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IMPLEMENTATION AND USAGE OF DIGITAL LIBRARIES: A CASE STUDY OF BUNDA COLLEGE GREENSTONE DIGITAL LIBRARY IN MALAWI.

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Abstract

The study investigated how the Bunda College Digital Library was implemented and used. 91 undergraduates, 10 postgraduates and 43 academic staff responded to questionnaires on the digital library usage. Facebook instant messages and phone interview were used to obtain data from library staff about managerial and technical activities. The digital library (DL) was created to address the need for digitizing documents on Malawi and/or by Malawians. Staff members were trained in the DL activities, however it lacked funding and largely utilized available resources. All the three categories of respondents agreed that the digital library was useful. Engaging in DL consultancy services, employing one library staff on temporary basis and including activities of the DL in the annual budgets were presented as the major recommendations. The study was limited in the sense that 3rd and 4th undergraduate students were on holiday during the data collection period and many postgraduates were out for their field research. This affected the richness of the study. Bunda College Library staff, Malawian librarians and Bachelor of Library Science students at Mzuzu University would find this research useful. Although similar research initiatives have been carried out, this research is unique as it tackles managerial and technical aspects of DL implementation as well as usage by the end users.

Background to the study

Digital library creation, management and use of digital information are the essential aspects of the 21st century information managers' tasks, due to the overwhelming creation and availability of digital information witnessed in the recent years and its associated challenges. The British Library (2005) estimated that by the year 2020, 40% of UK research monographs will be available in electronic format only, while a further 50% will be produced in both print and digital formats. A mere 10% of new titles are expected to be available in print alone by 2020. This makes digital libraries increasingly significant as the information only available in electronic format will need proper management and preservation to prevent it from getting lost and ensuring it remains accessible over a long period of time.

This study assessed the implementation and usage of the Bunda College Greenstone Digital Library in Malawi. It mainly focused on the managerial and technical activities taken to implement the digital library, the views of the end users in terms of the relevance and usability as well as challenges posed in its implementation. Attempts to create digital libraries in Malawi have been jeopardized by several challenges such as lack of equipment, inadequate institutional support and lack of required IT skills (Bunda College Library n.d). In the midst of all these challenges, Bunda College of Agriculture Library managed to create a digital library and made it accessible to the College's community. Are there some worthwhile lessons that other libraries in Malawi can learn from Bunda College Library? This is the question that this research attempted to address.

Greenstone Digital Libraries in Malawi

Initiatives have been undertaken in Malawi to install Greenstone in various libraries. The College of Medicine Library which is a branch of the University of Malawi Libraries was the first institution in Malawi to install Greenstone in 2005. According to Mawindo (2009) about 300 documents were scanned, unfortunately, the collection was damaged by computer viruses in 2006. In 2007 the first workshop on the creation of Greenstone Digital Libraries took place at Bunda College. After the workshop, staff in several libraries installed Greenstone software (Bunda College Library n.d.). However, there was little or no progress as noted by Salanje (2008, p.7). Out of all the participating libraries, Bunda College was the only institution which had managed to successfully create a digital collection and made accessible to its community of users in 2008, making it an appropriate case study for this research.

Figure 1. Map of Malawi

Showing Lilongwe, where Bunda College of Agriculture is located



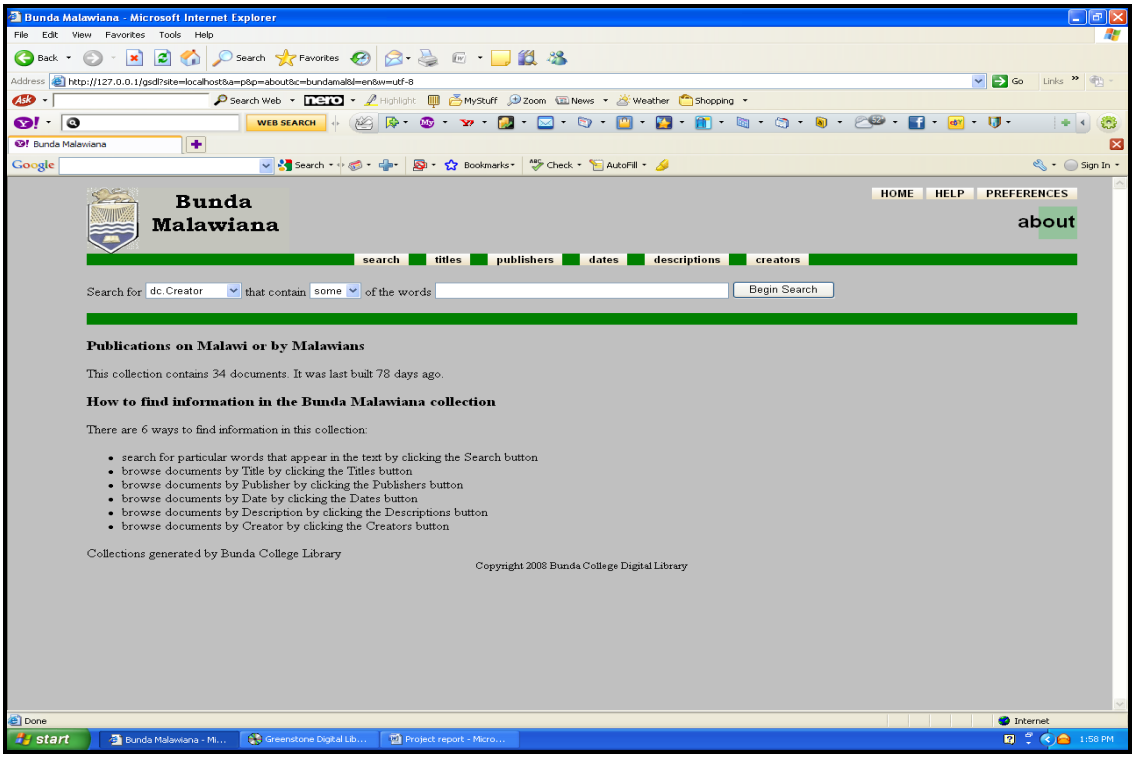
http://geography.about.com/library/cia/blcmalawi.htm

