casual users to learn a system (Nielsen, 1993).

Researchers working in the area of the usability of digital libraries have prioritised testing and evaluation (Koohang, 2004). However, Blandford and Buchanan (2002b) explained there is a need for further work utilising additional methods when evaluating usability. Various usability test techniques are available, including surveying the opinions of users with questionnaires, direct interviews, thinking aloud, and observations or not involving users, such as heuristics, cognitive, walkthrough, and action analysis; all of which have been used to evaluate and test usability of digital libraries.

However, several studies have examined users' views concerning the usability of digital libraries. Moreover, Koohang (2004: 2) argued that 'a critical, yet largely unexamined facet of the usability of digital libraries is the users' views of the usability of digital libraries.' Nevertheless, researchers have acknowledged that users' views play an important role when assessing the usability of digital libraries. Furthermore, views derived from users' behaviour regarding the usability of digital libraries might inform the success of learning in general (Koohang, 2004).



Since digital library usability need to be understood as multi-dimensional, various views and attributes render the process of evaluating and designing systems for digital libraries difficult and complex for the researcher. The evaluation of usability of a digital library is important to offer strategic direction for the development of the future systems, which are intended to make the learning process easy and simple, as the Hungarian Academy of Sciences confirmed.

### **4.3    *USABILITY OF SOCIAL TAGS IN DIGITAL LIBRARIES***

Social tagging offers an alternative mechanism for browsing digital resources, based on tags added by users. Through tagging, users are able to organise information for ease of retrieval in future, tailoring the digital world to own interests, as well as organising and storing favourite links, while gaining inspiration from others (Gray, 2011).

To attain user's interest and establish the need for different information within library locations and communities, the public collections at libraries should be accessible in a manner that meets users' needs. Evaluation criteria that have been used to evaluate the adoptability of social tags include:

- Affect: users' feelings about using the system (Oulanov and Pajarillo, 2001);
- Learnability: degree to which the user can learn and use the system (Oulanov and Pajarillo, 2001);
- Helpfulness: user's perceptions that the software communicates in a helpful way;
- Efficiency (accuracy): the degree to which the system is able to achieve its goals and tasks; and
- User satisfaction: the degree of the digital library user's pleasure, happiness, fulfilment, agreement, liking, comfort, appreciation, and enjoyment of/with the digital library (Koohang et al., 2005).

Tagging in the digital library environment is also influenced by the social media tool used to afford tagging options (Hammond et al., 2005). According to Devaraj et al. (2008) and Hargittai and Walejko (2008), personality and socioeconomic status also play a major role in influencing engagement in social media and tagging activities in a digital library.

Social tagging in a digital library helps users generate metadata on a large scale; this data is then accessible to the public repositories used to describe these resources. Social tagging affords insight into the search habits of users, and is a crucial component in facilitating the search for information in the digital library (Woodsworth, 2010).

Social tagging allows digital library users who share similar interests to interact with each other, thereby, facilitating the sharing of information via the Internet. Digital libraries, on the other hand, are mostly found in academic institutions, rendering learning enjoyable and comfortable. Social tagging has also increased access to the digital library, increasing entry points (W2GIS, 2011), and expanding user numbers. It also has a great impact on the lives of students since they can easily perform research in a logical manner. Social tagging has also changed how people use the library and how people use vocabulary in the digital library context (Lalmas, 2010).

#### **4.4 THE DEVELOPMENT OF THE RESEARCH HYPOTHESES**

##### ***4.4.1 SOCIAL TAGS AND USER SATISFACTION IN DIGITAL LIBRARIES***

As explained above, user satisfaction encompasses users' feelings about an application, how enjoyable they find it to use, and how usable it is (Norlin, 2002). As user satisfaction is important to digital libraries. The relationship between social tags and user satisfaction has been studied by many researchers. It is also noteworthy that

satisfaction is numbered among the most cited attributes of usability, while usefulness is frequently overlooked (Thomas, 1998).

It is predicted that henceforth, digital library will become the main avenue through which the world will achieve developmental goals and success. This is because people studying at research and education institutions spend much of their time on the Internet performing research and communicating via the available social platforms. There are many online social tools, through which people can meet to share interests and exchange ideas. Interactions between individuals, both online and physically, result in the emergence of efficient and reliable tools that are accurate and precise.

Users of digital libraries, should be offered the opportunity to use tagging tools for communication or for academic purposes that allow them to simply and freely exchange ideas. Users' views regarding the usability of digital libraries might serve as the major conduit to user acceptance and satisfaction. According to Chowdhury (2010), effective access to digital information content requires investment in information organising tools and services to acquire the best content from digital information databases (Chowdhury, 2010). In addition, Chou (2010) highlighted that satisfaction with social media utilities is very important in motivating knowledge sharing.

The usage of the social media in the literature and in relation to libraries is heavily dependent on the motivations one receives when using social media. These motivations, which involve content creation or knowledge sharing, can be categorised as either intrinsic or extrinsic motivations. According to Cho et al. (2010), intrinsic motivations are directly related to the activity that one is engaged in, and are initiated if the activity is enjoyable, interesting, or satisfying. In addition, the commitment and sense of obligation to contribute to the literature is also an intrinsic factor motivating academics to use social media (Cho et al., 2010). This was evident from findings highlighted by Cho et al. (2010) in reference to the influences of knowledge sharing on Wikipedia.

They found the Web 2.0 environment knowledge is not static but a ‘public good’, built, shared, and managed through mutual collaboration.

Wikipedia allows and supports a sense of altruism that encourages both social and relational contexts that are key to shaping attitudes toward knowledge sharing. With such intrinsic motivation, people are able to share knowledge, to help others and eventually to fill in the gaps present in the literature (Cho et al., 2010). Generalised reciprocity is another social factor that encourages knowledge sharing using social media. This imposes social pressure or creates an obligation to respond or give back to the community information that has already been learned (Cho et al., 2010; Cox, 2008).

A sense of belonging is another important underlying social factor influencing knowledge sharing capabilities and intentions. This type of intrinsic factor is critical, because it applies to all those who belong to the community and have the opportunity to help others with the knowledge that they have. Such information can be acquired by customers and business organisations responsible for organising web-based discussion boards. The enjoyment of helping others is also another important intrinsic motivator that allows individuals to share knowledge (Lee et al., 2006).

This study assesses satisfaction from the perspectives of user’s reactions; of course, it is possible to either canvass users’ opinions to measure their satisfaction, or to track the usage of systems directly by analysing observations, traces, or results of such usage. This approach will be adopted to determine whether the use of social tagging in digital libraries increases user satisfaction or not. This will involve simple multiple choice questions, to which respondents will give yes or no answers.

In chapters five and six, the methods for data collections will be analysed with some response diagrams and figures used where applicable to show the numbers of those interviewed. Chapter six, will demonstrate why the findings in chapter five arose.

Social tagging allows users to 'tag' or describe information using their own words, in a manner that is applicable and meaningful to them. The tagging process is usually undertaken by users employing their own consumption and retrieval processes. As a result of this process, tagging produces a collective intelligence, arising from the knowledge shared among the social media community (Anfinnsen et al., 2011). Social tagging tools offer users a new way to organise and share information using folksonomies, by freely adding tags to data.

Spiteri (2007) found social tagging enhances user's interaction with information as it eliminates all potential barriers between the user and the item. This is realised as the user is actively involved in the information sharing process through the provision of their own opinions and viewpoints regarding information, which further enhances the control process (Spiteri, 2007). Social tagging encourages user participation, creating a sense of community among users, improving the incorporation of teamwork when enhancing the proper organisation and dissemination of information (Spiteri, 2007). User interactions can also take place via online communities that not only enhance teamwork, but also encourage the development of information partnerships and friendships among individuals, thereby enhancing increased levels of knowledge sharing within the community.

According to Refthlefsen (2007), 'now social bookmarking and tagging tools help librarians to bridge the gap between the library's need to offer authoritative, well-organised information and their patrons' Web experience.' Through the medium of social tagging, librarians have the ability to learn about the information seeking behaviour of users, by looking at the information they tag and the categories of information they seek.

Hypothesis 1: User satisfaction in a digital library can be increased by using social tags.

#### ***4.4.2 SOCIAL TAGS AND ACCURACY OF RESULT IN DIGITAL LIBRARIES***

Although the process of tagging of library resources shows substantial promise as a means of improving the quality of users' access to resources, several important questions have arisen about the level and nature of the warrant for basing retrieval tools on user tagging. These are yet to receive full consideration from library practitioners and researchers.

The quality of retrieved documents is a key criterion for the successful use of a digital library. Anday et al. (2012) found that search results from social tagging in digital libraries can be distinguished from the results conducted when following a traditional approach, because of their accuracy. According to Woodsworth (2010), social tagging in digital libraries help users to access the large body of metadata that is accessible via the public repositories used to describe such resources.

Social tagging also assists individuals to organise resources for themselves and to share them with others, as well as to find the resources that other people have tagged. Social tagging data has been used to enhance descriptions of metadata in some collections. Web connections made in digital libraries resulted in libraries becoming more sociable, personal, accessible and integrated places (Dasgupta, 2010). Social tagging is also important for organising content, utilising collaborative indexing, based on user-generated tags.

According to Bao et al. (2007), Choy and Lui (2006), and Golder and Huberman (2006), social tagging has received significant attention, because it helps organise content with collaborative and user-generated tags. Social tagging also improves retrieval performance on the web (Heymann et al., 2008; Kipp and Campbell, 2010; Sen et al., 2006; Yanbe et al., 2006), and it is therefore important for users to add their own tags based on their interests. Efficiency assessments are important to evaluate whether social tagging systems as a whole can be used to retrieve information efficiently and to

measure, how much time it takes to complete tasks and how many steps are required. In the case of libraries, the aim is to achieve the maximum level of service delivery for users, as the success of the library depends on their management and their ability to offer materials (Li, 2001: 23).

The questionnaire conducted for this study will mainly focus on the amount of time saved by using social tagging, and the willingness of students to adapt to new technologies. The subsequent interviews will be conducted with 175 students chosen randomly, and cover issues that will include research accuracy in relation to access to social tags in a digital library.

Hypothesis 2: Accuracy of research can be improved by using social tags in a digital library.

#### ***4.4.3 ADOPTABILITY OF SOCIAL TAGS IN DIGITAL LIBRARIES***

When comparing traditional methods of identifying data with social tagging it is evident that the newer approach results in quickly achievable and accurate searches. Traditional methods of study for academic excellence involved spending considerable time in libraries, perusing books and conducting physical experiments. Through technology, modern digital libraries have ensured that some of these tiresome experiments can be performed using prototyping, in which case, actual elements are replaced with virtual elements and the results analysed. The questionnaire and interviews targeted 175 randomly chosen students across various universities to examine the number of people in education institutions willing to adopt this new technology.

The willingness to adopt related to three important aspects. The first being learnability: Alsalem (2013) pointed out that the issue of ease of use for electronic projects becomes more significant in developing countries, including Saudi Arabia. Learnability refers to how easy it is to learn about applications and to become a skilled user (Norlin, 2002).

According to Blandford and Buchanan's (2003) research, there has been minimal work conducted in the context of digital libraries in reference to learnability and how users learn. As a result, there has been relatively weak understanding of how digital libraries develop in terms of expertise, and how digital libraries can be better designed to support learning.

Users need to obtain a number of skills in all digital library environments, which is not always straightforward. Often, skills developed when using a particular digital library cannot be easily transferred. Furthermore, the situation is complicated by the fact that skills learned to use digital library interfaces can become largely obsolete within a few months, because the technology is changing rapidly.

Blandford and Buchanan (2003) have noticed that beginner users struggle more when learning to use digital libraries. Thus, because digital libraries require a more sophisticated query formulation than web search engines such as Google. To conclude, further work needs to be done on learnability in digital libraries, to understand how people learn to search effectively for information, and to use digital libraries in that search and hence to determine how libraries can be better be designed to support learning (Blandford and Buchanan, 2003).

Social tagging in the digital word is considered helpful from many perspectives. Data retrieval is fast and easy, and no physical material retrieval is required. More than one user can use the same material at the same time, irrespective of the separation distance. Thus, users can easily communicate and advise each other on the best material when referring to a given topic.

Hypothesis 3: Social tags are more readily adoptable than traditional methods.



#### **4.5 SUMMARY**

To summarise the data covered in this chapter; first, the scope of the term usability in the field of digital libraries has been explained, and then different point of views and multiple definitions presented. In addition, the usability of social tags in digital libraries in particular has been discussed; especially in relation to how easy it is to access information, and consider the data obtained. Finally, the main three hypotheses that drove this study, and which were employed to identify the usability aspects of the social tagging system will be examined in the next chapters, and addressed with a detailed explanation.

## **CHAPTER 5**

### **PRESENTATION OF FINDINGS FOR QUANTITATIVE STRANDS**

This chapter introduces survey descriptive statistics and survey inference statistics of the on-line questionnaire and tests the hypotheses using SPSS.

## 5.1 INTRODUCTION

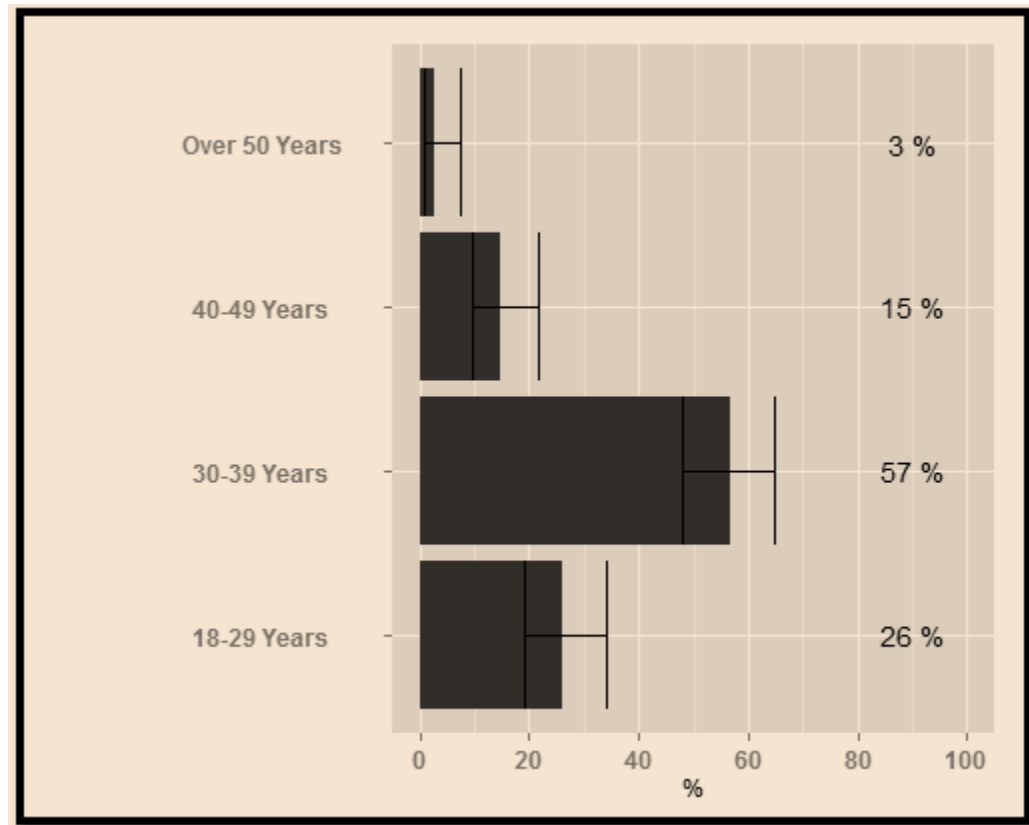
This study aims to evaluate the use of social tagging in digital libraries. SPSS software was used to carry out the analysis of the quantitative data obtained in the study. The data was collected from a sample of 175 on-line questionnaires. Demographic variables and other variables associated with the research study were statistically analysed. Cross tabulation was also used where chi-square analysis was conducted, to identify any relationship between the various study variables.

Descriptive statistics for the researched questions provide information about the distribution of answers for each question and help to identify global trends in the data structure.

## 5.2 SURVEY DESCRIPTIVE STATISTICS

After applying descriptive statistics to the research questions, answers were obtained, to provide an evaluation of the system's structure.

1. Please indicate your age group



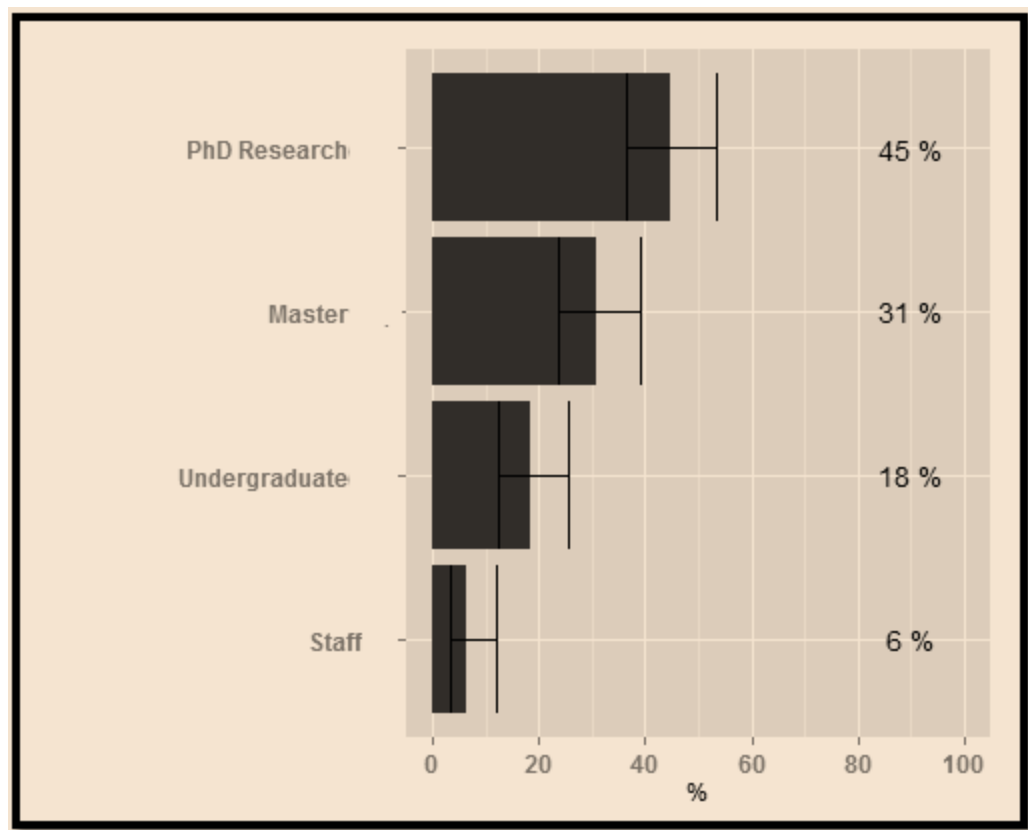
Confidence +/- 5.6 %, Average score=2,1 (levels=1-4)

Figure 7 Results for 'Please indicate your age group'

The age distribution for the survey study is close to normal and is as expected. The largest segment of participants are aged 30-39 years. This group is interested in using technology, and in books, studies and expanding their cultural knowledge. It is the central age group for our study, and the confidence interval is 51-63%. The least represented category is individuals aged over 50 years; there are fewer people from this age group in the entire target population, and it is expected that this group also prefer manual searching.

2. *Please indicate your degree level*

The histogram for level of qualification has a left-skewed distribution. The largest group among respondents were PhD researchers, who accounted for 45% (64 people). Almost a third of the group comprised Masters students with 31% (44 people). There were also obviously fewer Undergraduates and members of staff: 18% and 6% respectively. It is notable that those groups most concerned with conducting research were also those most interested in digital library implementation. The confidence level for degree level distribution is about 6% (the average score is 3.1), which corresponds to Master's level.