Bunda College Library and the Greenstone Digital Library Project

The Digital Library has four collections to date. These are:

Bunda Malawiana, which is a collection of rare documents about Malawi or written by Malawians (Malawi Greenstone Report n.d.).

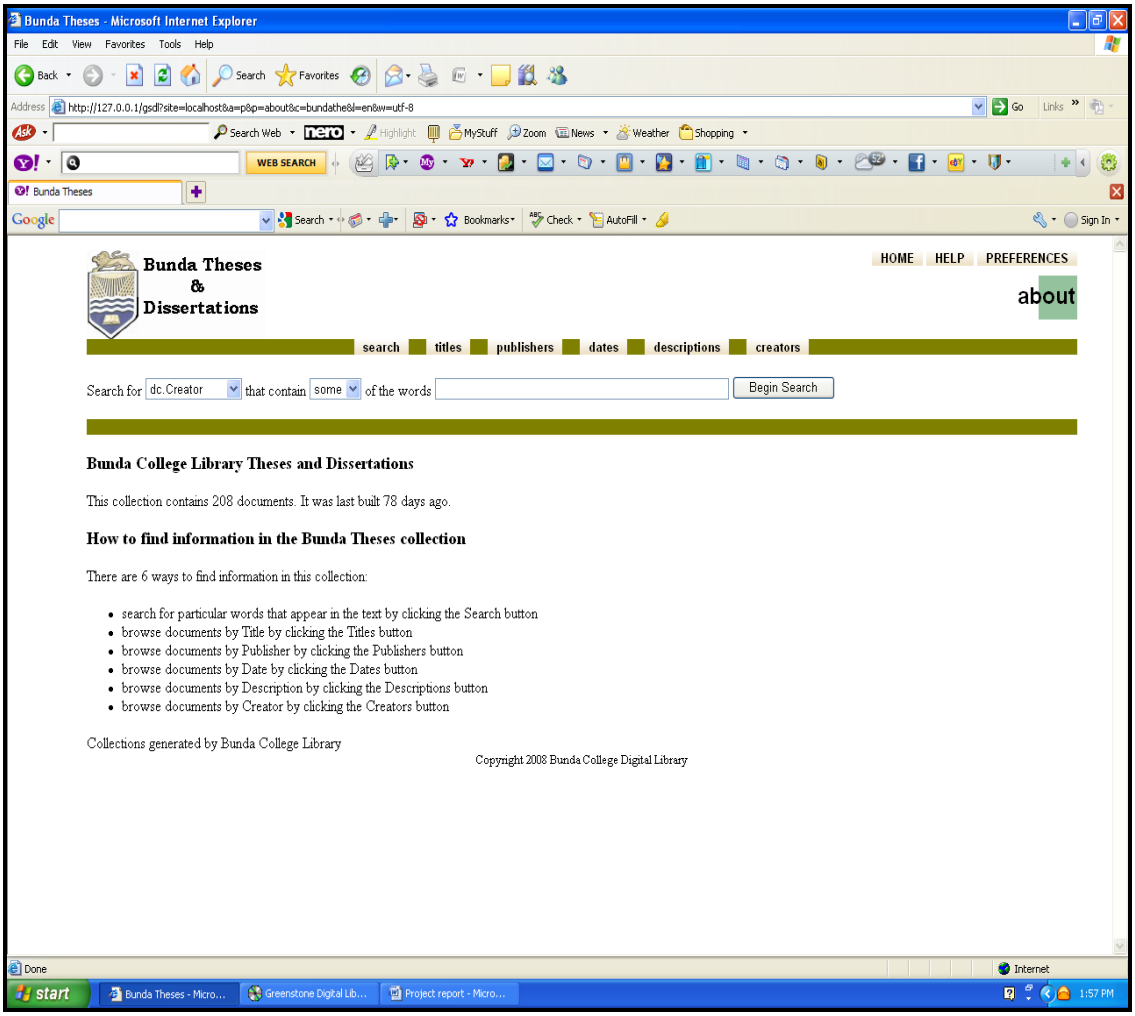
Figure 2. Bunda Malawiana Home Page



(http://www.flickr.com/photos/24495559@N08/3276654967/in/set-7215761376774401 0/).

Bunda Theses and Dissertations which is a collection containing theses and dissertations written by Bunda College staff and postgraduate students who undertook their studies at Bunda College. It also contains documents written by non members of Bunda College who wrote about Malawi and about subjects of interest to the College.

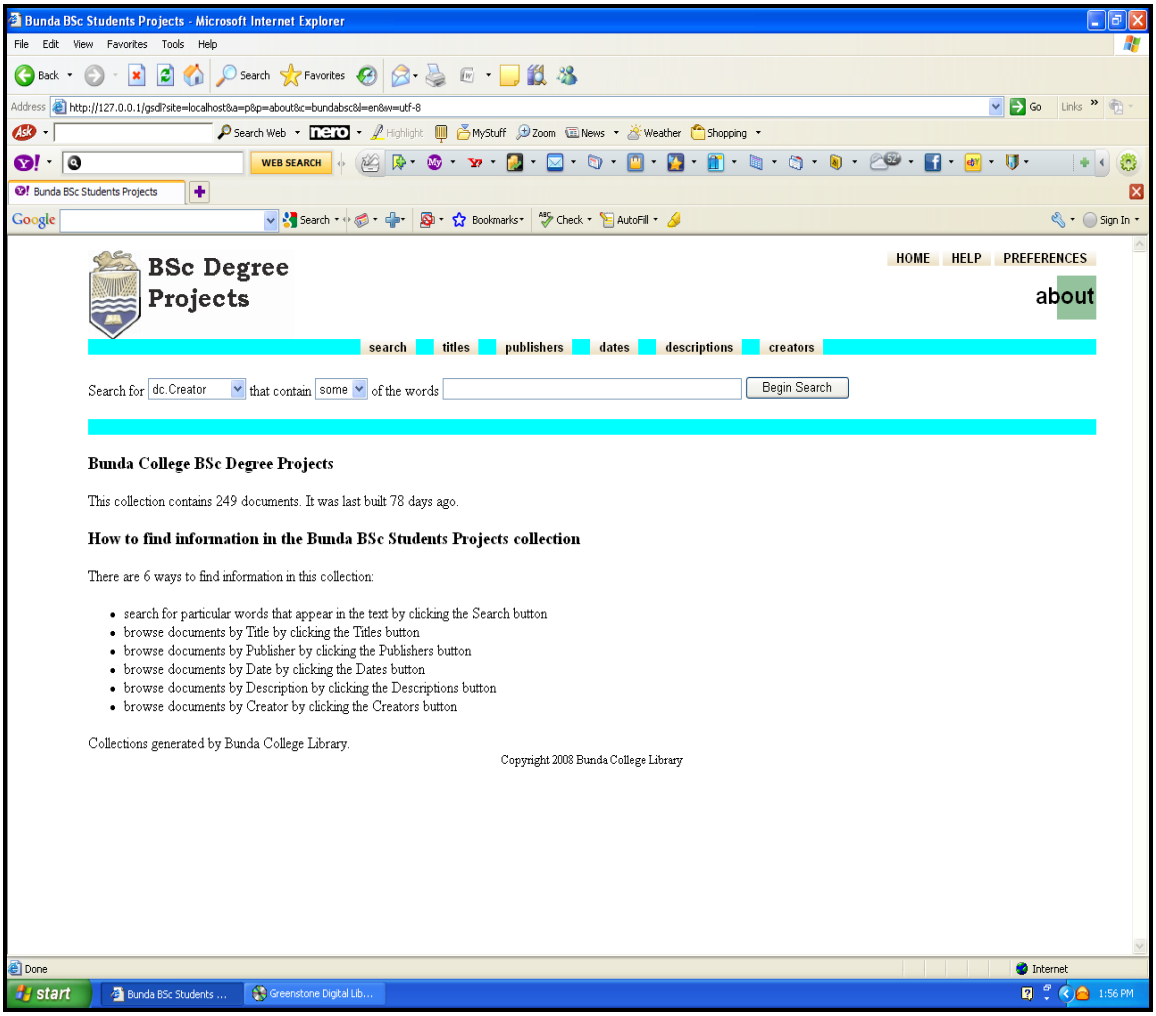
Figure 3. Bunda Theses and Dissertations Collection Home Page.



(http://www.flickr.com/photos/24495559@N08/3276654697/in/set-72157613767744010)

The third collection is entitled BSc Degree Projects. These documents were written by Bunda College undergraduate students as projects written in partial fullfillment of the various degree programmes offered by the College.