*Confidence +/- 6.12 %, Average score=3.1 (levels=1-4)*

**Figure 8** Results for 'Please indicate your degree level'

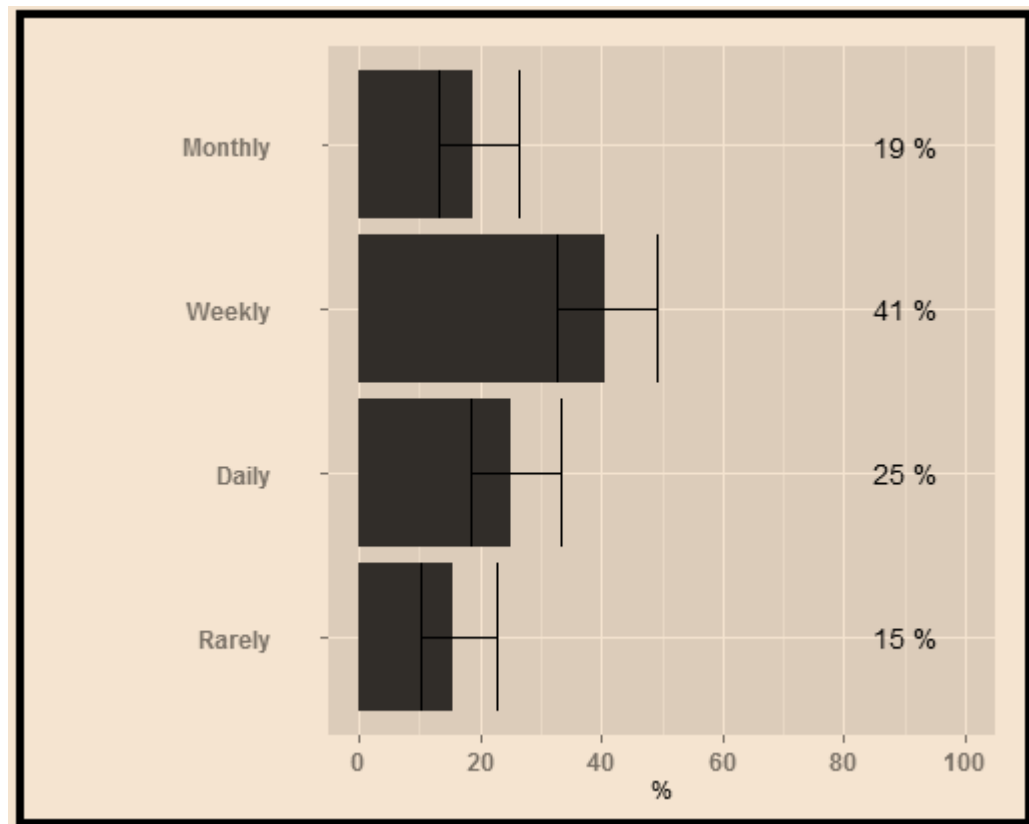
3. *What kind of information do you look for in digital library?*

Table 2 Types of information

Answer	Frequency	Answer	Frequency
Books	14	Books, novels, since studying	1
Papers, articles, journals, books, theses, dissertation	13	Books, articles and everything	1
Articles, journals	10	Business and management	1
Papers, articles, journals, books, theses, dissertation, multimedia	9	Computer science	1
Papers	6	Computing	1
Papers, articles, journals, books	6	Data	1
Theses, dissertations	6	E-journal, E-book	1
Articles, journals, books	4	Education teaching and learning	1
Articles, journals, books, theses, dissertations	4	Engineering	1
Papers, articles, journals, theses, dissertations	4	Engineering research	1
Papers, articles, journals	3	Family business	1
Research	3	IT	1
Science	3	Journals	1
All	2	More details about the content	1
Articles, journals, theses, dissertations	2	Papers	1
Books and articles	2	Papers, Books, Thesis, dissertation	1
Books, Multimedia	2	Pictures	1
Computer science	2	Regard my study	1
IT	2	Related to my field linguistics	1
Multimedia	2	Research and statistics	1
Theses	2	Review study, research in health	1
Theses and papers	2	Scientific books and articles	1
Data in my field	2	Signal processing	1
Academic essays	1	Software engineering	1
Academic research	1	Specialty keywords	1
Accounting and finance	1	Statistics	1
Articles	1	Study	1
Articles	1	Subjects related to my field	1
Articles, e-books	1	Technology	1
Articles, journals, multimedia	1	Different data	1
Bioinformatics	1	Books / story / since / study	1

This open ended question resulted in a multimodal distribution. The answers that were obtained, are shown typically as described by responders to the survey; it was noted that the most frequent resources users mainly searched for were books, journals and articles; of course, this result matches the results when analysing data associated with the category of age. Hence, these resources are mainly used by PhD and Master's degree students. On the other hand, we can see the fields which the digital library was utilised to search for are wide various and distinct, while differing from one user to another.

4. *How often do you use the digital library?*

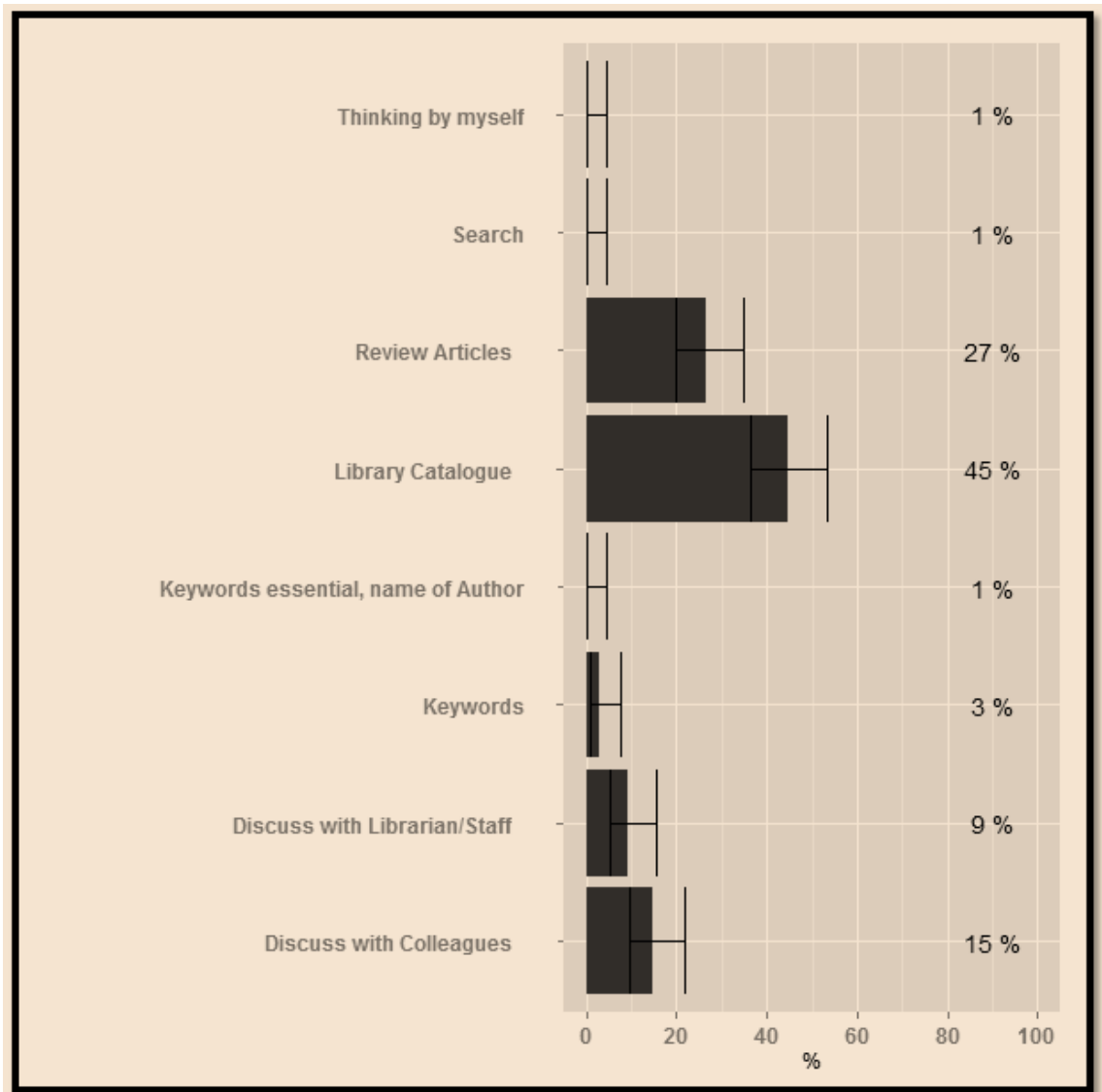


*Confidence +/- 6.47 %, Average score=2.6 (levels=1-4)*

**Figure 9** Result for 'How often do you use the digital library?'

The frequency of library usage received a normal distribution with confidence at about 6% and an average score of 2.6. This means respondents visited the library weekly; this might be associated with normal weekly assignments or increased search time caused by weekends. The distribution plot shows the number of respondents in the central part was 41% for weekly visits and 25% for daily visits. The subset also includes 15% of people who visit the library rarely and 19%, who visit the digital library once each month.



5. *How do you access information?*

*Confidence +/- 3.52 %, Average score=4.6 (levels=1-8)*

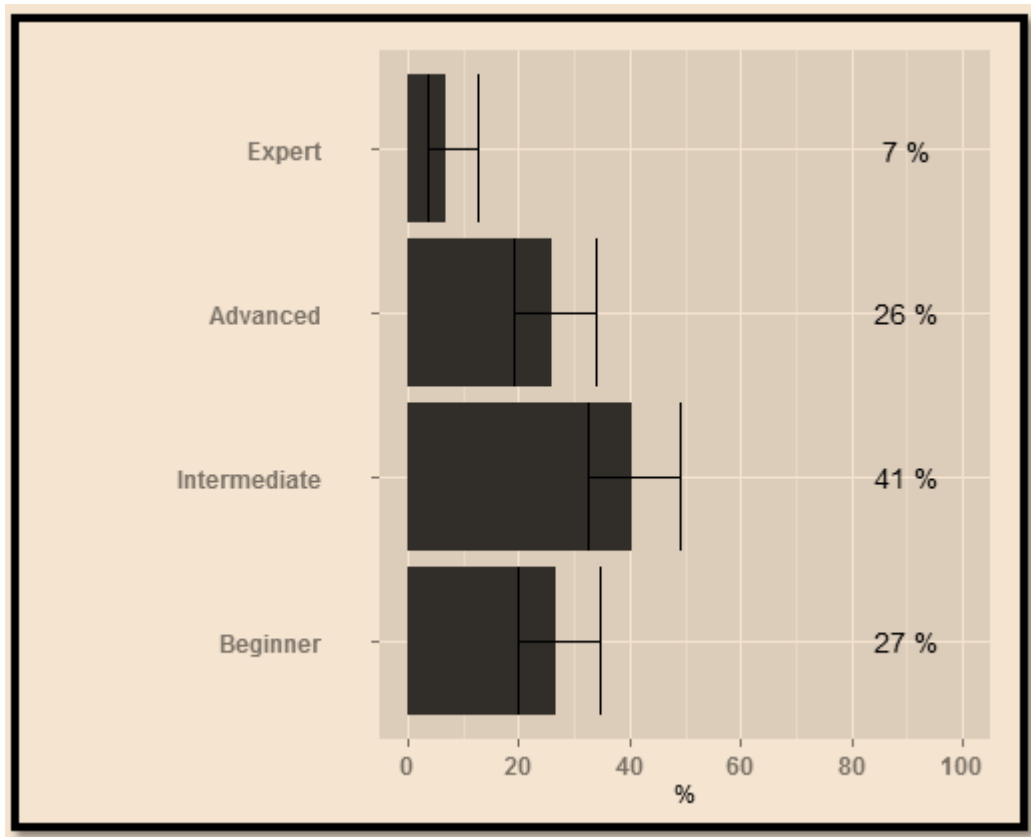
**Figure 10** Result for 'How do you access information?'

The information above summarises the statistics describing how respondents obtained the information they needed. This distribution describes the *library catalogue*, the most popular source of information with a frequency of 45% through the study group, which clearly indicates the efficiency of this method, and its advantages over

other options. The lowest percentages refer to how to get information by *thinking by myself*, *search*, *essential keywords*, and *name of Author*. These accounted for about 1% of the total number of respondents. People often use *review articles* (27%), *discuss with colleagues* (15%), and 9% *discuss with librarian staff*. This distribution returned a confidence interval below 4%, showing that the results of distribution are significant. A central respondent of this subset uses the library's catalogue, because average score is about 5.

6. *How do you consider yourself as a user of the digital library?*

(i.e. your university library's website)

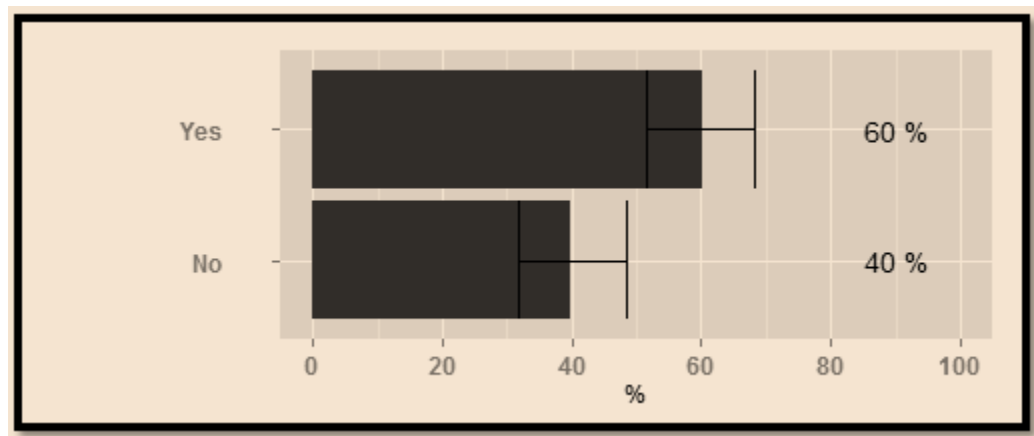


*Confidence +/- 6.27 %, Average score=2.1 (levels=1-4)*

**Figure 11** Result for 'How do you consider yourself as a user of the digital library?'

Level of responses relevant to university's digital library website showed a right-skewed distribution with a confidence of about 6%. This confidence interval corresponds with the distribution, which is close to normal. The average score for this response is 2.1 the mean central respondent for the study is person, who considers himself *intermediate* at tag systems usage. Almost half the respondents have answered in the same way: 41% *intermediate*. *Beginner* and *advanced* levels were selected as 27% and 26% respectively. Just 10 people (7%) consider themselves expert users.

7. *Have you ever used the social tag system in a social website?*

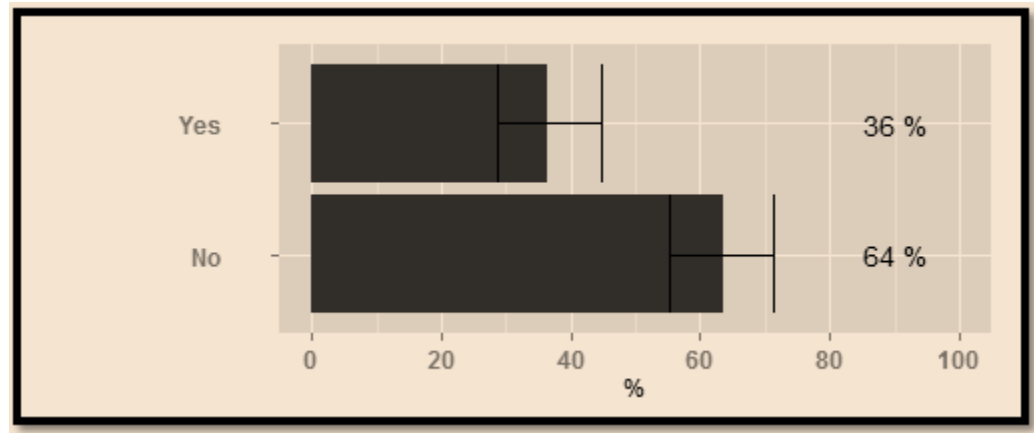


*Confidence +/- 8.26 %, Average score=0.6 (levels=0.1)*

**Figure 12** Result for 'Have you ever used social tag system in any social website?'

Using a social tagging system in the social environment was reported with almost homogeneous distribution. In total, 60% of users use tags and 40% do not. Distribution on the plot describes a high confidence level of about 8%, and the average score is 0.6. This means, in general, the proportion of individuals using/not using tag systems for social communication suggest that people would rather use tags than not.

8. *Did you use the tagging functions in any digital library?*

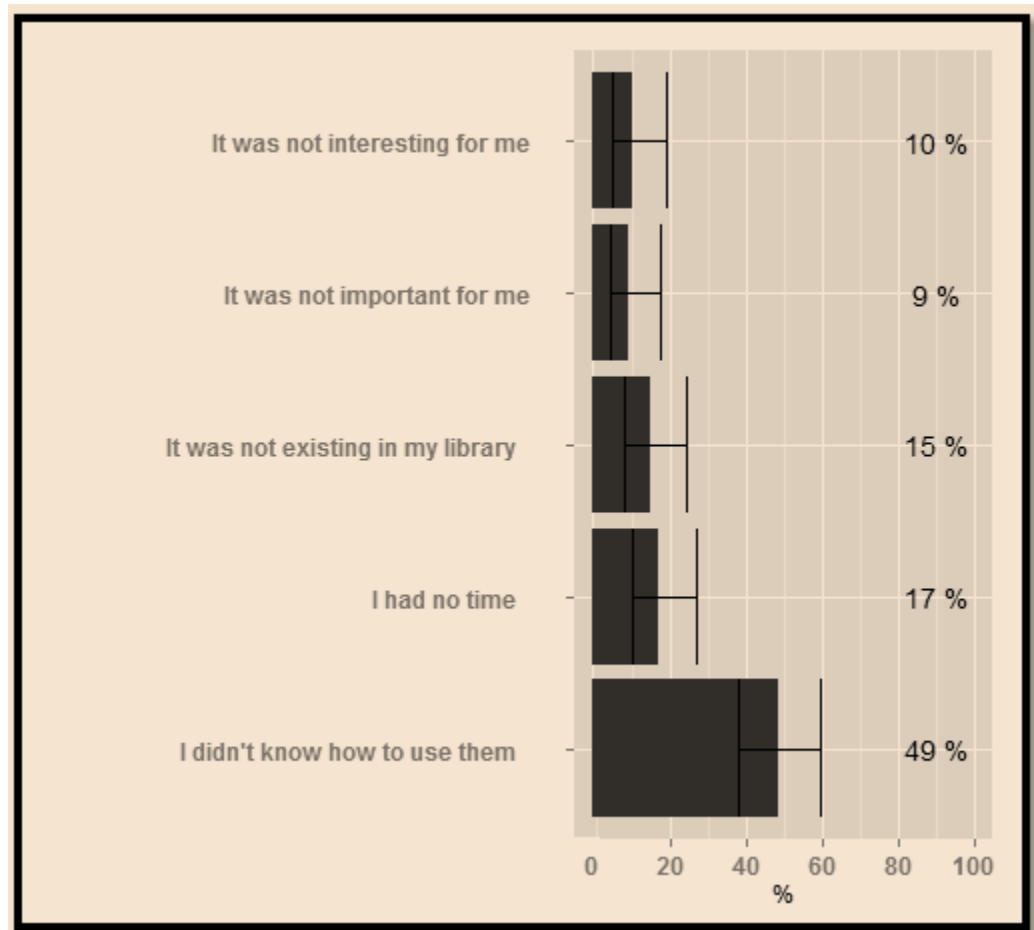


*Confidence +/- 8.13 %, Average score=0.4 (levels=0, 1)*

**Figure 13** Result for 'Did you use the tagging functions in the digital library?'

This result indicates that tagging is an option known to digital systems users, but also that more people do not use tagging than use it. In total, those people who do not use tagging- comprise 64% of the 143 people who participated in the survey.

9. *Why do you not use the tagging functions in the digital library?*



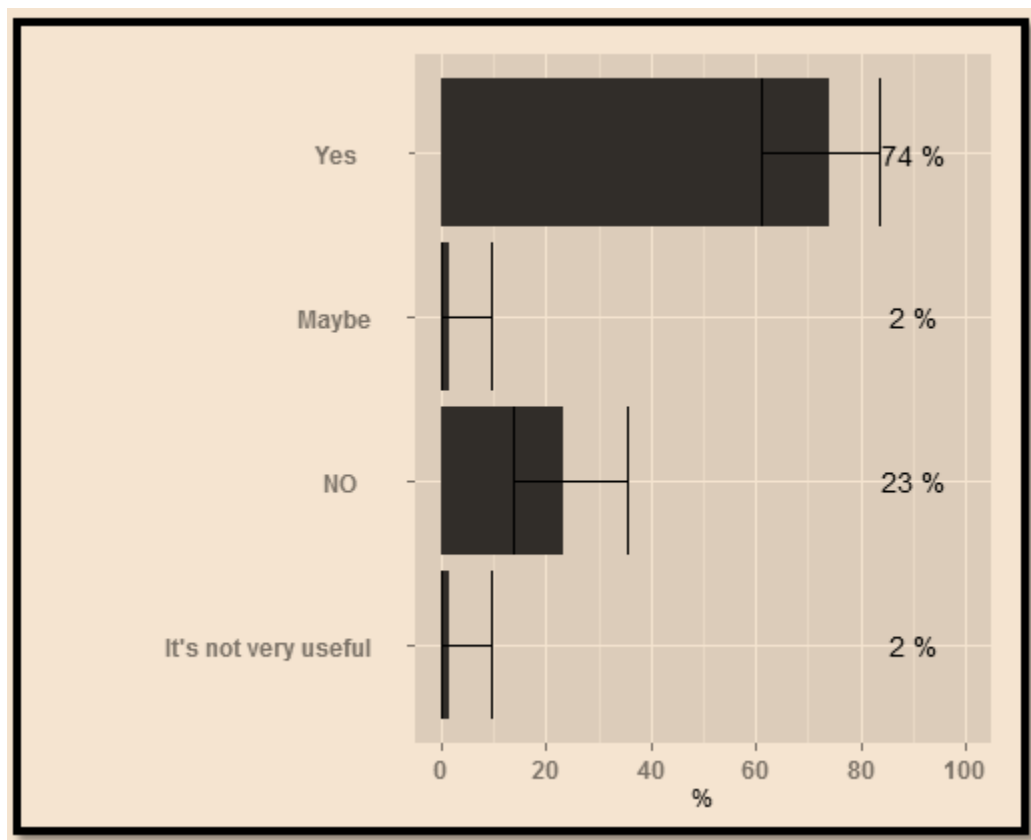
*Confidence +/- 6.78 %, Average score=2.1 (levels=1-5)*

**Figure 14** Result for 'Why do you not use the tagging functions in the digital library?'

Summarising answers to the questions asked we obtained distributions, described by the plots above. In total, 64% of respondents did not use the tagging functions of digital libraries, and 36% used tags when working with electronic documents. Confidence for users was high, but 56 – 72% do not use tags at all. Average score equals 0.4. demonstrating that the average participant does not use tagging when working in the library. 91 people, who answered negatively, gave reasons for not using tags in the library. The distribution of responses was as follows. The most frequent answer given

was: *I don't know how to use them*, this accounted for almost half (49%) of negative answers and 30% of the global subset. 15 respondents stated they *have no time*, 13 respondents asserted that *tags don't exist at their library*. A similar frequency (about 10%) answered: *it is not interesting for me, it is not important for me*. Confidence for this distribution was greater than 6%, and the average score was 2.1.

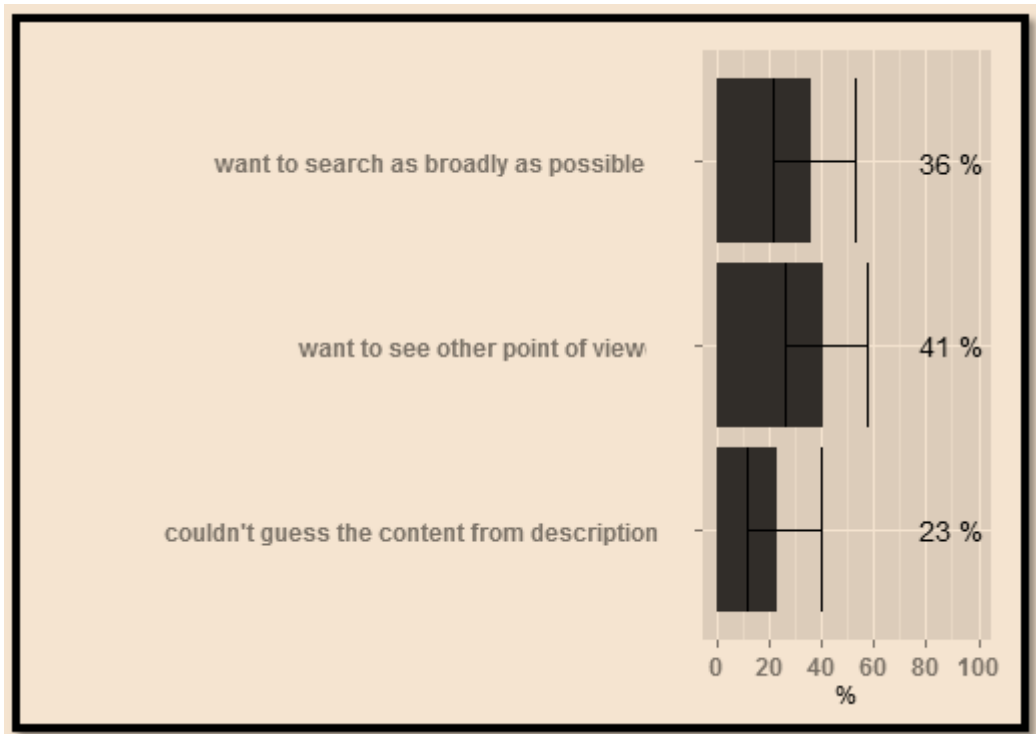
10. *Would you be interested to try a new way to find resources, based on the tag which the resource is saved under?*



*Confidence +/- 6.18 %, Average score=2.5 (levels=0-3)*

**Figure 15** Result for 'Would you be interested to try a new way to find resources, based on the tag which the resource is saved under?'

One of the central questions posed in this study concerned the respondents' opportunities and wishes. However, the data returned was incomplete, as only 65 out of 143 respondents answered this question. Distribution was described with an appropriate plot and was low-tailed. The median answer for the population was *yes*, denoting 74% (48 respondents). A general acceptance for tagging methods was shown here, which can provide an opportunity to achieve success when developing a tagging system in the digital library structure. In summary, respondents are interested in trying the tagging system, and the average score equalling 2.5 proves this conclusion. Only 1 person from the subset stated they were *not sure* about using it, and one person answered *it's not very useful*. Also responding negatively: 15 respondents (23%) stated they would not be interested in tags. Confidence for this distribution was satisfied (approximately 6%). The reasons for the positive answers were further investigated and plotted.

*11. Reasons for interest in trying a new way to find resources based on tagging*

*Confidence +/- 13.54 %, Average score=2.1 (levels=1-3)*

**Figure 16** Result for 'Reasons for interest in trying a new way to find resources based on tagging'

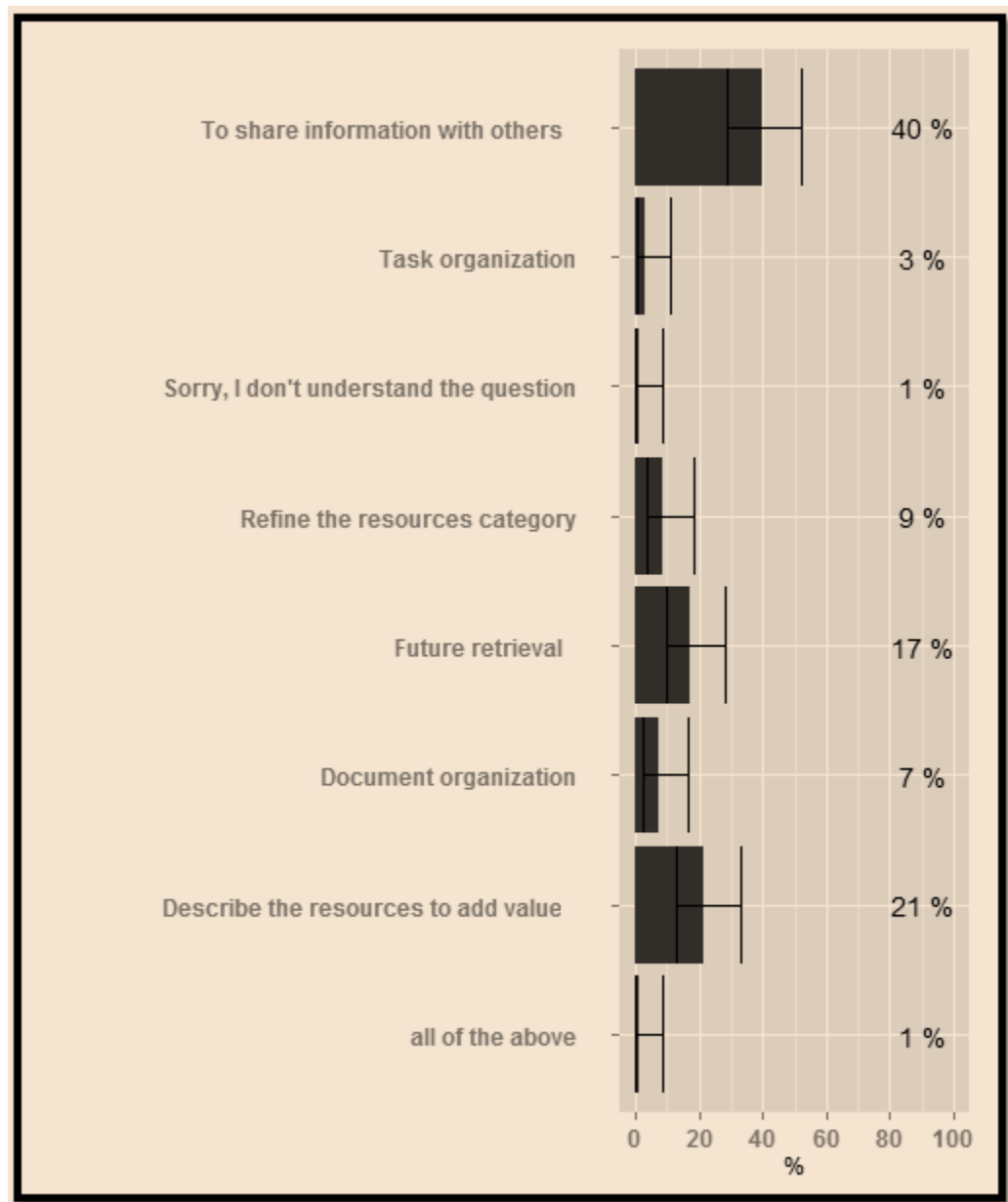
The topic above is very important and uncovers the users' aims when choosing to use tags. Moreover, it helps to clarify the tagging process, and so the findings could prove helpful to individuals wishing to use tags in the future. Out of 48 respondents, who gave positive answer to the previous question, only 39 gave responses to this one. The distribution was close to uniform, and all frequencies were approximately close. In total, 41% of respondents wanted to try tags, because they wanted to see other points of view about the electronic documents, and believed that tags would describe the documents more broadly. About one third of respondents, who expressed an interest in the tag system, just wanted to search as broadly as possible, and realised tags could assist in



this. In addition, 9 people (23% of respondents and 6% of the total), were unable to guess the document's content, believing that tags would be useful from this point of view. Confidence for this distribution was sufficiently high at about 13%; we also obtained a small subset with varying answers. The average score is 2.1.

*12. What made you use tags repeatedly?*

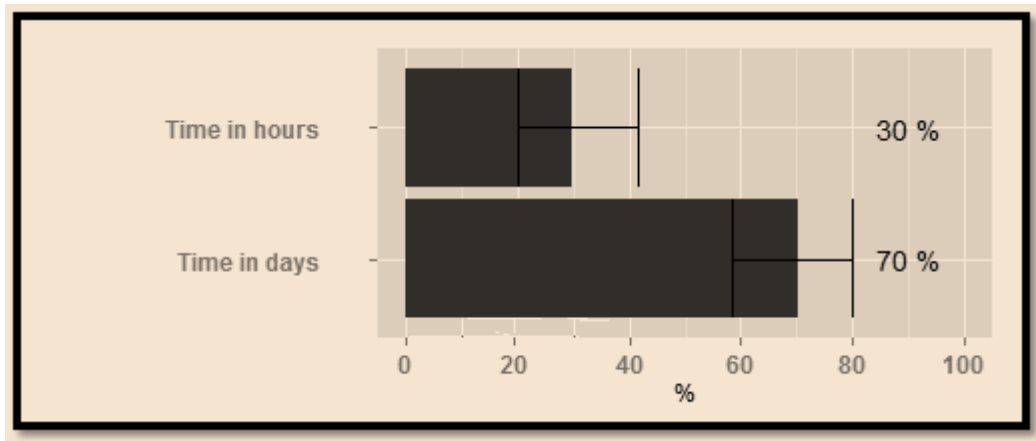
The participants revealed multiple reasons for repeatedly using tags. As this question is open-ended, there are eight levels of answers offered, described with a multiform distribution. This set of answers is also incomplete, as only 70 respondents offered responses. The highest frequency response was for the response: *share information with others* (40% out of 70 answers). Responses that can be considered broadly popular included: *describe the resources to add value* (21%), and *future retrieval* (17%) of the current subset. Significant answers also referred to the *refine the resources category* (9%) and *document organisation* (7%). There were also some answers for the categories *task organisation*, *all the above* and *I don't understand the question*. The confidence interval was satisfied at about 5%. The average score for this question was 5.3.



*Confidence +/- 5.26 %, Average score=5.3 (levels=1-8)*

**Figure 17** Result for 'What made you use tags again?'

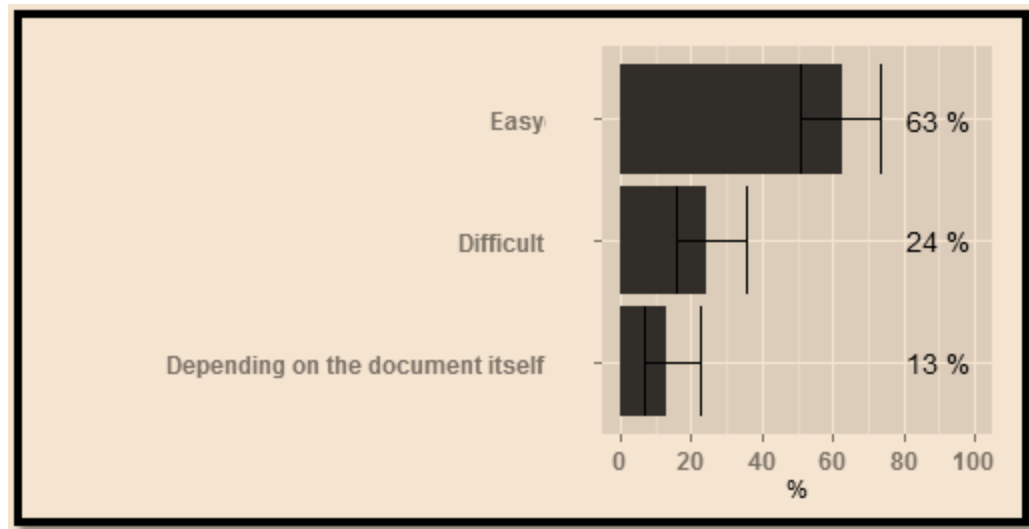
13. How much time approximately did you spend exploring the tagging functions?



*Confidence +/- 10.64 %, Average score=1.7 (levels=1,2)*

**Figure 18** Result for ‘How much time did you spend approximately exploring the tagging functions?’

Responses to the question concerning time spent exploring the tagging function are described by the plot above. Approximately 1/3 of respondents answered regarding time spent from first to last login, and the remainder of the respondents (close to 2/3) answered referring to absolute time spent. The confidence interval was rather large (greater than 10%). The average score for this question was 1.7, meaning that the central respondents answered regarding absolute time.

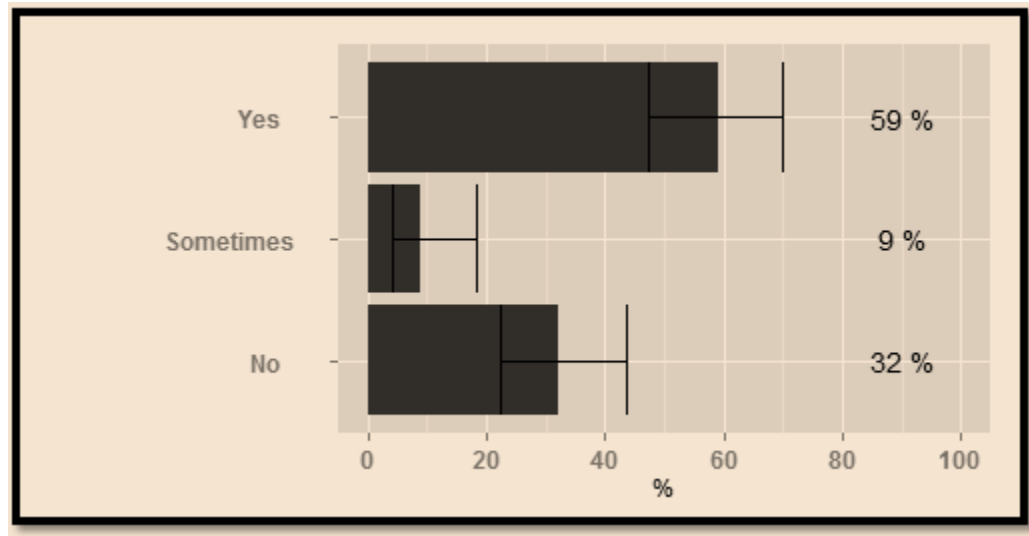
*14. Using tags to describe documents*

*Confidence +/- 8.87 %, Average score=1.5 (levels=0-2)*

**Figure 19** Result for 'Using tags to describe documents'

A summary of the use of tags in terms of the simplicity they offered regarding reaching subsequent conclusions was made. The total number of respondents answering this question was 78; thus, not all respondents chose to answer it. Of those who answered; 63% of respondents found using tags to describe documents easy, 24% found using tags difficult, and the remaining 13% claimed that the simplicity of assigning tags depended on the document itself. Confidence level for the results is high (more than 8%), and the average score was 1.5, meaning that central respondents felt using tags was an easy process.

15. Do you think it takes time to determine a suitable tag to describe the document?

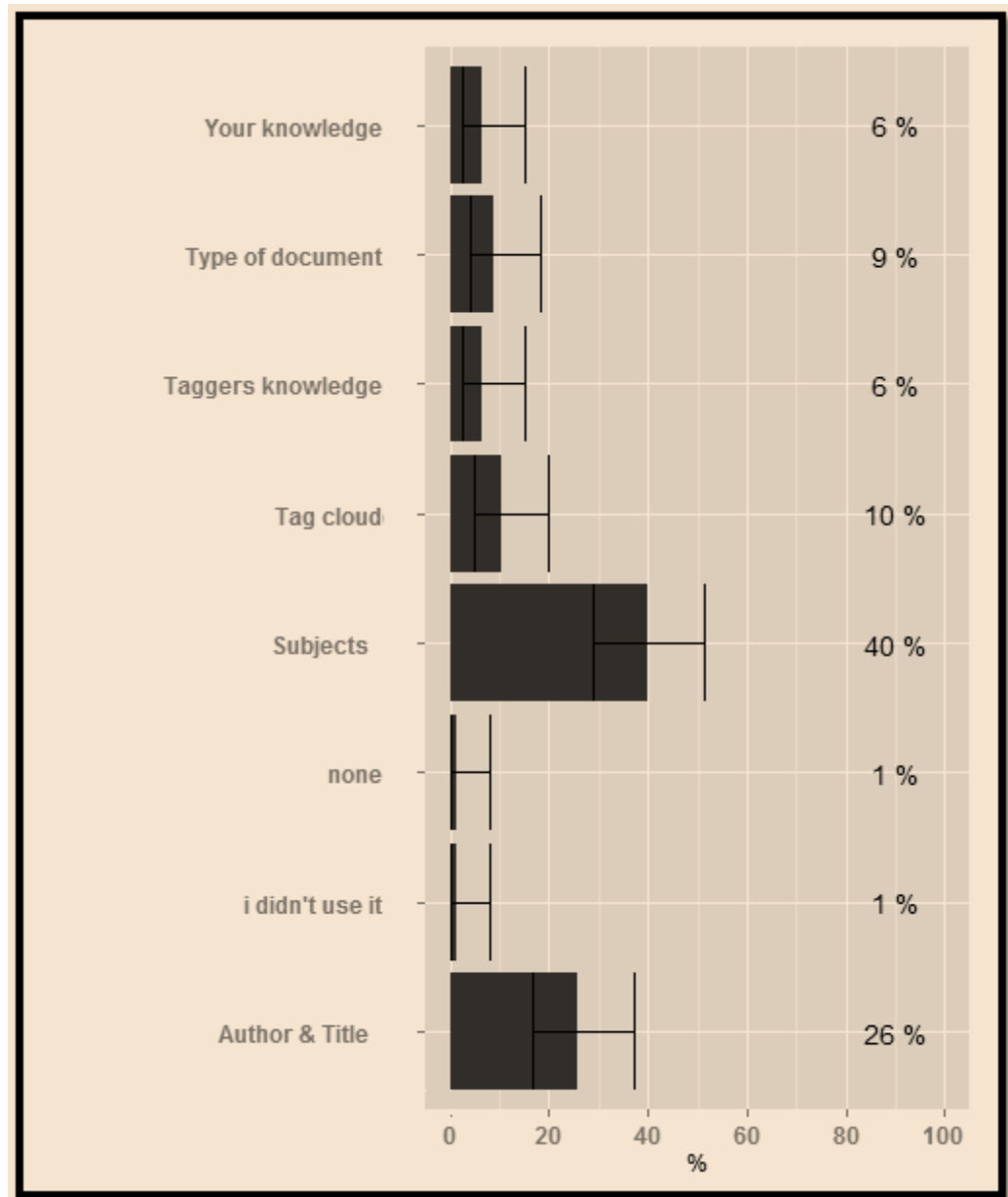


Confidence +/- 8.86 %, Average score=1.3 (levels=0-2)

**Figure 20** Result for 'Do you think it takes time to decide on a suitable tag to describe the document?'

Answers to this question were given by 78 respondents only, as not all the participants answered it. Estimating time taken to find a suitable tag to describe the documents, respondents were divided into three groups. The first group of 46 people (59%) chose the answer *yes*, the second group comprising 7 people (9%) answered *sometimes*, the third group of 25 people (32%) chose the response *no*. Therefore, the distribution was close to uniform with a confidence level of over 8%. The average score equals 1.3, corresponding to a subset with a central person, who thinks it sometimes takes time to choose a suitable tag.

16. How do you determine what tags to choose for the resource?

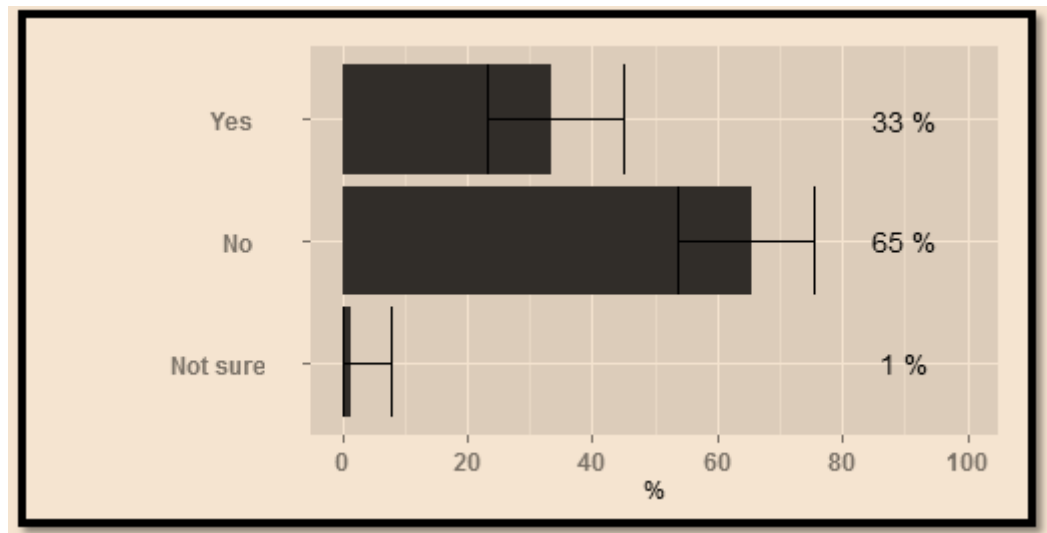


Confidence +/- 5.06 %, Average score=4.3 (levels=1-8)

Figure 21 Result for 'How do you determine what tags to choose for the resource?'