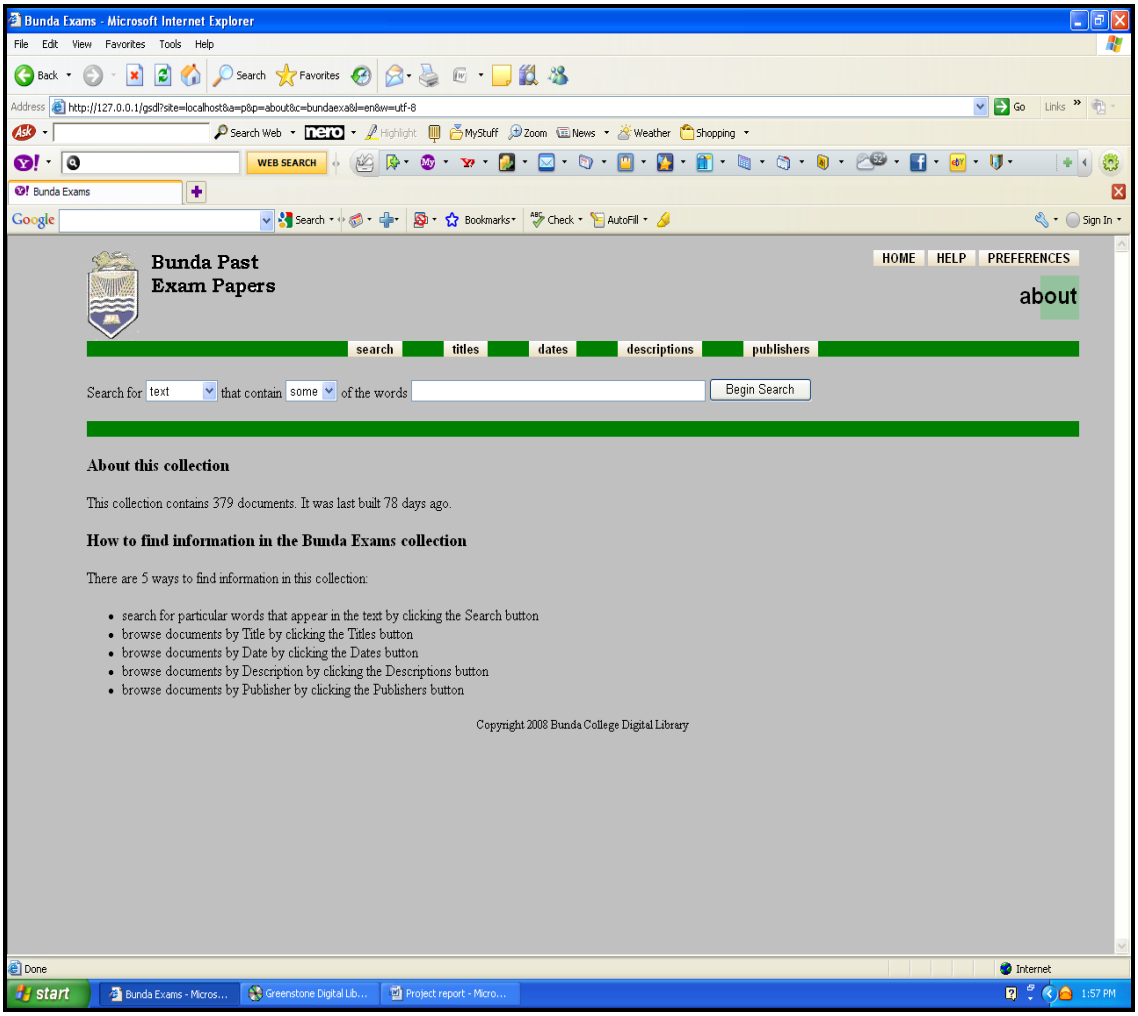
Figure 4. BSc Degree Projects Collection Home Page



(http://www.flickr.com/photos/24495559@N08/3277475546/in/set-7215761376774401O)

Finally, the Bunda Past Exam Papers collection which contains past examination papers for both undergraduate and postgraduate students of the College.

Figure 5. Bunda Past Papers Collection Home Page



(http://www.flickr.com/photos/24495559@N08/3277475304/in/set-72157613767744010)

Objectives

Main objective

- To assess how the Bunda College Greenstone Digital Library was implemented and how it was being used.

Specific Objectives

- To investigate the activities carried out to implement the digital library
- To find out the rate of usage of the digital library by the end users
- To examine the challenges faced in the management and usage of the digital library
- To identify elements of good practice in the development and management of the Bunda College Greenstone Digital Library.
- To develop recommendations for the better development and management of digital libraries in Malawi.