The summary for this question can be described according to a multimodal distribution. There were a large number of possible, answers producing significant dispersion. Leaders responding to answers used the *traditional search term (Author & Title)* at 26% and *subjects* at 40%. Answers such as *tag cloud*, *type of document*, *taggers knowledge* and *your knowledge*, occupy 10%, 9%, 6% and 6% respectively. Insignificant answers were given for the categories *none* (1%) and *I didn't use it* (1%). The confidence level for this distribution was satisfied at about 5%, with an average score of 4.3.

17. *Have you ever used the tag cloud?*

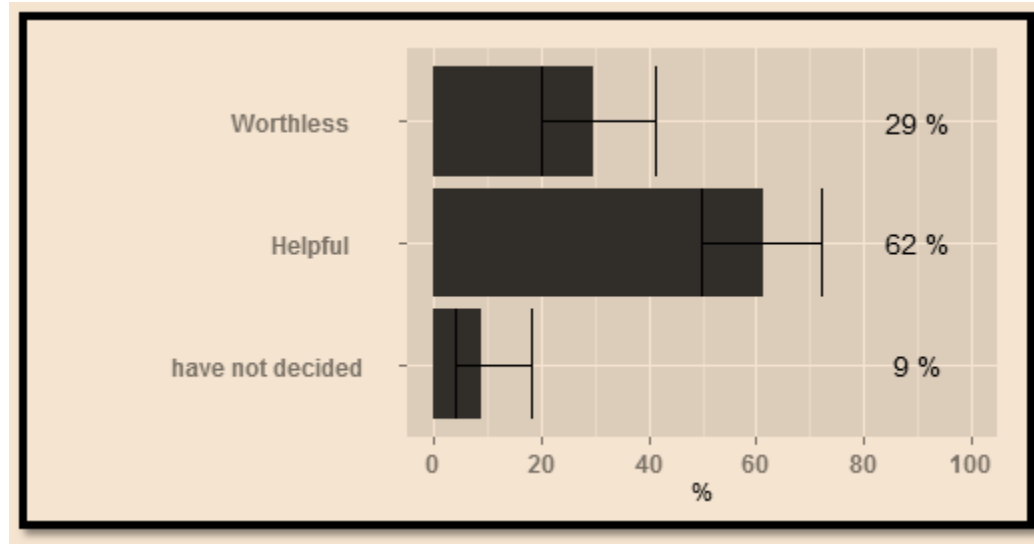


*Confidence +/- 7.65 %, Average score=1.3 (levels=0-2)*

Figure 22 Result for 'Have you ever used the tag cloud?'

Use of the tag cloud function is a key consideration of the current study. However, as we can see from the plot above, 65% (51 people) out of a total 78 respondents have never used a tag cloud. If confidence about this result is about 8%, we can summarise that between 57% and 73% have never used the tag cloud. In total, 33% respondents reported experience with the tag cloud, and 1 person claimed to be uncertain whether he had used it.

18. *What do you think about the tag cloud?*



*Confidence +/- 8.75 %, Average score=1.2 (levels=0-2)*

**Figure 23** Result for 'What do you think about the tag cloud?'

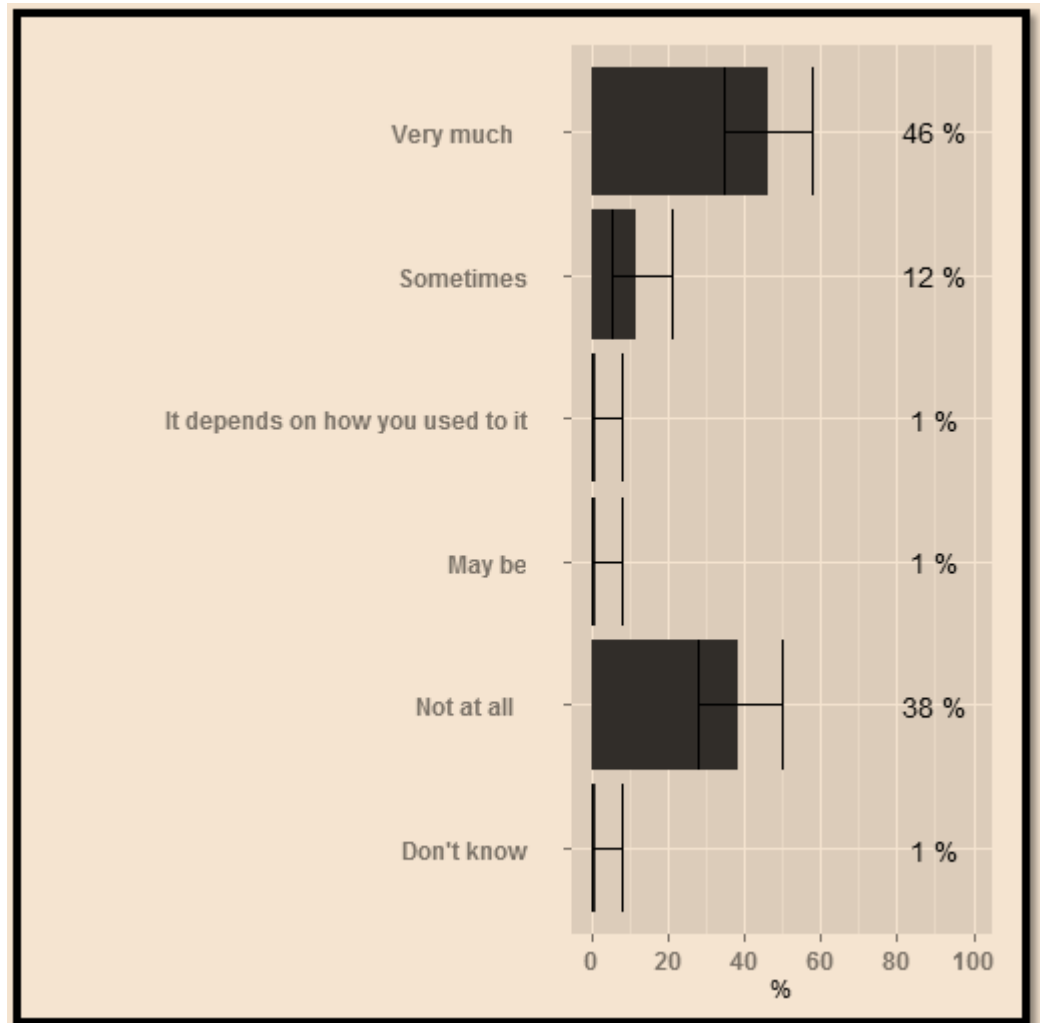
The subset of respondents answered the current question gave the same responses as for the previous question. Remarkably, most of respondents found this helpful. The percentage of positive answers was 62%. Meanwhile, 9% (7 respondents) made no comment regarding the advantage of using the tag cloud. The remainder of the subset (29%) consider the tag cloud to have no value for them. The confidence level for the current distribution is greater than 8% and the average is 1.2.

19. *The use of tags speeds up the time taken to obtain target documents*

This question enquired whether using tags made it quicker to obtain a document. The results show a strong division of opinion, as 46% of answers confirmed this at a high level (stating *very much*), while at the same time, 38% of respondents asserted *not at all*. The remainder of the respondents were divided into the responses: *sometimes* (12%),



*depends on how to use it (1%), don't know (1%), and maybe (1%).* The confidence level for the distribution was small at 5.21%.



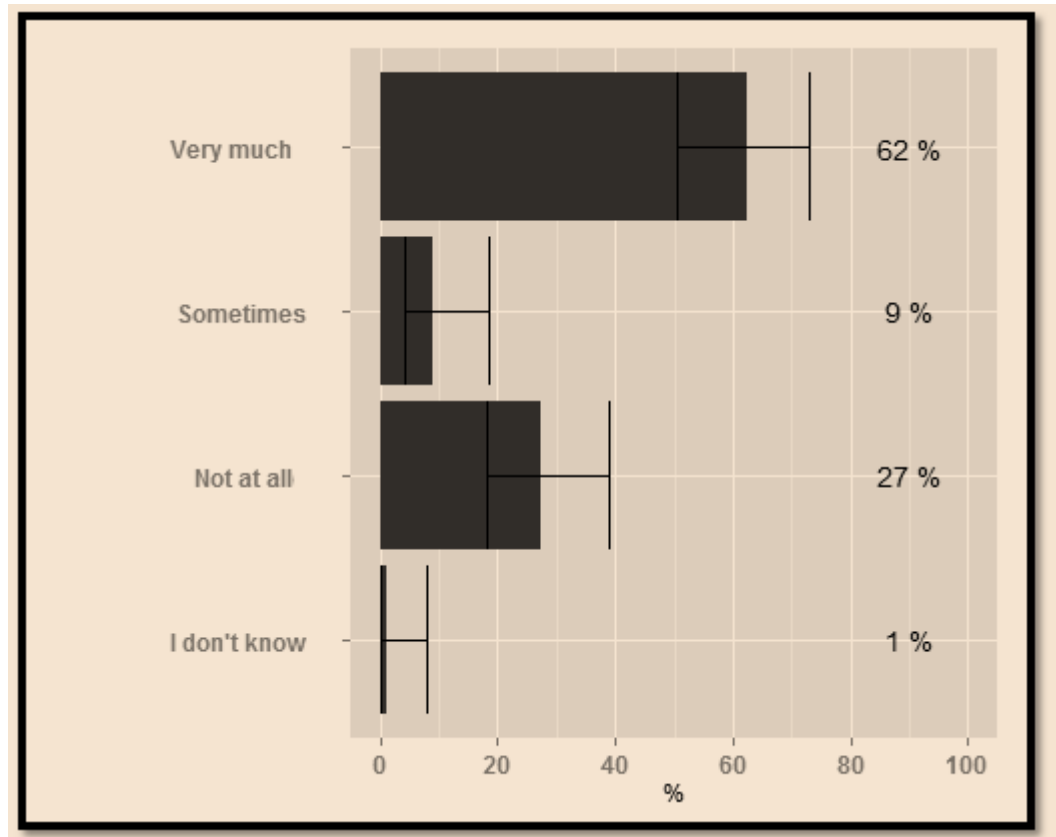
*Confidence +/- 5.21 %, Average score=3.2 (levels=0-5)*

**Figure 24** Result for 'The use of tags sped up the time needed to obtain target documents'

*20. The use of tags improved the quality of the search results.*

The next question regarding the use of tags to deliver high-quality results was rather similar to the previous one. 62% of respondents believe that using tags improves the quality of a search considerably, and 27% that tags do not impact on search quality.

Other responses were *sometimes* and *don't know* at 9% and 1% respectively. The confidence level for this distribution was satisfactory (6.83%).



*Confidence +/- 6.83 %, Average score=2.3 (levels=0-3)*

**Figure 25** Result for 'The use of tags improved the quality of search results'

21. *How satisfied are you with the functionality and implementation of the tagging functions?*

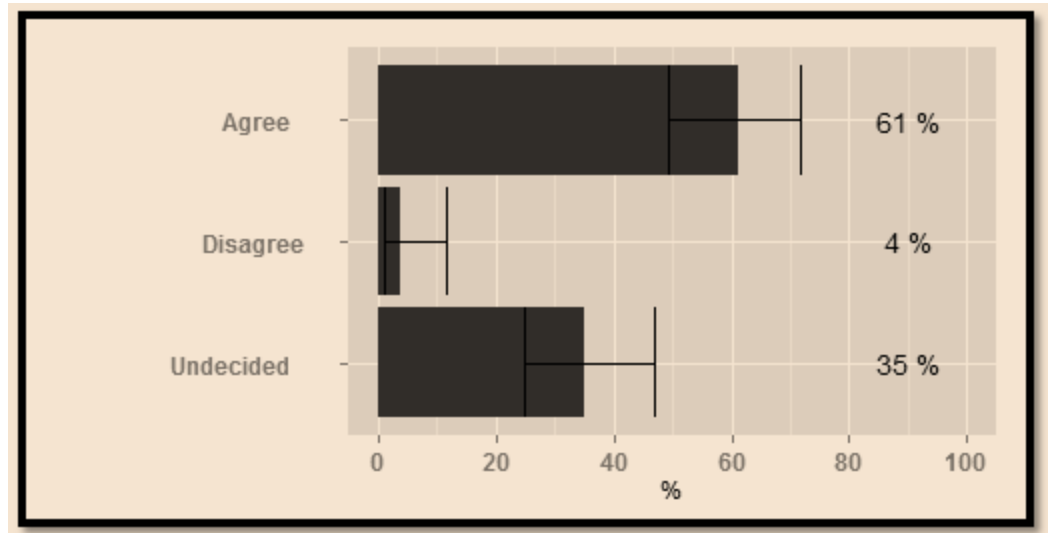
**Table 3** Result for 'How satisfied are you with the functionality and implementation of the tagging functions?'

Answer	Frequency
Tags will help me to find material more easily in the future	70
Tags are a good way to keep track of my literature	40
Tags are a good way to expose opinions and views	19

The tagging application improves the user experience	18
Tags improve user's interaction	10
I don't know	5
I don't use it	5
All	8
Have no idea	1
None	1
Should be readable, usable and effective before they are utilised	1
Tags can be useful	1
Tags would help me to find material more easily in the future and improve users interactions	1
Tags would help me to find material easier in the future, Tags improve users interactions	1

The current responses are not readily represented by statistics, due to the diversity of possible answers. The vast majority of respondents (41%) are satisfied with the functionality and implementation of the tagging function and state that they could help to find materials more easily in the future. One more confident group at 26% thinks that tagging helps them to keep track on the literature. The third and fourth groups consider tagging as a way to expose opinions and thereby improve user's experiences (comprising 8%). The remainder of respondents left answers that cannot be readily classified as negative or positive. Those answers are mostly neutral and comprise fewer than 4% of responses.

22. *Do you believe that the social tag system increases satisfaction when using the digital library?*

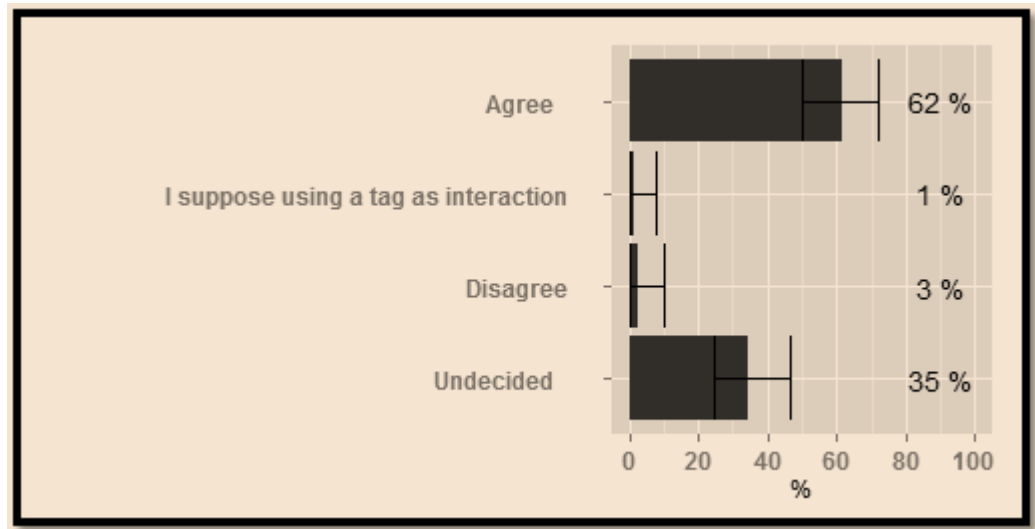


*Confidence +/- 8.33 %, Average score=1.3 (levels=0-2)*

**Figure 26** Result for 'Do you believe that the social tag system increases satisfaction when using the digital library?'

This question is central to the current study; however, the answers given have a multimodal distribution. 61% of respondents agree that tagging raises satisfaction when using the digital library, and just 4% counter this statement. However, more than a third of respondents (35%) have not decided either way. Confidence is above 8%, and the average score is 1.3. Central respondents disagree with the statement considered here.

23. Do you believe that social tags increase the interactions between the users of the digital library?



*Confidence +/- 6.31 %, Average score=1.3 (levels=0-2)*

**Figure 27** Result for 'Do you believe that social tags increase the interactions between the users of digital library?'

One of the main questions raised in this study has no uniform distribution. More than half of respondents (62%) agreed with the statement, and only 3% directly disagreed with it. However, more than one third were unable to decide if the statement was true or false. Confidence is more than 6% and average score is 1.32. Thus, the central respondent in the study is a person, who disagrees that tagging increases interaction between users.

### 5.3 SURVEY INFERENCE STATISTICS

The current survey is based on a population, which includes individuals experienced with tagging system via social websites, individuals currently using tagging at digital libraries and others who are unfamiliar with tags. To examine the significance of the association between variables, a Chi square test was performed. To avoid unclear results, open-ended questions were used for analysis and probabilities and associations are described in the next table.

**Table 4 Probabilities of associations**

	<b>Var1</b>	<b>Var2</b>	<b>Var4</b>	<b>Var6</b>	<b>Var7</b>	<b>Var8</b>	<b>Var9</b>	<b>Var10</b>
Var1	-	-	-	-	-	-	-	-
Var2	0	-	-	-	-	-	-	-
Var4	0,02	0,03	-	-	-	-	-	-
Var6	0,01	0	0	-	-	-	-	-
Var7	0,02	0,66	0,03	0,45	-	-	-	-
Var8	0,77	0,65	0,38	0,01	0	-	-	-
Var9	0,65	0,57	0,96	0,05	0,19	0,72	-	-
Var10	0,75	0	0,74	0,03	0,15	0,08		-
Var13	0,10	0,06	1,00	0,74	0,15	0,07		
Var14	0,68	0,32	0,07	0,08	0,58	0		
Var15	0,27	0,11	0,49	0,44	0,86	0,01		
Var17	0,87	0,04	0,85	0,27	0,01	0		
Var18	0,24	0,05	0,73	0,02	0,35	0		
Var19	0,53	0,30	0,13	0,50	0,07	0,03		
Var20	0,35	0,49	0,75	0,65	0,18	0,02		
Var22	0,02	0,34	0,01	0,41	0,07	0		
Var23	0,25	0,04	0,01	0,26	0,25	0,07		

Thus, the chi square test was used to test the hypothesis that the data was independent. The test was performed on the complete initial data set, but not all the cells in the table have values. Therefore, we can see many empty cells in corresponding tables, where there are no intersections with the data. Thus, those who answered the first 10 questions had not answered the final 13 survey questions: from 11 to 23. For this reason, there are few pairs at the contingency table and analysis is impossible. Cells with numbers correspond to the p-value to reject the hypothesis, that the data is independent. The lower number is at the row and column interception, and there is a higher probability of a data correlation and a pair of appropriate variables.

The general population has the strongest relationship between the pairs of variables:

var1-var2; var2-var6; var2-var10; var4-var6; var7-var8; var8-var14; var8-var17; var8-var18; var8-var22.

Graphically, dependency across the complete population can be described with the following plots.

The plot below describes the distribution between four variables as a complete data set. It is evident that there is a strong relationship between those variables. Those respondents, who are intending to discover a new way to locate resources depending on the tag, are people aged from 30 to 39 years, who consider themselves advanced tag users. The greatest proportion is studying at PhD level, and the remainder are Master's students. High interest in the tag system is also observed among Undergraduates aged 18-29 years, who are already at the intermediate level in terms of using tags. The third significant subset is a group with specific characteristics 40-49 years, PhD researches, and user level – intermediate. Generally, the respondents have an interest in using tags, and actively wish to try to identify a new way to find resources using them. In addition to these groups, we also consider the following as groups:

- People under 50 years old;
- Beginners using tags aged 30 years and over; and
- Expert tag users.

These characteristics describe populations that have no interest in discovering new possibilities for using tags in digital libraries.

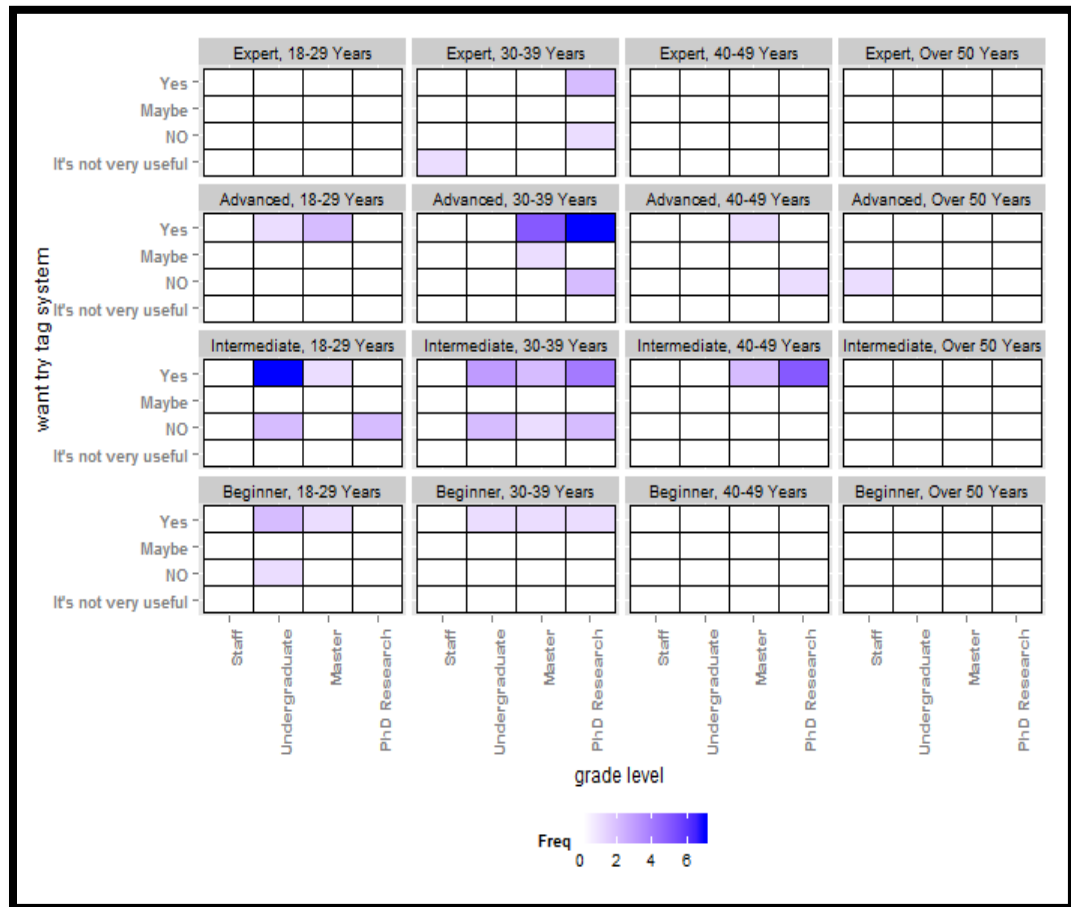


Figure 28 Grade level vs. desire to try the tag system vs. age vs. user level



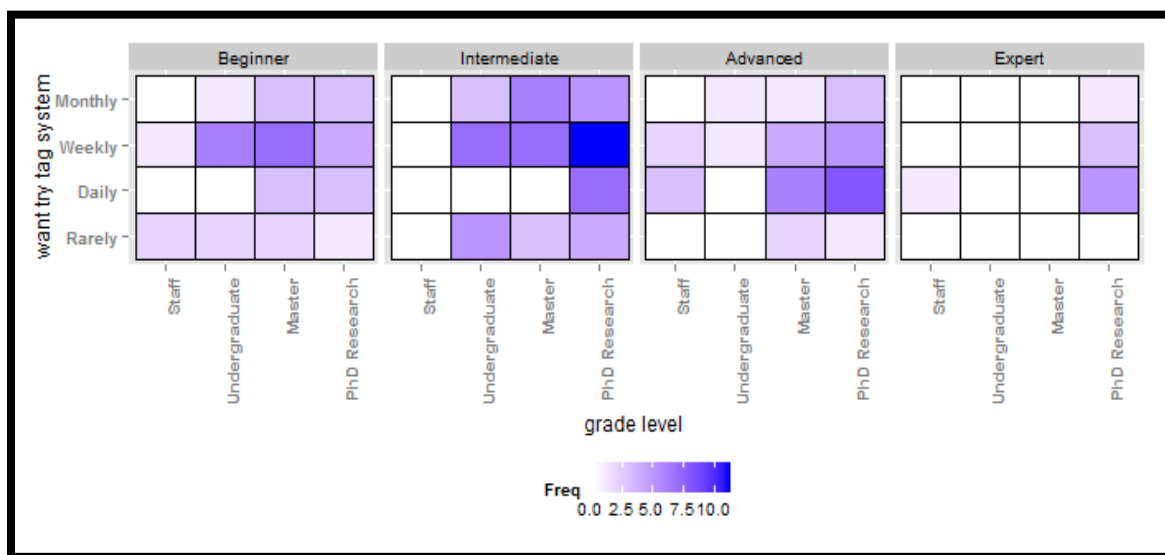
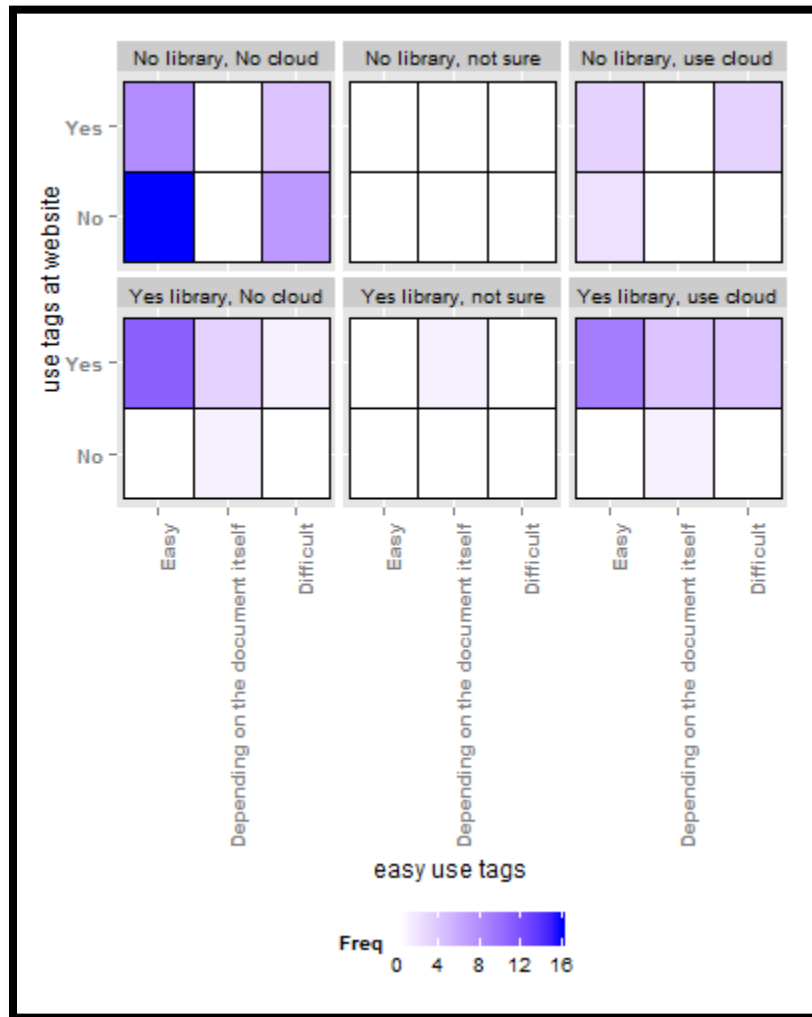


Figure 29 Grade level vs frequency of library use vs. user level

To summarise frequency of use of the digital library Figure 37 was created.

The largest proportion of the population is consists of people who use the digital library weekly. They are mostly intermediate level tag users, are rarely – beginners, and have educational qualifications above the level of the staff. PhD researchers with an intermediate level of tag usage, who visit the library weekly, provide a focal point in the study group. Generally, there is no significantly strong division based on the variable, ‘frequency of library usage’.

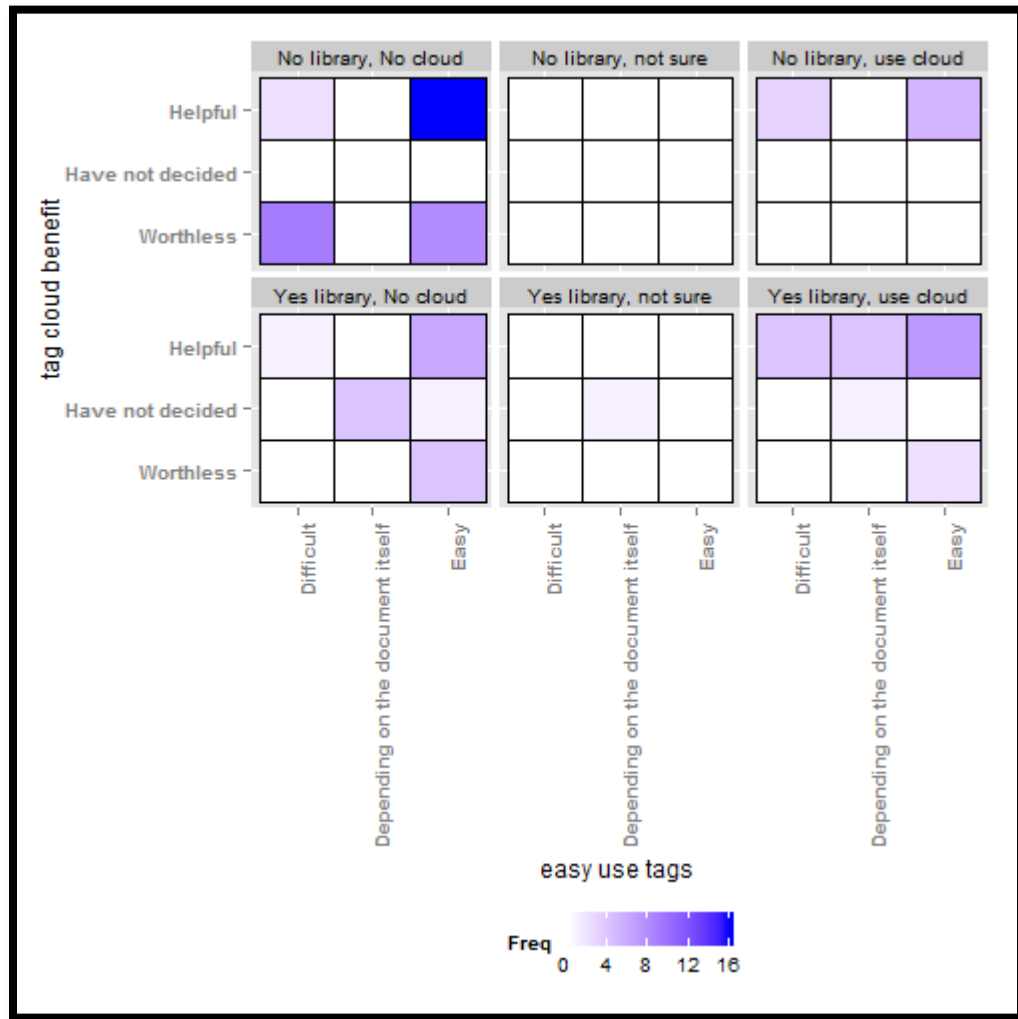


**Figure 30** Using tags on websites vs. using tags in the library vs. using tags in the cloud vs. perceived ease of use

One of the central questions of the study requires the use of tags at different aspects of life. The plot above summarises tag usage at libraries and websites, combining the use of tag cloud and the simplicity of use. The biggest subset of respondents comprises people who have never used tags in libraries and do not know about tag clouds. The largest such group does not use tags on websites either, but there are also individuals, who use tags for social websites only. The respondents are divided in their opinion regarding the simplicity of using tags, although the majority feel it is a straightforward

process. The respondents mostly think that document type does not result in tag simplicity. In summary, the majority of respondents do not use tags as part of their activities, sometimes they use them on websites only; but they expressed confidence that they would not be difficult to use.

Tag cloud benefit was estimated by respondents who use tags already and respondents who do not. The greatest frequency of answers given expressed the following combination: a *tag cloud is helpful and easy*. This result was obtained from respondents who use tags and/or tag clouds and those who do not. The remainder of the respondents, who never use tag clouds stated that it would be of no benefit. However, they have not confirmed whether tags are easy to use or not. Those already using tags in digital libraries and familiar with tag clouds believe that the tag cloud is helpful and relatively easy to use.



**Figure 31:** Using tags at library vs. using tag cloud vs. tag cloud benefit vs. ease of use

The last plot, which describes the complete survey population, is the plot below. It combines answers about tags at digital libraries, tags at websites, the simplicity of using tags and satisfaction gained from using tags. The vast majority of applicants agree that tags increase satisfaction when using the digital library. This group includes persons, who use tags at library and websites and consider them easy to use. Only a few people believe that tags do not heighten user satisfaction, although those already using them in libraries and in a social context consider them reasonably easy to use.

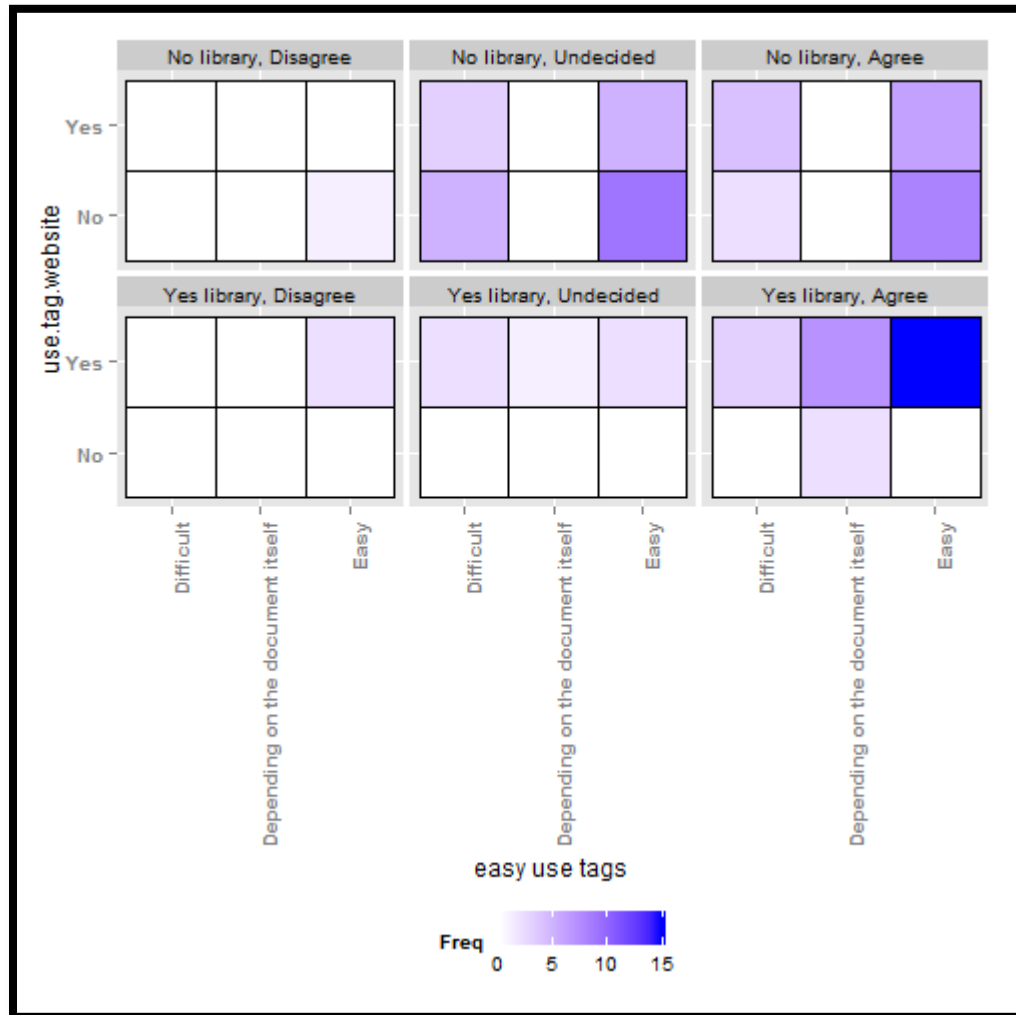


Figure 32: Using tags at websites vs using tags at library vs easy of usage vs tags using satisfaction

By summarising the reported results, we can formulate a general impression about what the most important aspects to consider are when building an effective tagging algorithm for use within a digital library, and who the users choosing to visit the digital library to gain access to the necessary data using tagging and cloud topology are. The results also revealed that a significant percentage of people who cannot use tagging easily, or were unaware of the method before participating in this research. This raises concerns about

the need to publicise tagging, as well as to make tagging techniques as easy as possible, to match the needs of people studying at different levels; although, the survey also found that people with higher educational levels are those most likely to prefer to use tagging methods for searching.

Furthermore, users need to build an intelligent tagging system to build accumulated knowledge based on previous usage and feedback gained from each user, in order to create systems that are more reliable and intelligent. Finally, the survey for the current work identifies challenges to building a reliable system, to provide services easily to users of different ages and different educational backgrounds. For example, to create more practical tagging benefits, it would be necessary to apply an intelligent system that can upgrade itself automatically, relying on users searching for terms; hence, it is not necessary to consider tagging terms as the most frequent words, or words that appear in the title. Many major words are more efficiently detected by specialist users, so the tagging system that will be built here within the digital library, will allow manual editing of tagging terms by users, under certain conditions and restrictions.

#### 5.4 SUMMARY OF QUANTITATIVE RESULTS

The descriptive results revealed that most users of social tags in digital libraries are postgraduate students aged between 30-39 years old using digital libraries frequently and performing many search processes while conducting their studies. It was interesting to note that some (39%) users consider themselves intermediate users of the digital library ( $n = 68$ ), while others consider themselves beginners (31% ( $n = 54$ )). However, the majority of the participants have never used tagging functions in the digital library context 65%, although 35% have done so. Nearly 70% perceive of applicants agree that tags are easy to use and reduce the time taken to find resources.

This chapter of the study presents an analysis of the qualitative results and highlights the study findings according to the study hypotheses. Inferential statistics resulted in significant results for all levels of associations: 1) There is a significant relationship between user satisfaction and increased usage of social tagging in digital library; 2) There is a significant relationship between the accuracy of the research and increased usage of social tags in digital library; and 3) social tagging systems are better than tradition methods.

## **CHAPTER 6**

### **PRESENTATION OF FINDINGS FOR QUALITATIVE DATA**

This chapter introduces the findings and analyses the data that was collected during the semi-structured interviews. The qualitative data was analysed using a thematic approach to analysis, whereby different themes were introduced and drawn up, depending on the participants' responses, and analysed to supplement the quantitative data.



## **6.1 INTRODUCTION**

This chapter represents the second phase of the study, which aims to collect qualitative data, to help explain the quantitative data in greater depth. The qualitative data was collected using the interview guide (n=15). This data explained and explored the quantitative findings, adding depth and richness to the data. Most importantly, it gave the participants the opportunity to share their experiences. The qualitative data was analysed using a thematic analysis. The different themes depended on the participants' responses and were presented and analysed in such a way as to supplement the quantitative data.

## **6.2 INTERVIEW DATA**

The qualitative method that provides the basis of this chapter was carefully designed and rigorously conducted. Furthermore, the analysis of users' responses was both comprehensive and detailed. Qualitative data was collected using the interview guide, and all interviews transcribed by the interviewer for accuracy and content.

There are several computer-assisted qualitative data analysis software packages available that can be used to manage and help in the analysis of qualitative data. Common programmes include ATLAS.ti and NVivo. Such programs manage the data and make handling of them easier. In this study, the transcripts were analysed manually to provide two benefits. First, to allow data to emerge, and second to give the researcher a closeness to the data (Creswell, 2005). As Creswell points out it is possible to analyse transcripts by hand when there are only a small number of transcripts and where the researcher has time to commit to the process to achieve an intimate understanding of the emerging themes. Large margins were included on the transcripts, to enable the researcher to make notes and identify themes readily throughout the document. A

thematic analysis used to analyse the qualitative data. This involves to discover themes in each interview transcripts and to attempt verifying, confirming and qualifying them by searching through the data and repeating the process to identify further themes and categories.

In order to do this, a summary statement or word for each element that is discussed in the transcript has been offered which called code. The exception to this is when the respondent has begun to move away from the topic under discussion, then, it can simply be uncoded.

Those participants who participated in the interviews were instructed to conduct a tag search on topics of personal interest. After this, the participants were directed to find items related to their original items, either by adding new tags, or by using the tag cloud/other user's tags. Data collected from the participants was analysed into themes, depending on the responses attained regarding various aspects of the study, and when presenting the findings of the study, as explained in methodology section.

The majority of the interviewed participants were between 30 and 39 years, had a PhD level of education and used the digital library weekly.

**Table 5 Interviewees' characteristics**

Interviewee	Sex	Age	years of study	Level
1	Male	20	3 years	Undergraduate
2	Male	23	3 years	Undergraduate
3	Female	18	2 years	Undergraduate
4	Female	21	2 years	Undergraduate
5	Male	35	5 years	PhD
6	Male	37	4 years	PhD
7	Male	43	6 years	PhD

8	Female	32	3 years	Master
9	Female	35	2 years	Master
10	Female	38	5 years	PhD
11	Male	19	2 years	Undergraduate
12	Female	20	3 years	Undergraduate
13	Male	38	5 years	PhD
14	Male	35	4 years	PhD
15	Female	37	5 years	Master

The content analysis was based on three major categories deducted through the consolidation of themes present in the transcripts in combination with objectives derived from questions posed in the structured interview guide. The three categories included: adaptability of social tags to digital libraries, user satisfaction when using social tags in digital library and accuracy of the search when using social tags in a digital library. The cores of the categories, as well as their sub-categories are illustrated below.

### ***6.2.1 CATEGORY 1: ADAPTABILITY OF SOCIAL TAGS IN DIGITAL LIBRARIES***

This category represents the views of interviewees when using social tags in digital libraries, determining whether they will adopt the system or not and how they view it. How users perceive social tags was relevant to understanding their tagging behaviour and needs. To determine the level of users' adaptability to social tags in digital libraries, the sub-categories underlying this category were given as: Affect, Learnability and Helpfulness, based on the findings of the literature review. This scale was also used in the questionnaire.