Research Questions

- What technical and managerial activities were taken to create the Bunda College Greenstone digital library?
- Why is it that Bunda College managed to create and implement the digital library in a reasonable period of time as compared to other libraries in Malawi?
- What are the users' perceptions about the relevance and usage of the digital library?
- What challenges were faced in the creation, management and usage of the digital library?
- What aspects from the Bunda College Greenstone Library Project are worthy of recommending to other libraries?

Literature Review

Introduction

Researchers writing in the area of digital libraries in Africa have focused on different aspects and features of the topic (Rosenberg 2004; Iwhiwhu & Eyekpegha 2009; Byamugisha 2009; Awasom 2003; Nyambi 2010). These researchers have brought to light various issues in terms of progress, challenges and opportunities of digital libraries in Africa. However, they all focused on generating information from librarians and neglected the end user who is a key stakeholder in the development of digital libraries. The research on frameworks for digital library evaluation done by Zhang (2009) agrees and states that the validity of the frameworks was weakened by either the exclusion of end users' opinions or the limitation of DL level coverage.

University libraries in Africa have progressed towards establishing digital library services at very different speeds and levels (Rosenberg 2006, p. 289). Baro (2009) found that some library schools in Africa had introduced digital library education as part of their training programmes, signifying the importance of digital libraries in Africa and their capacity to provide an integrated set of services for capturing, cataloguing, storing and searching digital information. .

Digital Library Planning

Planning the digital library means taking the necessary steps to transform the library into a cohesive system of networked information resources and services. Iwhiwhu (2009) found that university libraries in Nigeria lacked written policies for their digitization projects. As much as policies are necessary in articulating the guidelines for maintaining and using digital libraries, planning is an equally important aspect of a digital library creation. Seadle (2008, p.5) argues for digital library planning with emphasis on interoperability so that documents can move readily from one system to another. However, planning for other aspects of digital library management is also necessary, including, rights management issues, budgeting, staff implications and hardware specifications. It was essential for this research to find out if some kind of planning was done to implement the DL.

Digitization

Digitization is mainly done for the purpose of improving information access. For example, Hamson (2001, p.265) reported that the digitization project at Birmingham University was purposed to improve access to learning materials in support of undergraduate and postgraduate courses. Digitization has become a major area of activity and research in digital libraries and many large projects have been undertaken over the past years (Chowdhury & Chowdhury 2003, p.103).

Prioritisation of material to be digitized is a complex issue. The research done by Bultmann et al. (2006, p.109) found that some organizations selected too much material and found it difficult to prioritize, while others found that although a list of criteria had been established, there was still too much material that fitted the criteria. However, it is important to have a guide on what to digitize due to the cost involved in the digitization process, for example, the best student dissertations as recommended by faculty members.

Optical Character Recognition (ORC)

ORC could be characterised as taking "dumb" page images that are nothing more than images and producing smart electronic text that can be searched and produced in many different ways (Witten, Bainbridge & Nichols 2010, p. 140). Witten, Bainbridge & Nichols further pointed out that although the OCR process can be entirely automatic, subsequent manual cleanup is invariably necessary which is the most expensive and time consuming operation involved in creating a digital library from printed material. On the other hand Breaner, Iyengar & Pianykh, (2005) indicate that modern OCR engines are implemented with fast pattern recognition techniques. However, Zhou (2010) points out that the OCR process is not accurate for high resolution images in either colour or grayscale. This study explored how the digital library project was handling the OCR process and the challenges experienced.

Digital Library Usage

A useful DL fits the needs, activities and context of the people who use it, as well as those of the people who create it, operate it and contribute to its contents (Van House, Bishop & Buttenfield, 2003 p.1). The research done by Sheeja (2010) on undergraduate students' perceptions of the Cochin University of Science and Technology digital library, found that almost all the students used the digital library for learning by accessing past examination papers, syllabi, and other materials pertaining to their study. Students were also satisfied with the features and functionality of the digital library. This research attempted to find out the difference in usage between the sections of the user communities of students and academic staff. It also

endeavored to find out the proportion of usage between the collections available in the digital library and identified the reasons for different usage patterns.

Accessibility

Digital Libraries should be flexible in adapting to a diverse user population. However, they will never be as easy to use as automatic teller machines (ATM) or other single-purpose technologies. People must make some investment in learning to use them effectively (Borgman 2003, p.86). Thong, Hong & Tam (2002) observed that system accessibility will also increase users' perception of the ease of use of digital libraries. If a digital library is very difficult to access, either because of lack of computers or necessary software, users will tend to perceive it as difficult to use. This research endeavored to find out how the users accessed the digital library.

Digital Library Promotion

Libraries need to proactively promote their resources and services to their clientele (Mi and Nesta, 2006) or face the risk of losing these customers to the likes of Google and Yahoo (Kaur 2009). The study of perceptions of LIS professionals regarding use of the Pakistan National Digital Library databases by Warraich & Ameen (2010) found out that the resources of the Higher Education Commission (HEC) National Digital Library (NDL) were underused. This underutilization was attributed to lack of promotion in that it was recommended that HEC NDL could develop a promotional strategy and a feedback mechanism. This research investigated the promotional mechanisms applied by the Bunda digital library staff to enhance both usage and submission of documents for inclusion in the digital library.

Preservation

Preservation requires ongoing, active management that begins at the creation of the material and depends on a proactive approach by digital repository staff and the cooperation of other stakeholders, including data providers (Trusted Repositories 2002, p.18). There are two technical aspects in preservation, the first being to ensure that the physical item remains intact at the bit stream level and secondly that the digital object remains understandable (Jones 2007, p.111). Davidson (2009) observes that although some proactive digital preservation activities may be undertaken, it is more likely that most information technology departments will limit their activities to traditional backup services. It was of interest for this research to find out the preservation strategies being applied by the digital library staff and to gauge the effectiveness of these strategies.

Challenges in development and usage of digital libraries

Lynch and Garcia-Molina (1995) ; Kavulya (2007); Rosenberg (2006 p. 289); Iwhiwhu (2009, p.529); and Byamugisha, (2010, p.47) have identified various challenges associated with the development, management and use of digital libraries. Among them, lack of written policy on digitization, inadequate ICT infrastructures and manpower, fund, and inadequate government support as the main challenges. Although these challenges tend to be similar in different institutions and different African countries, the degree or intensity of each challenge cannot be the same. This difference justifies the need for carrying out research particularly in Malawi which may reveal unique issues relating to the Malawian digital library environment.

Summary

This chapter has reviewed the literature on the development and management of digital libraries including the following aspects: digital library planning, collection management and development; digitization; usage; promotion; access, preservation and challenges. The reviewed literature shows that many researchers have conducted research on various aspects of digital library with differences in scope such as at world, continent, region and country levels. It has revealed that the end user has largely been neglected in most of the reviewed research works. Digital libraries are created for particular communities of people and involving them will help to ensure user centered design of digital library services.

Methodology

The case study approach was used to obtain both quantitative and qualitative data using questionnaires and interviews. A total of 91 undergraduates, 10 postgraduates and 43 academic staff responded to questionnaires, while 4 members of the library staff were interviewed. Interviews were conducted using Facebook instant message facility in getting data from three library personnel. Telephone interview was used to collect data from the College Librarian.

Study Population

The total population for this study was 1,242 individuals comprising first and second year undergraduate students, postgraduate students, academic staff and library staff.

Sampling

Stratified random sampling technique was used in this study for students and academic staff study groups. This technique was appropriate for the study because the researcher directly used the faculties of the college as strata for the study and randomly selected respondents from each stratum.

Purposive sampling technique was used to select the library staff, that were directly responsible for creating, maintaining and managing the digital library.

Research Sample

In this study the sample was divided as follows:

Table 1. Research population and sample

Study Group	**Population size**	**Sample size**	**Percentage %**
1st and 2nd year Undergraduate Students	940	101	10.8
Postgraduate Students	128	17	13.3
Academic Staff	160	50	31.3
Library Staff	14	4	28.8
Total	**1242**	**172**	**13.9**

Seaberg (1988) stated that in most cases a 10% sample should be sufficient for controlling sampling errors. Therefore in the present study, the sample of 13.9% places it in a better position to represent the population.

Data Analysis

The researcher used SPSS/PASW for data analysis. The programme was used to analyse quantitative data that was obtained from the questionnaires. Qualitative data was summarised into categories based on themes.

Limitations

This research was limited in two ways. Firstly, the third and fourth year undergraduate students were on holiday and many postgraduate students were in the field for their research work during the period of data collection for this research. Secondly, the researcher failed to carry out interviews through Skype as previously planned due to low bandwidth at Bunda College, resulting in a lack of opportunity to benefit from participants' non verbal expressions. This certainly affected the richness of the study.

Research Results and Discussion

101 questionnaires were distributed to undergraduate students, 17 questionnaires to postgraduate students, 50 questionnaires to academic staff and interviews were carried out with four library staff. The summary of the response rate is presented in table 2.

Table 2. Response rate

Study Group	**Research Sample**	**No. of Responses**	**Response Rate (%)**
Undergraduate Students	101	91	90
Postgraduate Students	17	10	58.8
Academic Staff	50	43	86
Library staff	4	4	100
Total	**172**	**148**	**86**

Table 3. Faculties Representation of Respondents

Faculties	**Undergraduate Students**	**Postgraduate Students**	**Academic Staff**
Agriculture	42	5	18
Environmental Sciences	20	2	12
Development Studies	29	3	12
Not Indicated			1
TOTAL	**91**	**10**	**43**

Table 3 shows that the highest number, 42 (46.15%) of undergraduates were from the Faculty of Agriculture, followed by 29 (31.87%) Faculty of Development Studies and 20 (21.98%) from the Faculty of Environmental Sciences. 5 (50%) of the postgraduate respondents came from the Faculty of Agriculture; 3 (30%) Faculty of Development Studies and 2 (20%) Faculty of Environmental Sciences. It also shows that 18 (41.86%) of academic staff respondents belonged to the Faculty of Agriculture; 12 (27.91%) Faculty of Environmental Studies and 27.91% from the Faculty of Development studies. 1 (2.33%) did not indicate their faculty. Therefore, most respondents for the three groups came from the faculty of Agriculture.