### Sub-Category 1: Social tags affect in digital library

The in-depth interviews required participants to express their feelings about whether the option existed to search by social tags in the library catalogue, and if so, whether that was something the participants would use. Since some of the participants had never used tags before, and had only been recently introduced to them, their perceptions form a baseline clarifying their feelings. The participants were in general aware of social tags and willing to use them. The participants gave a numbers of reasons for their acceptance of the idea of using social tags in digital libraries, and were able to explain possible advantages which that might arise from using this technique.

Examples of participants who agreed with the existing of the social tags:

*If hashtags in libraries were used applying the same techniques as for hashtags in social media, the students would find it more exciting and beneficial to use them. (Undergraduate, never used tags)*

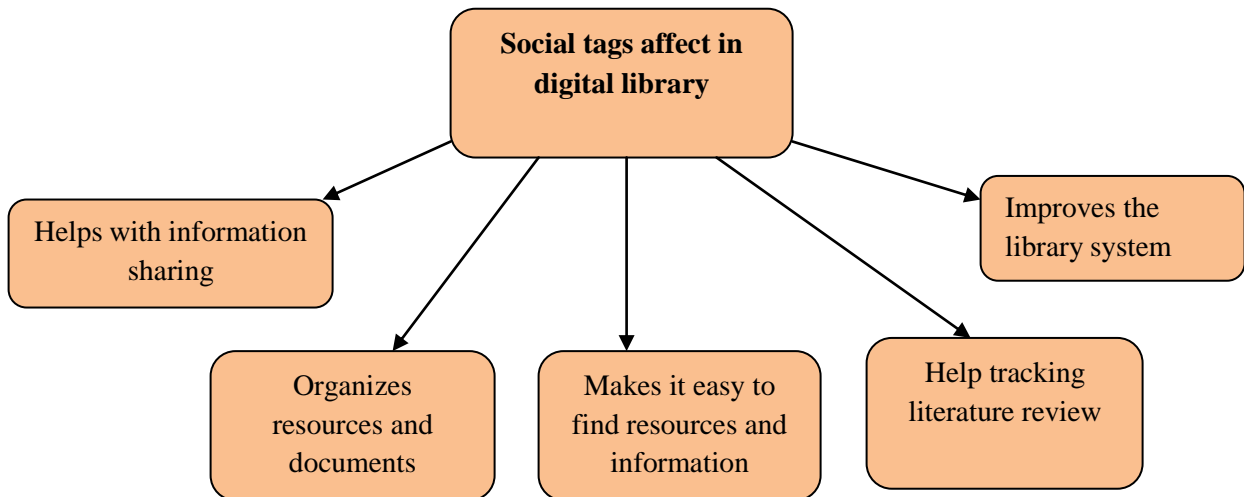
*I am not sure as I have never used the system before, but I guess it would be popular. It sounds interesting. (Undergraduate)*

*I am very agreeable to adopting such a system within our digital libraries, I have used it and I am pretty sure this will be the future for digital libraries. We do not want to be left behind. (PhD student)*

*Education facilities should embrace technology and use social tags in digital library. (Master's student)*

*I didn't believe that social tagging in digital libraries would make a difference until I used them - then I started enjoying this service. I therefore would like to encourage my colleagues to use social tags. (PhD student)*

When it comes to participants' opinions about what differences social tags will make to the utilisation of digital libraries, the participants agreed that social tagging systems make a huge difference. They highlighted that social tagging helps with information sharing, it improves the library system, speeds up the time taken to find resources, and makes it easy to find resources and information that is crucial and relevant for organising resources and documents easily.



**Figure 33** Social tags effects in a digital library

Examples of participants believing that social tags assist with information sharing:

*Social tagging function in digital library is very important and key to me because it helps me to share information and the tags that we use to verify the information before using it. It also assists me because I am able to retrieve information that I had shared easily without any difficulties. (Undergraduate)*

Examples of participants believing in social tags to organise resources and documents:

*It helps me to organize resources and even share them with others and also find resources that other people have tagged. (PhD student)*

*One can get organized data and information when using social tagging services. (PhD student)*

*Since I have started to use social tags, I have been able to access organized data, which has helped me to spend less time arranging my resources. (Undergraduate)*

Examples of participants who believe that social tags make it easy to find resources and information:

*This will enhance searching and allow easier access to information. (PhD student)*

*Social tags have made my study easy because I am able to access the information that I want very easily. (PhD student)*

*Social tagging function is very useful because it helps me to find materials that I need easily. (Master's student)*

Examples of participants who believe that social tags help to track reviewed literature:

*Social tagging has made my study easier, especially when I am searching for literature to carry out my research, because I can find the relevant literature related to my study very easily. (Master's student)*

*I have been using social tagging in my studies and it makes my life easy, since I am able to carry out an analysis of the literature that is available and access information that is crucial to my project very easily. (PhD student)*

*I must not forget to say that social tagging also helps me to determine and keep track of the literature that I need. (PhD student)*

*It is important for education facilities to improve the library system and use social tags to enhance library services and ensure that all information can be accessed through the Internet. (PhD student)*

*I strongly agree that social tagging is key to changing the library system, and to allowing more people to access more relevant information easily. (Master's student)*

*I agree that embracing technology and using social tagging in the digital library will make a big difference to the library system. (PhD student)*

## Sub-Category 2: Helpfulness of Social Tags in Digital Library

### Sub-Category 2: Social tags helpfulness in digital library

Tag cloud has received mixed reviews concerning its usability, and its ability to assist in the search process. Approximately half of respondents evaluated the tag cloud negatively, stating there is no need for it. The majority of these have not used social tags. Arguably, while the tag cloud is likely to enhance the usage of social tags, it will not necessarily improve the quality of those tags. Moreover, one participant commented that the tag cloud would not make a significant difference in terms of the use of social tags in digital libraries, as he mostly uses document related tags and finds that option sufficient.

Example of participants who find a tag cloud unhelpful:

*I do not think it is useful; there is no need for it.*

*Most of the time I browse related tags in the same document; I rarely take a look at the tag cloud.*

*It gives an indication of popular tags, but is not necessary that you can use them or benefit from them.*

*I have not used it before and I think I won't. It does not make any different.*

Meanwhile, the remainder of the participants believed that the tag cloud could prove helpful. Participants who find tag clouds helpful presented some reasons for this, based on their experiences using social tags. Although they do not express certainty that social tags would be useful.

Examples of participants who find the tag cloud helpful:

*It might be helpful to know about recent subjects that have been viewed as important and gained priority in the search.*

*I think it might be helpful for newer users, as they will learn about how others use tags.*

*I guess the tag cloud is helpful. It provides a shortcut to find out if there are documents that can benefit my area of study.*

*Some of the students on our library website added tags with the name of course - this is a popular tool and is the most beneficial.*

Furthermore, some participants mentioned that the tags themselves are helpful. The majority believe that other user's tags provide them with other point of views and increase their awareness of the dimensions of the subject.

Examples of participants who find tags assigned by other users helpful:

*I can use their opinions and relate or find different point of views. (Undergraduate)*

*It is very helpful and adds value to my studies, as I can benefit from others tags to find resources related to my subject. (PhD student)*

*I have been able to express my views and opinions regarding various subjects and topics. Tagging enables me to learn a lot from other people's ideas, opinions and views, which has helped me to learn a lot. (Master's student)*

*I enjoy using social tagging in the digital library, because I am able to share opinions, views and information that I know about with other users and to learn from them about certain concepts that I don't know. (Undergraduate)*

*Reading the comments from other users and their criticisms has made me learn and share more about certain concepts that I am interested in. (PhD student)*

When participants were asked about the time they spent learning how to use social tags, the vast majority stated that no time is required. Moreover, once they know basically how to use them they quickly gain experience doing so.

*No time at all is required to learn how to use social tagging. (Undergraduate)*

*It took me less than ten minutes to figure out how to use social tags. (Undergraduate)*

*Social tags did not take me a long time when I first learned to used them. (PhD student)*

### Sub-Category 3: Learnability of Social Tags in a Digital Library

Learnability of social tags in digital libraries is a widely reported topic. The majority of the participants agreed that social tags are easy to learn and do not require much more effort to be learned or applied. Those participants who had been newly introduced to the use of social tags were apprehensive about using them and asked for a training session. However, once they used the social tags they all agreed that it was easy.



Examples of participants who find social tags to have high learnability:

*I can use their opinions and relate to them, or find different points of view. (Undergraduate)*

*It is very helpful and adds value to my studies as I can benefit from others tags to find resources related to my subject. (PhD student)*

*I have been able to express my views and opinions regarding various subjects and topics. Tagging enables me to learn a lot from other people's ideas, opinions and views, which has helped me to learn a lot. (Master's student)*

*I enjoy using social tagging in the digital library because I am able to share opinions, views and information that I know with other users and also learn from them about certain concepts that I don't know about. (Undergraduate)*

*Reading the comments from other users and their criticisms has encouraged me to learn and share more details about certain concepts that I am interested in. (PhD student)*

*It is very easy. I learned how to use it quickly.*

*I can use social tags myself and I realized how easy it is.*

*I really believe social tags are easy to learn and there is no need to get help from others.*

*Social tags are easy to learn and do not require much effort to be learned or applied.*

*I have not used social tags before, but it took me no time to learn how to do so.*

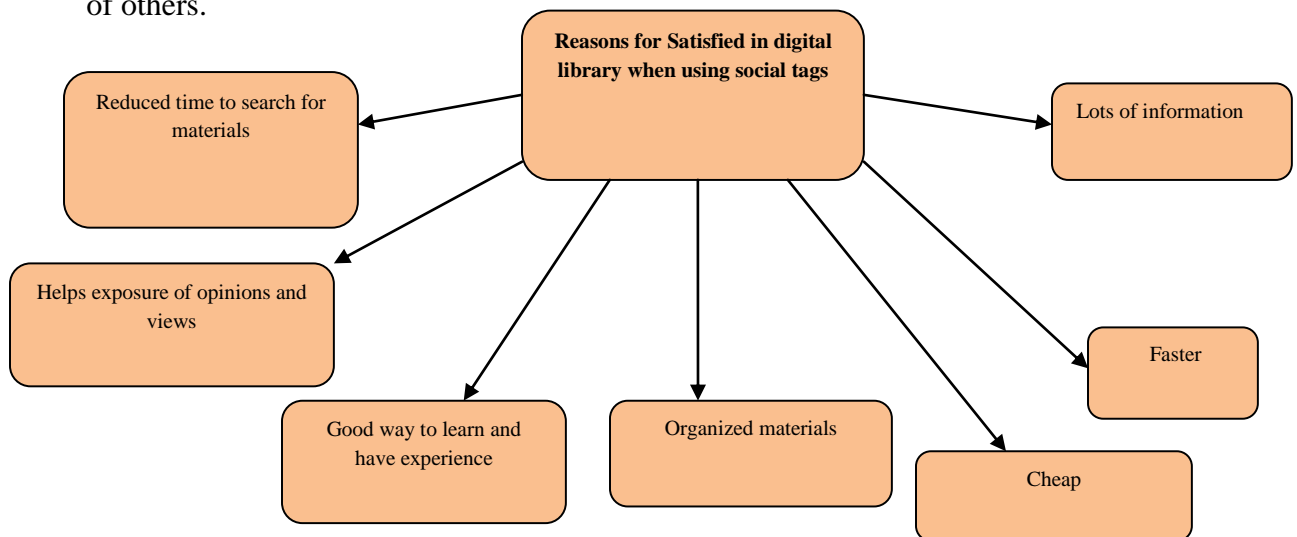
*Social tags are easy to learn to use and this is crucial if they are to be adopted by digital libraries.*

An important observation made concerned the learnability of social tags in digital libraries. The opinion given here was interesting and deserves to be mentioned as it opens up avenues for further investigation and discussion in other studies.

*It depends on the user. Some computer users are beginners, and it possibly will take them time to learn how to assign new tags to the documents. However, other users might find it easy and flexible to add new tags, as they are familiar with using computers. (Undergraduate)*

### 6.2.2 CATEGORY 2: USER SATISFACTION OF SOCIAL TAGS IN DIGITAL LIBRARY

Most participants concurred that they attain satisfactory results when using social tags. They highlighted some important reasons for this satisfaction; including that the tags were cheap, fast to apply, reduce the time required to search for materials and information, demand lots of information, involve the careful organisation of materials, offer an effective way to learn and share experience, and expose the opinions and views of others.



**Figure 34** Reasons for satisfaction when using social tags in a digital library

The number of participants who expressed their opinions and feelings about the adoption of the use of social tags in the digital library will lead to increased satisfaction in the digital library.

Examples of participants who find social tags satisfactory:

*I definitely agree that satisfaction when using social tags will lead to an increase in satisfaction using digital libraries in general. (PhD student)*

*Using social tags in digital libraries will motivate students to use library resources rather than online journals and increase satisfaction when using digital libraries. (Undergraduate)*

*Social tags are satisfying to me because I can use others' opinion and relate or find different point of views. (Undergraduate)*

*It is very helpful and adds value to my studies as I can benefit from others tags to find resources related to my subject, yes I can say that I am satisfied when using social tags. (PhD student)*

*I have been able to express my views and opinions regarding various subjects and topics. Tagging enables me to learn a lot from other people's ideas, opinions and views, which has helped me. I can positively agree that user satisfaction will increase when using social tags. (Master's student)*

*I am satisfied and enjoyed using social tagging in the digital library because I am able to share opinions, views and information that I know with other users and also learn from them about certain concepts that I don't know. (Undergraduate)*

*I am satisfied when using social tags. Reading the comments from other users and their criticisms has made me learn and share more about certain concepts that I am interested in. (PhD student)*

*I am very happy and I would encourage those who have not used tags to do so, since it makes work easier and one can get all the information that is relevant.*

*I am satisfied and will continue to use social tagging in the future to access and learn more about the topics in my career.*

*I am very satisfied and I will continue using the services to learn more.*

*I am very satisfied with the services of digital library, especially when I use social tagging in search of information that is relevant and useful to my study.*

*Using social tags will encourage students to become motivated to use library resources rather than online*

### **6.2.3 CATEGORY 3: ACCURACY OF SEARCH WHEN USING SOCIAL TAGS IN DIGITAL LIBRARY**

In this section participant were required to register their impression after doing the task explained previously. This category includes two sub-categories which are: how relevant and how speed.

#### **Sub-Category 1: time required to find document**

The majority of the participants made a number of positive comments about the time required to obtain resources using social tags. Social tags shortened the time required to find relative resources. It must be noted that all positive comments about shortening the

time related to finding relevant documents. Meanwhile, some participants pointed out that finding a particular source by just using social tags can be time consuming or difficult. The difference in the expression of time between finding a particular resource or finding a relevant resource emerged inductively from the information the interviewees gave.

Examples of participants who find social tags do not hasten their searches when seeking a particular source:

*I could not find the resource that I wanted. (Undergraduate)*

*It took me almost the same time as searching when using the library catalogue. (Undergraduate)*

*I am not sure if it is me who took a long time to find my resource or if it is the system that requires more time. (Master's student)*

*I think it took me additional time, maybe because I am not used to using it. (PhD student)*

*Social tags definitely take time when trying to find resources by just using them. (PhD student)*

Examples of participants who find social tags speed up the search process when finding relative resources:

*Social tagging is a crucial aspect when using the digital library, because it is not time consuming and does not require much effort. All one needs is a connection to the Internet. (Undergraduate)*

*Working on my Masters' thesis has been very easy because I am able to get all the information that I need within the shortest period using the tags I was assigned. (Master's student)*

*Social tagging has enhanced and improved the digital library services, because when I search literature using the tags I am able to get information that is organized under that keyword, and it is very important because I am able to access the materials that I want within the shortest period. (PhD student)*

*Social tagging in the digital library has reduced the search time for me when compared to the traditional library where I was spending most of the time searching for books and materials that I wanted so that I could carry out the research. Right now I am able to get more information within the shortest possible time without using up more effort. (PhD student)*

*I will continue using social tagging in the future, so that I can spend as little time as possible when carrying out the research. (PhD student)*

Furthermore, an interviewee who found himself an expert at using social tags, due to his use of them on the library website expressed the fact that the size of the tags database has a major impact on reducing time spent searching.

*Since I consider myself an expert in using social tags, I believed the time to find resources by just using social tags depends on the size of tags database. The bigger the tags database the more effective results can be obtained.*

One important observation arose regarding the time needed to complete the search process. Another interviewee opined that we cannot consider social tags time consuming when searching for a particular resource, as the process limits the time taken to find resources.

*It took me time to find the resource, but it shortened the time taken relatively, so it can be considered balanced. (PhD student)*

#### Sub-Category 2: Documents relevant to a particular resource

Similarly, the majority of participants noted that the strongest property of social tags is the ability to find related or relevant resources. This makes the search process easier, motivating and more enjoyable.

Examples of participants who found social tags helpful for finding relevant documents:

*I am able to get lots of information and data that is relevant to my study. (Master's student)*

*I use social tagging in the search for information that is relevant and useful to my studies. (PhD student)*

*One can get all the information that is relevant. (Undergraduate)*

*Social tagging that I was assigned to allows me to use keywords when carrying out searches for literature, which enables me to access lots of information that is categorized under each tag. (PhD student)*

New themes were inductively created from the information given by the interviewees, based on their suggestions, concerns and expectations. These themes will be introduced and discussed further to add more reliability and validity to the interview data.

The participants shared their expectations and suggestions concerning possible solutions that might improve the quality of the social tags system employed by digital libraries. Most of the participants believed that the majority of the concerns regarding using social tags in digital libraries relate to training. Most of those who do not use social tags in digital libraries agree that training and workshops are important factors if social tags are to be successful tools in digital libraries.

Examples of participants' recommendations for improving the use of social tags.

*Training sessions are important as they give us a general idea about the social tagging system and help show us how to use it. (Undergraduate)*

*Training plays an important role when it comes to dealing with technology. (PhD student)*

*Workshops and training are key to improving the use of social tagging in a digital library.*

*These workshops are meant to introduce the social tagging functions in the digital library in addition to evaluating the previous session and to determine any failures and points of weakness when using the social tagging in the search results and addressing with those challenges and failures.*

process. A number of participants pointed out they do not know whether tagging existed on their library websites, while others highlighted that they did not feel they needed it.

Examples of Participants' concerns regarding using social tags:

*I am not sure if my library incorporates social tags into its system but I know that no one spoke about it or encouraged me to use it. (Undergraduate)*

*I believe if social tags are important to my studies then at least one of my teachers will point this out and encourage me to use it. (Undergraduate)*

*I think most of us want some motivations and encouragement to use social tags, as we have not used it before and we are not sure if it would affect our study positively. (PhD student)*

*Students need to be motivated to use social tags. (Master's student)*

*Motivation and encouragement are the first steps in the success of incorporating social tags into our digital libraries. Students should be aware of the existence of social tags in libraries and should be encouraged to use the system. (PhD student)*

Of course, there were some negative comments; although they were few they deserve to be mentioned, as they can help to advance the discussion of findings in this thesis and capture a complete impression of the use of social tags in digital libraries.

Examples of some negative comments:

*I don't know how to use it and I don't have adequate knowledge about how to use it.*

*I am not interested in the social tagging function in the digital library. One can only use a function if he or she is interested in doing so to increase the search results in the digital library.*

*I don't see if the social tagging function in the digital library is important to my studies, so why should I waste my time?*

*I have never used social tagging because it is not important to me.*

### 6.3 SUMMARY OF QUALITATIVE RESULTS

The qualitative results comprised three major categories (themes), one of which contained three sub-categories (or sub-themes) and another that included two sub-categories, thus making up five sub-categories in total. The themes were deductively formulated using the interview questions from the interview guide, while one of the sub-themes was inductively created using the information given by the interviewees.

The findings reveal that interviewees perceived social tags to be mostly beneficial, based on their experience. However, others perceived social tags as not important or uninteresting; largely due to a lack of experience using computers and technology in general or with using social tags in particular.

In view of their search behaviour, all the interviewees who regularly use digital libraries identified the features and advantages of social tags, and the majority agreed they are easy to use, helpful and effective. Furthermore, user satisfaction was mentioned as high among users of the digital library. In terms of the accuracy of searches, many users

pointed out that finding relevant resources is key to the success of social tags in the field of digital libraries. With regard to length of time taken to conduct a search, it is reported to be shortened and to require less effort. Key challenges of social tags were identified to include: training session and workshops to be conducted to students. Moreover, it was seen to be a challenge to attract students' attention to motivate them to give social tagging a try to assist their search processes.



## **CHAPTER 7**

### **DISCUSSION OF RESEARCH FINDINGS**

This chapter synthesises the quantitative and qualitative results, and presents an interpretation of the results. The section also explains how to utilise social tagging in research. Furthermore, data collected and analysed has led to the conclusion that social tagging can improve both the accuracy of the research and users' satisfaction.

## **7.1 INTRODUCTION**

This chapter discussing the research findings presents and merges the quantitative and qualitative results analysed independently in the previous chapter, in order to compare and identify convergent and divergent components of both data sets. Throughout the discussion, this section will also compare and contrast the research findings with those presented by previous researchers (Murray and Beglar, 2009).

## **7.2 SYNTHESIS OF QUANTITATIVE AND QUALITATIVE RESULTS**

As described in the preceding chapters, mixed methods data analysis was conducted to answer the research questions comprehensively, to determine whether the quantitative and qualitative results agreed concerning the factors associated with the usability of social tags in digital libraries; in other words, whether the results for both analyses converged. According to Creswell and Clark (2007), when using a mixed methods analysis strategy, analytical techniques for combining results should be used to assess whether the results from the databases are congruent or divergent. However, if databases are divergent, then further analysis is required to attempt to reconcile the divergent findings (Creswell and Clark, 2007).

To convey merged results, quantitative and qualitative results are presented in a summary table side by side for easy comparison. For the purposes of comparing the two databases, the dimensions across which the data sets could be compared were specified as: adoptability of social tags by users, obtaining accurate resources when using social tags, and user satisfaction in digital libraries when using social tags as a classification tool.

A comparison of interview results and survey results found examples of three major themes.

Table 6 Comparison of information gained from the interviews and the questionnaires

Major Themes	Interview results (qualitative)	Questionnaire survey results (quantitative)
Adoptability of social tags	<p><b>Learnability:</b> almost all the interviewees agreed that social tags are easy to learn, and do not require much effort or time for use</p>	<p><b>Learnability:</b> the majority of participants agreed that using social tagging functions in a digital library is easy (very much so) and they spent minimal time learning how to use the system.</p>
	<p><b>Affect:</b> the prevalent feelings related to the use of social tags and willingness to use them. Reasons included assisting information sharing, to assist when tracking literature and reviewing and organising resources and documents.</p>	<p><b>Affect:</b> the majority of the participants agreed that they used tags to share information with others, describe resources and assist in retrieving information in the future.</p>
	<p><b>Helpfulness:</b> the tag cloud has received mixed reviews, Contrariwise, the participants mentioned that tags themselves are helpful</p>	<p><b>Helpfulness:</b> most of respondents felt the tag cloud should be helpful, although 65% had never used it before. However, they pointed out that tags assigned by other users are helpful.</p>

Accuracy of search	Time required: social tags were judged time consuming when seeking a particular resource but limited time when finding related information.	Time required: answers proved social tags make it quicker to find resources that are linked or related to specific documents.
	Relevant resources: the majority of participants find social tags helpful for finding relevant documents.	Relevant resources: 62% of respondents believed that using tags improves the quality of the search very much by making it easy to find related resources.
User satisfaction	The highest frequency statement selected for this theme was 'satisfied'. The participants pointed out that using tags was interesting and enjoyable. Furthermore, that this helped to increase user satisfaction when using digital libraries.	The majority of respondents (41%) were satisfied and agreed that using tags could increase satisfaction when using digital libraries.

### 7.3 INTERPRETATION OF RESULTS

After merging the two data sets, the mixed methods results were interpreted to answer the research questions mentioned earlier; i.e. to what extent do quantitative and qualitative results agree on the factors associated with the use of social tags in digital libraries? This encouraged similarities and differences to be sought between the two databases and conclusions drawn from them.

Based on the research, it is apparent that those people who currently benefit most from the option of using tagging in digital libraries are people aged between 30 and 39 years. The study also found out that the majority of users of social tagging in the digital library were PhD researchers. Of these, most used the digital libraries frequently for educational reasons, since some were carrying out projects and theses. These were consistent with Huang et al.'s (2014) finding that the hybridisation of user's preferences with frequency, recency and duration played an important role.

The use of a digital library is not common among Undergraduates, as they need to explore multiple options prior to its adoption. However, it is apparent that other groups of users are willing and ready to embrace social tags. This finding was supported by Sin and Kim (2008), who highlighted that young users of the library tended to use the library specifically for educational purposes, while the older generations use libraries mostly for recreational reading.

Furthermore, according to Connaway et al. (2008), the different generations describe their view of what comprises an ideal information system differently. Therefore, it is evident that the majority of teenagers want to use a digital library that shares similar characteristics with the library catalogue, but also require physical places or spaces when socialising together. In addition, people in their 20s and 30s demanded more personalised and convenient services (Connaway et al., 2008).

In terms of both quantitative and qualitative results, the majority of participants had not used social tags in the digital library. Some also indicated that they do not know if such a system was available on their university library websites or not. The reasons for not using social tags ranged from disinterest, to lack of awareness, and the supposition that such a system would not be important to their studies. As most users had not been accustomed to using social tags and library websites often before their Undergraduate years, it appears that this had resulted in less access to information in general. However, from the positive responses of the small number of existing users it is clearly important to draw potential users' attention to social tagging to motivate them to use them. To achieve this it would be beneficial to conduct training sessions and workshops to educate users about their university library websites; specifically on key features and how they can benefit from them.

The study also found that a different level of accessibility to information for participants when using the digital library. The participants used the library catalogue, reviewed articles, discussed them with colleagues and librarians/staff, and used keywords and search functions when accessing information. This finding mirrors that of Cornell University (2010), which reported that the rapid increase in the capacity of information searching had inspired researchers to provide easy and effective methods to retrieve information from digital collections.

The digital library embraces new and advanced technology, allowing students to access information in a digital format, rather than the options offered by the traditional library, which offers printed publications and books. Students visiting digital libraries can access articles, documents, images, video files, audio files, and eBooks, all presented in a digital format (Cornell University, 2010).

Both the results for the quantitative and qualitative surveys indicated that the majority of participants used social tags in social media such as citeULike, delicious, Twitter, Instagram, Facebook and Library Thing. These findings link well with those of Kakali

and Papatheodorou (2010), who stated that the collaborative tagging or social tagging phenomenon became very popular, especially on social bookmarking sites such as Flickr, CiteULike and Delicious.

From the above findings, it is reasonable to suggest that using social tags indicates users are willing to use this kind of tool even in a digital library. There is no limit associated with their culture, civilization or habits that prevents them from using it. This view was supported by Devaraj et al. (2008) and Hargittai and Walejko (2008), who highlighted the fact that personality and socioeconomic status play a major role in influencing engagement in social media and tagging activities in the digital library.

### ***7.3.1 LEVEL OF USER ADOPTABILITY OF SOCIAL TAGS IN DIGITAL LIBRARIES***

To examine key factors associated with levels of adoption, any analysis of qualitative and quantitative data concerning affect, learnability and helpfulness must be taken into account. A general acceptance of using the tagging method was reflected in both quantitative and qualitative results, suggesting scope to achieve success in developing a tagging system to serve the digital library structure. In addition, many reasons to use social tags have been offered by users.

According to quantitative statistics, sharing information with others, and future retrieval, are the key resources needed and supported by the effective use of social tags in digital libraries. Sharing information with others was given the highest significance by respondents, who then established the importance of future retrieval. Similarly, the interviewees mentioned similar views regarding the effect of social tags. They highlighted that social tagging assist information sharing, improves the library system, and helps track literature reviews and organise resources and documents. This notion is supported by Heckner et al. (2009), who found that personal information management and knowledge sharing are the two main motivations for users when tagging resources in general.

The findings also revealed social tagging helps individuals to organise information for future retrieval. The majority of participants highlighted that they used tags repeatedly because they wanted to be able to retrieve information in the future. This finding was supported by Lu et al. (2010) who highlighted that tags are crucial because they serve as a way for users to organise their information based on their preference for future retrieval. These results were also supported by Dasgupta (2010), who highlighted that social tagging helps individuals organise resources for themselves and share them with others, as well as to identify resources that other people have tagged. This aspect is also very important as it ensures the user of social tags can draw on key words that are easy to remember for future retrieval (key words may be one word, phrases, or collections).

These findings concur with explanations offered by Kumar and Rao (2014) and Varatharajan and Chandrashekara (2007), which assert that social tagging in the digital library enhances the user's ability to retrieve information. They went further, stating that the digital library offers a reactive interface that enables users to search for information by word, phrase, or collections (Kumar and Rao, 2014) and Varatharajan and Chandrashekara (2007). Future retrieval is also linked to the principles of organising and tracking expressed in the literature review, offering an additional reason for using social tags, as stated by participants.

As is evident from both the questionnaire and interviews, users can easily determine the important characteristics of social tags, amending them to ensure they recoup maximum benefit. Furthermore, users perceive social tags as easy to learn. Certainly, the steps involved in searching using social tags, or adding tags to describe documents are easy to follow and uncomplicated.

There are no special or advanced skills required when learning how to use it. According to quantitative statistics, the majority of participants (52%) stated that they spend less than an hour exploring social tagging functions. The result, as emphasised by the users



in interviews, was that almost all of them agreed that the time spent learning about social tags and how to use them was very short.

The study also found out that the majority of participants used the social tagging function in the digital library, because of the ability it afforded them to add tags easily using keywords which could assist them to retrieve information easily. This finding was supported by Golub et al. (2009) who stated that the majority of people use social tagging because the freedom to add tags or keywords to resources online is a significant aspect of social bookmarking, as related to folksonomy.

The major aim of social tagging is to afford easier access to studies held in the library in the future, by bestowing the ability to search using tags marked as keywords on resources. The information involved in social tagging can be classified in many ways conveying meaning to users. Users also have the ability to use tags in their own language, which they found matches their meaning (Golub et al., 2009) and is consistent with the work of Eden and Steele (2009). They further highlighted that social tagging thrives on user participation, thereby enhancing users' access to academic libraries, as the system renders tagging an easy, informative and fun process.

It is worth noting that the majority of the participants had not used social tags previously, having been newly introduced to them at the interview phase; this confirmed the findings about learnability enhancing reliability. The study also found out that usage of social tagging in a digital library depends on the knowledge that one has and their ability. One important observation was raised in interview to show that the user had significant ability and experience at using technology in general, and that this might affect his/her ability to learn easily using social tags. Meanwhile, in the questionnaire several participants argued that choosing tags to describe documents might prove difficult, depending on the subject of the document.

Contrary to this, the tag cloud was perceived as incomplete, meaning that certain things had to be included to improve its use. A further examination of user's statements revealed that 51 of the 78 respondents (65%) had never used the tag cloud despite opining that it is not helpful. The data from the interviews also revealed that approximately half of the respondents who had evaluated the tag cloud as negative saw no need for it.

A majority of the respondents had not used social tags before, so arguably users are not aware of the mechanism by which the tag cloud works, with the result that they cannot recognise or understand its function and role in the social tags system. For this reason, the number of people who agreed that the tag cloud is helpful cannot be overlooked, even if this reflected the views of only a small sample of participants.

Similarities between the quantitative and qualitative results were evident in the helpfulness of the tags themselves. This was confirmed several times in both the interviews and the questionnaires, as the participants pointed out that they use tags to share information and opinions, and view tags as a means to learn more about subjects they are interested in. Once again, it was confirmed that participants the agreed the efficiency of social tags arises when finding relevant or related resources as tagged by others, thus helping to guide them through their studies or projects. According to Dasgupta (2010), social tagging is also important for organising content, using collaborative indexing based on user-generated tags (Dasgupta, 2010).

The level of adoptability of social tagging in the digital library in this study depends on affect, learnability and helpfulness. These three aspects proved a significant association with the usability of social tags in the digital library. The vast majority of participants in both the questionnaire and interviews agreed they were willing to use social tags in digital libraries. However, the adoption of social tags cannot be a substitute for the importance of the library catalogue. The two complement each other and one cannot be replaced by the other.

Anday et al. (2012) also highlighted the view that social tagging provides new avenues and processes for users and librarians to relate to the library catalogue. They went further than this, stating that social tagging seeks to complement subject headings, together with controlled vocabularies, as both seek to enhance the development of the knowledge organisation and tagging enhances the initialisation of searches, offering users to locate tags in their native languages that utilise subject headings to enhance the retrieval of related documents (Anday et al., 2012).

### ***7.3.2 USER SATISFACTION WHEN USING SOCIAL TAGS IN DIGITAL LIBRARIES***

Satisfaction with the functionality and implementation of tagging functions and satisfaction with the digital library after using social tags were both reported in the two data sets. Increased interaction between users was also reported and attributed to user satisfaction. The majority of participants were satisfied with the functionality and implementation of the tagging functions and with the fact that the digital library helped them to find materials with greater speed and ease.

The study found that increased use of social tags heightens the satisfaction in the search for information in the digital library and increases interactions between users in the digital library. Social tagging increases user interaction as confirmed by Spiteri (2007), who further stated that social tagging enhances a user's interaction with information as it eliminates all the potential barriers between the user and the item. This occurs because the user is actively involved in the information sharing process through the provision of their own opinions and viewpoints, which further enhances their control of the process (Spiteri, 2007).

It is also evident that social tagging encourages user participation, creating a sense of community among users that enhances the incorporation of teamwork and enhances the proper organisation and dissemination of information (Spiteri, 2007). User interaction can also be created through online communities that not only enhance teamwork, but

also encourage the development of information partnerships and friendships among individuals, improving levels of knowledge sharing within the community.

### ***7.3.2 ACCURACY OF SEARCHES WHEN USING SOCIAL TAGS IN DIGITAL LIBRARIES***

In another study, Smith (2007) found the tags in the digital library to be better than subject headings when investigating tags assigned in Library Thing and the subject headings assigned by the Library of Congress Subject Headings (LCSH). According to Lu et al. (2010), tags are very important because they serve as a way for users to organise their information based on their own preference for future retrieval, and thus the majority of participants using tagging are satisfied.

Establishing that social tagging improves search results, the findings of this research are consistent with Kipp and Campbell's (2010) findings that social tagging is also useful for information retrieval, especially when the scope of information is limited to scholarly documents such as academic articles. The study also revealed that social tagging increases the accuracy of search results, and hastens the time taken to carry out a literature search. According to Eden and Steele (2009), the incorporation of social tagging systems within libraries enhances users' ease of access to library resources that previously proved harder to access online.

According to Marlow et al. (2006), social tagging also allows individuals with similar interests to connect with each other, facilitating information sharing. These researchers further highlighted that in addition to the collection of information, the taggers developed social relationships amongst themselves, which proved a useful discovery. According to Andy (2012) improvements in research as a result of social tagging have been reported.

Also consistent with Woodsworth (2010), social tagging in a digital library helps users to access a large body of metadata that is accessible to the public repositories used to describe resources. Social tagging offers insight into users' search habits. Social tagging

is a crucial aspect of digital library users' lives, because it facilitates the discovery of information.

Furthermore, one interviewee reported himself to be an expert at using social tags having used them on his library website. He further expressed the fact that the size of the tags database has a significant impact on shortening the time taken to locate information. This finding was supported by Mufutau et al. (2012), who stated that social tagging increases in value over time, as collaborative tagging can assist users to discover links between resources.

In relation to finding relevant resources, the study found the majority of the participants used social tagging in the digital library because they were able to access information of relevance to their interests and research projects. This was further supported by Soergel (2008), who highlighted that digital libraries cannot be effective unless they combine organisation information tools and digital information collections because of the enormity of digital libraries. The ability to link digital content together with services for digital libraries will facilitate the search process, making it quick and effective and ensuring anyone can gain additional information of relevance to their activities.

In reference to the cost of social tagging, although none of the questions in the questionnaire considered this point, it was mentioned by a number of users. The existence of a social tags utility in digital libraries can devalue other social sites, such as Delicious, to the field of education.

The findings presented in this study have so far established that one can access information using social tagging at no cost or minimal charge, depending on the type of tags preferred. Similar findings were also reported by Pazos-Arias et al. (2012), who stated that most tagging systems can be accessed quickly at no or low cost. This finding was also reported by Kumar and Rao (2014) and Varatharajan and Chandrashekara

(2007), who highlighted that social tagging in a digital library crucial as it enables access to information and literature at low-cost.

In general, from the qualitative and quantitative results, a general impression of the most important aspects to consider when building an effective tagging algorithm for a digital library are apparent, as is a profile of those users who frequently use the digital library to access data using tagging and cloud topology.

The results also showed a significant percentage of people do not use tagging, and are unaware of the existence of the system, indicating a need to expand the popularity of tagging techniques. At present, people with a high educational level are those most likely prefer to use tagging methods for searching. Furthermore, there is a need to build an intelligent tagging system, to form accumulative knowledge based on previous feedback from each user, in order to create more reliable and intelligent systems.

Finally, the study provides challenges to build a reliable system to provide services easily to users of different ages and different educational levels. However, based on the results for usability, adaptability, increase in use, accuracy and the high rate of satisfaction it is reasonable to conclude that the answers to the first two research questions are yes. It has also been proved beyond reasonable doubt that through the use of social tags, there has been a noticeable improvement in accuracy as well as user satisfaction. The following section now provides answers to the third question regarding how social tagging works.

#### **7.4 HOW SOCIAL TAGGING WORKS**

The social tagging system works from two ends: back and front. The back-end involves programming, which works behind the scenes to produce the front-end so the system interacts with system users. Below are two examples of Shepard's (2013) codes for

Twitter, Google+ and Facebook, providing a back-end mechanism. According to Shepard (2013), these pieces of code allow optimal sharing by precisely defining how titles, descriptions and images appear in social streams, and conversation rate optimisation for social exposure.

Table 7 Social Media Tag Template

## Minimum Social Media Tag Template: Article

```

<!-- Place this data between the <head> tags of your website -->
< title>Page Title. Maximum length 60-70 characters</title>
< meta name='description' content='Page description. No longer than 155
characters.' />

<!-- Twitter Card data -->
< meta name='Twitter:card' value='summary'>

<!-- Open Graph data -->
< meta property='og:title' content='Title Here' />
< meta property='og:type' content='article' />
< meta property='og:url' content='[specific universal resource locator]' />
< meta property='og:image' content='[specific image]' />
< meta property='og:description' content='Description Here' />

```

The above code is slim, and contains the minimum data required for optimising sharing across Twitter, Facebook and Google+, running lean and fast. Included are title tags and meta-descriptions, even though they are not technically social media meta tags, this is so they can use different social media platforms (Shepard, 2013). In Table 6, the code is optimal, using typical article mark-up and data; this is ideal for blogs post and most written content.



Table 8 Social Media Tag Template 2

## Full Social Media Tag Template: Article

```

<!-- Update your html tag to include the itemscope and itemtype attributes. -->
< html itemscope itemtype='http://schema.org/Article'>

<!-- Place this data between the <head> tags of your website -->
< title>Page Title. Maximum length 60-70 characters</title>
< meta name='description' content='Page description. No longer than 155
characters.' />

<!-- Schema.org markup for Google+ -->
< meta itemprop='name' content='The Name or Title Here'>
< meta itemprop='description' content='This is the page description'>
< meta itemprop='image' content='http://www.example.com/image.jpg'>

<!-- Twitter Card data -->
< meta name='Twitter:card' content='summary_large_image'>
< meta name='Twitter:site' content='@publisher_handle'>
< meta name='Twitter:title' content='Page Title'>
< meta name='Twitter:description' content='Page description less than 200
characters'>
< meta name='Twitter:creator' content='@author_handle'>
< !-- Twitter summary card with large image must be at least 280x150px -->
< meta name='Twitter:image:src' content='http://www.example.com/image.html'>

<!-- Open Graph data -->
< meta property='og:title' content='Title Here' />
< meta property='og:type' content='article' />
< meta property='og:url' content='http://www.example.com/' />

```

```
< meta property='og:image' content='http://example.com/image.jpg' />
< meta property='og:description' content='Description Here' />
< meta property='og:site_name' content='Site Name, i.e. Moz' />
< meta property='article:published_time' content='2013-09-17T05:59:00+01:00' />
< meta property='article:modified_time' content='2013-09-16T19:08:47+01:00' />
< meta property='article:section' content='Article Section' />
< meta property='article:tag' content='Article Tag' />
< meta property='fb:admins' content='Facebook numeric ID' />
```

Table 7 above exemplifies code intended to advance that presented in Table 6, by adding more tags containing Google Authorship and Publisher Markup, which potentially add links to the pages searched for. The following paragraphs explain and exemplify the front-end, wherein the system interacts with users posting social tags.

According to Kanter (2015), the first step when undertaking social tagging is to register with a social bookmarking site. This is typically a free service, which allows users to store bookmarks, add tags chosen by themselves, and designate their own individual bookmarks as public or private. Having done this, then one can search for resources by keyword, person, or popularity, and see the public bookmarks, tags, and classification schemes that users have created and saved. Kanter further explained that users might employ a web-based tagging tool to add tags to describe online items, such as images, videos, bookmarks or text. These tags are then shared, and sometimes refined.

At this stage, it is imperative to be aware that when one starts using social network tags, the power of social bookmarking emerges. After registering with a bookmarking site and choosing a tag, the next step is to recruit social taggers. For example, in a group of 20 people, the inclusion of 2 taggers will make a difference. Kanter (2015) recommends that not everyone has to tag; ideally people who are fast readers and global thinkers

should tag, as are excellent taggers. The process involves checking whether anyone is already using specific social tagging sites to ask them to consider tagging for the entire group. It is recommended to encourage people to install the little tag bookmarklet on their browser (Kanter, 2015).

Social tagging becomes more meaningful and useful when taggers do not only tag, but also add a short annotation to explain why they think a link is valuable and to add other tags beyond the shared tag to help further define the tag (Kanter, 2015). Furthermore, the best characteristics of good tags are that they should be related to the topic. People need to be able to remember a tag and it should be unique to a specific group. Finally, Kanter (2015) recommended that tag feeds should be made visible to users, this might mean recruiting users, or simply making the fruits of the tagging visible to an existing group.

For example, an important method of social tagging is using the hash tag. Many networks support Hashtags such as Twitter, Facebook, Instagram and Google+. For simplicity, the following example explains Hashtags in Twitter, as they were explained by Patterson (2014). Patterson explained that creating one's own hashtags could be a powerful thing provided it is done properly, as it will initiate trends among one's own circle of followers. The same author advises that the key to creating a hashtag that does not leave the hashtag creator vulnerable is to create one that is free of ambiguity. This means there is a mechanism guiding how the conversation should go; otherwise it would be at the mercy of the Internet (Patterson, 2014).