Background Information of the Library Staff

Interviews were conducted with the College Librarian (CL), one Senior Library Assistant (SLA), and two Library Assistants (LA) who in this report are labeled as Library Assistant 1 (LA1) and Library Assistant 2 (LA2). The SLA has a diploma in ICT and is responsible for training users on how to use the digital library and troubleshooting both hardware and software. LA1 has a diploma in ICT and LA2 has a certificate in library studies (MALA Certificate). Both LA1 and LA2 are responsible for digitization and assisting users in accessing the database.

Data Analysis and Discussion

Planning

The CL indicated that no written plan or policy was used. This supports the findings by Iwhiwhu (2009) who found that university libraries in Nigeria lacked written policies for their digitization projects. The main purpose for the digital library was to digitize Malawiana, which are rare documents written about Malawi or by Malawians, agreeing with IMARK (2010, p.2) which indicated need identification as the first step in digital library planning. According to the CL the first step was to scan documents, this initially was done after installing Greenstone. The second step was to organize the digitized documents into four collections. He mentioned that although the plan to set targets for the number of documents to be added to the collections was thought of at first, it was never followed. Seadle (2008, p.5) has proposed the need for planning in design and implementation of digital libraries with an emphasis on interoperability so that documents can move readily from one system to another when an existing system fails. This signifies that planning is essential for a digital library project as it helps in decision making regarding requirements, challenges and proactive measures necessary for successful implementation of the project. On the other hand it could be used as a blueprint which can help in future activities.

Funding

The research endeavored to find out how the Bunda College digital library was being funded. The CL stated that the digital library project was lacking funding. Funding is fundamentally needed for acquiring an appropriate scanner, server and for providing incentives to library assistants responsible for scanning documents. Some of the resources meant for other functions of the library have been channeled towards the implementation of this project. He however, mentioned that one scanner was donated under the Malawi Greenstone Project for all libraries to scan documents for Greenstone digital libraries in Malawi.

These findings agree with Rosenburg (2006) who reported in her research that lack of funding for digital libraries in African universities remains the key challenge for the future. Bunda College has demonstrated that it is possible to use existing resources to implement the digital library, however, this creates several challenges. Much of the material budgetary resources for the library are allocated for book purchases and E-journal subscriptions. According to the 2010 Bunda College Library annual report, K13,600,000.00 (about £55,284) was allocated for book purchases in the 2009/10 budget and K13,700,000.00 (about £55,691) in the 2010/11 budget. K542,500 (about £2,205) was allocated for E-journal subscriptions in 2010. Although the library has prioritized print books and E-journals in terms of budgetary allocations, this research established that the digital library was an equally important source of information for the college community. This justified the need for channeling these budgetary resources towards the digital library activities as well.

Staffing

The CL was asked if the members of staff available were adequate and whether they had the skills needed to maintain the functions of the digital library. In response he mentioned that the library has adequate and well trained staff in specific activities of the digital library. This is contrary to the findings of a number of research studies on digital library projects in Africa as reported by Ngulube (2004); Rosenburg (2006); Iwhiwhu, 2009 who indicated that lack of appropriately trained staff was one of the key challenges for digital libraries in Africa. It was noted also that the College Librarian was directly responsible for the technical aspects of the digital library such as customization. This direct involvement of the CL places Bunda College digital library project in a much stronger position compared to other digital library projects in Malawi, where librarians at that level are not directly involved in the activities of the digital library.

However, the challenge with staff was still observed in the sense that these particular members of staff were not specifically employed the digital library functions.

Marketing the digital library

The main strategies for promoting the digital library in order to acquire documents and increase usage were indicated as face to face communication, orientation sessions, posters and memos. On the effectiveness of the strategies the LA2 had this to say:

> "Once we mention of the contents of the digital library in the posters and during orientation, users do not hesitate to visit and use it"

In relation to this promotion the researcher wanted to find out from the users, if they were aware of the existence of the digital library and how they came to know about it as a means of assessing the impact of the marketing strategies. 83 (91.2%) of undergraduates indicated that they were aware of the digital library against 8 (8.8%) who indicated that they were not aware of the existence of the digital library. All the 10 (100%) postgraduate students indicated that they are aware of the existence of the digital library. 40 (93%) of academic staff expressed awareness of the digital library against 3 (7%) who expressed ignorance of the existence of the digital library. Means of awareness were distributed as follows:

Table 4. Means of awareness of the digital library by undergraduates

Means of Awareness	Undergraduate Students	Postgraduate Students	Academic Staff
Personally from Library Staff	58	7	21
Library Training Sessions	40	6	12
From Colleagues	24	1	6
Library Bulletins	6	0	0
Library Web Pages	6	1	0
Other	11	2	0

As seen from table 4, most members of the college community came to know about the digital library through one on one communication. Although this is a positive development as face to face communication is more appealing to users, it may not reach all the members of the college community and it is difficult to sustain as members of staff are not always available for this task. This means that the other strategies are equally important. For example, Ramírez & Miller (2011) advocates marketing activities such as workshops, presentations, and lectures on topics such as copyright, publishing, and other scholarly communications to broaden an understanding of the objectives and benefits of a digital library.