Patterson (2014) further explained that using a hashtag in a social posting involves adding the '#' sign before a single word or phrase without spaces or punctuations. However, numbers can also be used; although it is highly discouraged to string too many words together with a single hash tag. From the above simple explanation, it is clear that if any one tweets using a hashtag on a public account about any interesting

topic or subject, anyone searching for that hash tag can find the tweet improving relevancy.

### **7.5 RESEARCH CONTRIBUTIONS**

The findings mainly confirmed and concurred with published research studying the academic utilisation of social media tools at western Universities by western students. However, because Saudi Arabian universities are culturally and academically different from western countries (Alsurehi & Al Youbi, 2014) this study deliberately selected a sample of students from Saudi Arabia, to ascertain their impressions about the usability of social tags in digital libraries. Since digital libraries projects in Saudi Arabia are still in the initial stages, and as yet are limited in their provisions for users, according to Bamofleh and Allohaibi (2009). Use of social tags as a classification tool is a recent trend in information retrieval.

It is anticipated that this study will benefit digital libraries in Saudi Arabia by providing data of relevance to their requirements. If Saudi digital libraries understand the social usability of tags they might be able to make more informed decisions when implementing and designing digital libraries to meet their users' demands. Saudi Universities are currently very willing to adopt e-learning and distance learning (Bamofleh and Allohaibi, 2009) as part of the significant expansion of the higher education. As Alsalem (2013: 1) stated 'prior to 2002, there were only eight government universities and two private universities located in the main cities; however, today, there are twenty-five government universities and eleven private universities dispersed across the country.'

Thus, there is a clear need to improve library resources and services to match the development of learning methods. Digital libraries are increasingly a part of digital learning communities, in particular, distance education. Roes (2001) has stated that digital libraries are natural complements to electronic learning settings. Meanwhile,

Bamofleh and Allohaibi (2009: 20) have confirmed that ‘digital libraries projects reflect the vested interest in applying new technologies in the university libraries to provide better level of information services to the users.’

Therefore, the results of this study can be utilised to help Saudi digital libraries to plan and implement this kind of system (social tags) at their colleges or universities. As the world becomes more competitive, and the global demands for greater collaboration and interaction in the e-learning environment in general and digital libraries in particular increase, the results of this study will contribute to meeting this demand. If institutions of higher learning create and support social tags in digital libraries, they will assist students to adjust in more holistic ways, so that they can complete their degree programs and join a competitive workforce.

Thus, this study aims to understand student’s behaviour and demands when using social tags in digital libraries. These findings can then be utilised by a variety of educators and researchers interested in understanding the role of social tags implemented in the digital library. Therefore, this research is also expected to open up doors for further research in this area.

## **7.6 SUMMARY**

In this chapter, the research findings have been discussed and linked to the literature review, in which social tagging users and their differences were also discussed. The importance of social tagging was also further discussed in relation to increased user satisfaction, increased user interaction, and increased accuracy of results. In addition, the chapter also presented details about how to utilise social tagging in research. Data collected and analysis led to the conclusion that social tagging can improve both

research accuracy and user satisfaction. The following section presents the conclusions and recommendations proceeding from this research.

## **CHAPTER 8**

### **CONCLUSION AND RECOMMENDATIONS**

This chapter summarises the research, establishes the originality of the research contribution, highlights the limitations of the study and presents future work.

## 8.1 RESEARCH SUMMARY

The aim of this study was to evaluate key aspects of usability when applying a social tagging system to the digital library context, and the objective was to determine whether social tagging has a positive impact on the accuracy of completed research and user satisfaction. This research also demonstrated the procedure for meeting the aims and objectives of the study. The study was predicated on recognition of the fact that results reported elsewhere but obtained from a study of western universities cannot be generalised to Saudi Arabian universities, because Saudi Arabia is culturally and academically different from western countries (Alsurehi and Al-Youbi, 2014).

To provide insight of value to the Saudi context, this study used a sample of students from Saudi Arabia, who have had the opportunity to experience using social tags during their studies abroad, particularly in the United Kingdom. This experience is potentially very important, and can be considered a first attempt to examine the usability of social tags in digital libraries, as well as being a unique attempt to include the Saudi perspective, which is covered by few if any empirical studies. Furthermore, those studies that focus on the use of social media in the Arab world have only touched on selected applications like Facebook and Twitter (Shen and Khalifa, 2010; Forkosh-Baruch and Hershkovitz, 2011). Thus, this project has extended the scope of studies using social tags to focus on digital libraries in Saudi Arabia.

The following paragraphs summarise the findings reported in this thesis by chapter.

The first chapter presented the background to the research, established its aims and objectives, and outlined the study. It also identified challenges to retrieving quality and accurate information, highlighting linguistic pluralism and growth in higher education demanding a need for smarter, linear and satisfying approaches to accessing accurate, relevant and reliable data and information.



In order to provide excellent retrieval services at minimal costs, the digital library demands a diagnostic process that is satisfactory, efficient, and accurate. A new, interactive approach to information retrieval, which is consistent with technological trends is the social tagging system.

The research background provided a detailed definition to explain the main aspects of digital library study, social tags and the e-learning environment, as addressed in previous studies. Each aspect was critically discussed in depth to apply fuller understanding of, and greater justification for the research.

Chapter three related to the research design, included the development of hypotheses and discussed the usability of social tags in detail.

Chapter four described and justified the research strategy, research method, data collection method, methodological design, research sampling method, data analysis and ethical considerations, for both the quantitative and qualitative research strands. The selection of mixed-method research to fulfil the aims and objectives of the study was further discussed. A web-based questionnaire and semi-structured interview were used to gather the data.

The use of SPSS software supported the analysis of the quantitative data obtained in the study. The data was collected from a sample of 175 study participants. The demographic variables and other variables related to the research questions posed in the study were analysed using descriptive statistics in which frequencies, percentage, measures of central tendency (mean), and dispersion (standard deviation) were conducted. Cross tabulation was also used for the purpose of conducting a chi-square analysis to determine any relationship between the various study variables.

Qualitative data was analysed using a thematic analysis to differentiate themes, depending on the participant responses drawn up and analysed to supplement the quantitative data. There was also a discussion of the research findings, derived from

both the quantitative and qualitative strands of the study and compared. The research findings were also presented leading to specific answers to research questions. In addition to the answers to the research questions, a summary of the research questions, research contributions, research limitations, and recommendation for further study was made.

## **8.2 RESEARCH LIMITATIONS**

As with any research, there are several limitations to this study. The primary limitation is that the population sample was limited to Saudi students studying in the United Kingdom already with access to social tagging systems in the digital library web-sites. Findings might differ in other countries, depending on the experiences of students.

It should also be noted that the results of the present study were obtained from a small sample size, so the findings are not generalizable to all Saudi students.

The majority of the respondents in the sample are male, and aged between 30 and 45-years-old, holding postgraduate degrees. Therefore, this limits the generalisability of the results of the study.

Finally, this study has been conducted with students from Saudi Arabia only; which has its own unique culture and so the findings cannot be generalised to other countries with different cultures.

## **8.3 RECOMMENDATIONS FOR FUTURE RESEARCH**

There are several points to be considered for further research. A future research study could examine other usability attributes in the usage of social tagging system in digital library, such as a follow up quantitative and qualitative study to further explore how to enhance the usability of social tagging system in digital libraries.

The other point is to obtain more accurate results; a larger sample of students from different sectors could be surveyed and interviewed. It would be worthwhile to investigate the influence of using social tagging system to student performance in digital library. Therefore, follow-up studies should be conducted to students who utilised social tagging in their library web-site determines what other adjustment issues they faced and whether and how they overcame them.

Optimal use of librarian personal experience: librarian personal experience and observations, and the way in which some librarians analyze these experiences and integrate them in to their work suggest that there is potential for them to be involved in evaluating the usability of social tags searches and assess the digital library role in enhancement the e-learning process.

Finally, Flexible and adoptable training materials: The results of this study suggest that training courses, materials and support for students need to be developed in a flexible and modular form to take into account individual differences between students. In addition, there is a need for learning resources for students and librarians that is generated on the basis of local experience and local examples.

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## **APPENDICES**

## APPENDICES

APPENDIX I: ON-LINE QUESTIONNAIRE**Dear Participant:**

Thank you in advance for taking the time to complete this survey. Your feedback is important on how the recent social tags system will affect the quality of search in digital libraries. This survey is a part of my dissertation in order to achieve a PhD degree.

Any data retrieved from this survey will be used for the purpose of collections only and not for any other use. Answers based on personal experience and thoughts and not on any bias perspective. This survey should take you approximately 5 minutes to complete.

Abeer Baslem

*Faculty of technology*

*De Montfort University*

*Email:p06004475@myemail.dmu.ac.uk*

### **Section 1: General Information about the users**

1. Please indicate your age group:

18-29 Years [ ] 30-39 Years [ ] 40-49 Years [ ] Over 50 Years [ ]

2. Are you :

Undergraduate [ ] Master [ ] PhD [ ] Staff [ ]

3. What kind of information do you look for in digital library?

Papers [ ] Articles, journals [ ] Books [ ] Thesis, dissertation [ ] Multimedia [ ]  
others [ ]

4. How often do you use the digital library?

Rarely [ ] Monthly [ ] Weekly [ ] Daily [ ]

5. How do you access the information?

Discuss with Colleagues [ ] Discuss with Librarian/Staff [ ]

Library Catalogue [ ] Review Articles [ ] Other

Methods [ ]

6. How do you consider yourself as a user of the digital library? (this is your university library website)

Beginner [ ] Intermediate [ ] Advanced [ ] Expert [ ]

7. Have you ever used tags in any social website?

- Yes [,CiteULike, delicious, twitter, instagram, facebook, Librarything, other]
- No

8. Did you use the tagging functions in any digital library?

- Yes ( please specify which digital library used, then move to Q10)
- No

If you chose No:

9. Please specify your reasons for not using the tagging functions

It was not existing in the library [ ] I didn't know about it or how to use it [ ] I had no time to try new way

It was not interesting for me to try new way to find resources [ ] Other, please specify [ ]

## **Section 2: adaptability of social tags to users**

### **Affect**

10. Will you be interesting to try a new way to find resources depend on your everyday language?

Yes [ ]

NO [ ]

11. Why did you use tags for the first time?

- I wanted to search as broadly based as possible.
- I couldn't guess the content of the resource from description.
- I want to see other point of view about the subject.
- Other, please specify

12. Have you ever used the tag cloud?

Yes [ ]

No [ ]

### **Learn ability**

13. Using tags to describe documents

Easy [ ] Difficult [ ] depending on the document itself [ ]

14. Do you think it takes time to decide a suitable tag to describe the document?

Yes [ ] No [ ] sometimes [ ]

15. How do you determine what tags to choose for the resources?

Your knowledge [ ] tag cloud [ ] Subjects [ ] Authors [ ] Title [ ] Other [ ]

16. How much time did you approximately spend exploring the tagging functions?

In hrs, it was easy to explore the system and dealing with it [ ] in days, complicated and need time to use it [ ] In between [ ]

### **Helpfulness:**

#### 17. What made you use it again?

To share information with others [  ] Describe the resources to add value [  ] Future retrieval [  ]

[  ] Document organization [  ] Refine the resources category [  ] other [  ]

#### 18. What are you thinking about the tag cloud?

Helpful in assisting me to choose a specific tag to describe a document [  ]

Worthless [  ] I have not decided [  ]

### **Section 3: Efficiency of social tags in digital libraries**

#### 19. The use of tags sped up the time needed for retrieve the wanted document

Agree [  ] Undecided [  ] Disagree [  ]

#### 20. The use of tags improved the quality of search results

Agree [  ] Undecided [  ] Disagree [  ]

### **Section 4: User satisfaction in using social tags in digital libraries**

#### 21. How satisfied are you with the implementation of the tagging functions?

- Tags would help me to find material easier in the future.
- Tags is a good way to expose opinions and views
- Tags improve users' interactions.
- Tags is a good way to keep track of my literature
- other

#### 22. The social tag increases the satisfaction of using digital library

• Agree [  ] Undecided [  ] Disagree [  ]

#### 23. The social tag increases the interactions between the users of digital library

• Agree [  ] Undecided [  ] Disagree [  ]

## **Appendix II: Interview guide**

Date of Interview:

Time of Interview:

Interview Location:

I want to thank you for taking the time to meet with me today. My name is ABEER BASLEM and I would like to talk to you about your experiences in using social tags in digital libraries in e-learning environment in order to capture lessons that can be used in future interventions. The interview should take less than an hour. I will be taking some notes during the session. All responses will be kept confidential. I will ensure that any information I include in my report does not identify you as the respondent. Remember, you don't have to talk about anything you don't want to and you may end the interview at any time.

Are there any questions about what I have just explained?

Are you willing to participate in this interview?

1. First collecting general information about the user:

19. Are you undergraduate/post graduate student?

20. How long have you studied in the university?

21. How often do you use the library?

2. To measure the level of adoptability of the system by users of the digital library.

22. If the option existed to search or browse by tags in your library catalogue, is that something you would use? (affect)



23. Do you think adapting social tagging system in libraries will make a different?  
How?(affect)
  24. What are you thinking about the tag cloud?(helpfulness)
  25. Do you think the other user's tags are helpful in assisting you to choose a specific tag to describe a document?(helpfulness)
  26. Does it take too long to learn on how to assign tags to the documents?(learn ability)
  27. Can you easily remember the step to assign tags to the documents?(learn ability)
3. To test the accuracy of research
28. How much time did you approximately spend to get the wanted item/ document?
  29. Do you think it takes time to decide a suitable tag to describe the document?
  30. On a 1–5 scale (1 being least useful; 5 being most useful), how useful did you find the social tags were in locating items related to you searches? How were the tags useful? How were they not useful?
  31. Do you think that tags, allowed you to find similar/relevant items more easily?
- 4- To measure user satisfaction participants were asked two questions:
32. Are you satisfied when using social tags in digital library? Why/why not?
  33. Do you think using social tags in digital library will increase satisfaction in using the digital library? Why/why not?

**APPENDIX III: THANKS LETTER FOR THE PARTICIPANTS IN THE INTERVIEW****23/5/2015****De Montfort University**

The Gateway,

Leicester

LE1 9BH

**Dear .....**

Thank you for taking the time to meet with me to participate in my research about the usability of social tags in digital libraries for e-learning environment. I enjoyed talking to you. Our conversation yesterday further strengthened my data and provides me with new insight regarding my subject. Please let me know if you can provide me with additional information. Thank you again for your collaboration and assistance.

Sincerely,  
Abeer Baslem

P06004475@dmu.ac.uk

**Appendix IV: Frequency Tables**

**1. Please indicate your age group:**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 18-29 Years	42	24.1	24.1	24.1
30-39 years	101	58.0	58.0	82.2
40-49 Years	25	14.4	14.4	96.6
Over 50 Years	6	3.4	3.4	100.0
Total	174	100.0	100.0	

**2. Are you**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Undergraduate	38	21.8	21.8	21.8
Master	58	33.3	33.3	55.2
PhD	78	44.8	44.8	100.0
Total	174	100.0	100.0	

**3. What kind of information do you look for in digital library?**

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	papers	45	25.9	25.9	25.9
	articles,journals	40	23.0	23.0	48.9
	books	22	12.6	12.6	61.5
	Thesis, dissertation	20	11.5	11.5	73.0
	Multimedia	4	2.3	2.3	75.3
	other	43	24.7	24.7	100.0
	Total	174	100.0	100.0	

**4. How often do you use the digital library?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	44	25.3	25.3	25.3
	Monthly	32	18.4	18.4	43.7
	Rarely	27	15.5	15.5	59.2
	Weekly	71	40.8	40.8	100.0
	Total	174	100.0	100.0	

**5. How do you access the information?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Discuss with Colleagues	29	16.7	16.7	16.7
	Discuss with Librarian/Staff	17	9.8	9.8	26.4
	Library Catalogue	74	42.5	42.5	69.0
	Review Articles	44	25.3	25.3	94.3
	Keywords	10	5.7	5.7	100.0
	Total	174	100.0	100.0	

**6. How do you consider yourself as a user of the digital library? (this is your university library website)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beginner	50	28.7	28.7	28.7
	Intermediate	68	39.1	39.1	67.8
	Advanced	45	25.9	25.9	93.7
	Expert	11	6.3	6.3	100.0
	Total	174	100.0	100.0	

**7. Have you ever used tags in any social website**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	108	62.1	62.1	62.1
	No	66	37.9	37.9	100.0
	Total	174	100.0	100.0	

**8. Did you use the tagging functions in any digital library?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	111	63.8	63.8	63.8
	Yes	63	36.2	36.2	100.0
	Total	174	100.0	100.0	

**9. Please specify your reasons for not using the tagging functions**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	It was not existing in the library	20	11.5	16.5	16.5
	I didn't know about it or how to use it	65	37.4	53.7	70.2
	I had no time to try new way	16	9.2	13.2	83.5

	It was not interesting for me to try new way to find resources	20	11.5	16.5	100.0
	Total	121	69.5	100.0	
Missing	System	53	30.5		
Total		174	100.0		

**10. Will you be interesting to try a new way to find resources depending on the tag which can save the resource under it**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	117	67.2	77.0	77.0
	No	35	20.1	23.0	100.0
	Total	152	87.4	100.0	
Missing	System	22	12.6		
Total		174	100.0		

**11. Why did you use tags for the first time?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I wanted to search as broadly based as possible.	26	14.9	26.5	26.5
	I couldn't guess the content of the resource from description	18	10.3	18.4	44.9
	I want to see other point of view about the subject	34	19.5	34.7	79.6
	Other, please specify	20	11.5	20.4	100.0
	Total	98	56.3	100.0	
Missing	System	76	43.7		

Total	174	100.0	
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**12. What made you use tags again?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	To share information with others	48	27.6	47.1	47.1
	Describe the resources to add value	20	11.5	19.6	66.7
	Future retrieval	18	10.3	17.6	84.3
	Document organization	10	5.7	9.8	94.1
	Refine the resources category	6	3.4	5.9	100.0
	Total	102	58.6	100.0	
Missing	System	72	41.4		
Total		174	100.0		

**13. How much time did you approximately spend exploring the tagging functions?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		76	43.7	43.7	43.7
	Absolute time spent (in hrs)	71	40.8	40.8	84.5
	Time span from first to last log in (in days)	27	15.5	15.5	100.0

Total	174	100.0	100.0
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**14. Using tags to describe documents**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	75	43.1	43.1	43.1
Depending on the document itself	10	5.7	5.7	48.9
Difficult	24	13.8	13.8	62.6
Easy	65	37.4	37.4	100.0
Total	174	100.0	100.0	

**15. Do you think it takes time to decide a suitable tag to describe the document?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	41	23.6	35.3	35.3
No	63	36.2	54.3	89.7
Sometimes	12	6.9	10.3	100.0
Total	116	66.7	100.0	
Missing System	58	33.3		
Total	174	100.0		



**16. How do you determine what tags to choose for the resource?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Your knowledge	13	7.5	11.0	11.0
	tag cloud	10	5.7	8.5	19.5
	Subjects	50	28.7	42.4	61.9
	Traditional search terms (author, title)	33	19.0	28.0	89.8
	Other	12	6.9	10.2	100.0
	Total	118	67.8	100.0	
Missing	System	56	32.2		
Total		174	100.0		

**17. Have you ever used the tag cloud?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	46	26.4	39.0	39.0
	No	72	41.4	61.0	100.0
	Total	118	67.8	100.0	
Missing	System	56	32.2		
Total		174	100.0		

**18. What are you thinking about the tag cloud?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helpful	64	36.8	53.8	53.8
	Worthless	31	17.8	26.1	79.8
	Have not decided	24	13.8	20.2	100.0
	Total	119	68.4	100.0	
Missing	System	55	31.6		
Total		174	100.0		

**19. The use of tags sped up the time needed for obtained the wanted documents**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	47	27.0	39.2	39.2
	Undecided	34	19.5	28.3	67.5
	Disagree	39	22.4	32.5	100.0
	Total	120	69.0	100.0	
Missing	System	54	31.0		
Total		174	100.0		

**20. The use of tags improved the quality of search results**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	59	33.9	49.6	49.6
	Undecided	32	18.4	26.9	76.5
	Disagree	28	16.1	23.5	100.0
	Total	119	68.4	100.0	
Missing	System	55	31.6		
Total		174	100.0		

**21. How satisfied are you with the implementation of the tagging functions?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tags would help me to find material easier in the future	48	27.6	40.3	40.3
	Tags is a good way to expose opinions and views	14	8.0	11.8	52.1
	Tags improve users' interactions	6	3.4	5.0	57.1
	Tags is a good way to keep track of my literature	33	19.0	27.7	84.9

	Other	18	10.3	15.1	100.0
	Total	119	68.4	100.0	
Missing	System	55	31.6		
Total		174	100.0		

**22. The social tag increases the satisfaction of using digital library**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	63	36.2	52.9	52.9
	Undecided	52	29.9	43.7	96.6
	Disagree	4	2.3	3.4	100.0
	Total	119	68.4	100.0	
Missing	System	55	31.6		
Total		174	100.0		

**23. The social tag increases the interactions between the users of digital library**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree	64	36.8	53.8	53.8
	Undecided	52	29.9	43.7	97.5
	Disagree	3	1.7	2.5	100.0
	Total	119	68.4	100.0	
Missing	System	55	31.6		
Total		174	100.0		