Rights management

At first document owners were being requested to fill in forms as authorization for the library staff to put documents in the digital library. However a policy was later established requiring documents to be submitted in electronic format for inclusion in the digital library.

> "An electronic copy of any document (Theses, Dissertations, Degree projects and any publication) should be sent to the library in addition to the hard copies for the digital library" (LA2)

LA2 reported that:

> "Many departments do not send electronic copies. This makes me on the College librarian's order to go around the campus departments to ask for the same which is involving. Some departments do not keep the electronic copies hence the challenge of scanning comes in again."

In addition it is a challenge for the library to seek permission to digitize Malawiana items authored by people outside Bunda College. Malawiana refers to items written by Malawians or about Malawi including those who are not members of the Bunda College community.

> "Digital repository projects must be undertaken with a full understanding of ownership rights and with full recognition that permission to include materials that are not in the public domain is essential (Witten, Bainbridge & Nichols 2010, p.35).

However, copyright in a digital environment is a complex issue as Kavulya (2007) noted that there is unclear global copyright law on digital information. In any case, Bunda College library has a responsibility to contact people before their works are digitized and added to the digital collection.

Digital Library Equipment

The SLA stated that the digital library is hosted on an ordinary computer. He described the computer hosting the digital library as an HP Desktop, 250GB, 2.7GHZ Duo core, 2GB RAM. However, there was a plan to host the digital library in the main library server, which was holding the (Online Public Access Catalogue - OPAC). A digital library involves full text documents that require a computer with adequate space. Having an ordinary computer for the project should be regarded as a temporary measure. Hosting the digital library on the server that holds the OPAC was a better option bearing in mind the funding situation of the digital library.

Greenstone Digital Library Software

The version of Greenstone being used was 2.80 on OS=Windows XP professional. The SLA indicated the advantages of the Greenstone Software as follows: it is a user friendly program and it can run on a number of Windows based platforms. One disadvantage observed by the CL was the constantly changing software versions, which requi continual updates of the software. The SLA also pointed out that it is vulnerable to virus attacks. On customization, the SLA stated that it is only done by the CL which supports Northam

(2010, p.18) who observed that Greenstone was not easy to customize. The fact that the software is open source is a great opportunity for libraries in Malawi that are struggling with funding to create digital libraries. However, the technical skills required to effectively operate Greenstone digital library systems remain a major challenge.

Digitization

According to LA1 the digitization process involves scanning page by page into PDF format although it is possible to use any other format of their choice. Two HP Scanjet 5590 flat bed, A4 size scanners are being used for the digitization process. The SLA, LA1 and LA2 concurred that this type of scanner is inappropriate for the digitization process because it is not able to scan pages larger than A4. The SLA also pointed out that the existing scanners are not as fast as more modern scanners.

The staff also indicated that the scanning tasks are time consuming and tiresome yet the incentive they received was not adequate and this makes other library staffs avoid the task. The CL stated that digitization is costly and the major activity that requires funding. This is in agreement with Hamson (2001); Witten, Bainbridge & Nichols (2010, p.138); and Chowdhury & Chowdhury (2003 p.117) who observed that digitization is a costly exercise. Although a policy to submit electronic copies of documents has been established at the College, digitization would still be required as many of the documents produced in previous years are still in print format.

Optical Character Recognition (OCR)

The SLA mentioned that OCR was being used to convert documents into formats that can be edited and to simplify the searching process by enabling users to search using any word found in the documents other than using the document name only. On the importance of OCR, the LA2 had this to say:

> "The documents that undergo OCR process are easy to find when searched. More related documents appear since it recognizes each and every character hence the name (OPTICAL CHARACTER RECOGNITION).

While LA1 indicated that:

> "The ability to polish up an old document to look presentable, readable, a big document to be a sizable, and the ability to change the format suiting your needs"

However the SLA pointed out disadvantages of OCR as follows:

> "Time consuming. The process needs one to undergo a special training if he/she is to be efficient and the software is not open source."

This statement concurs with Witten, Bainbridge & Nichols (2010) who pointed out that OCR is the most expensive and time consuming operation involved in creating a digital library from printed material. On the other hand the OCR software is commercial software which was obtained through the Malawi Greenstone project support partners. In this case Bunda College Library is responsible for purchasing updates when required, which is not easy bearing in mind the funding situation for the digital library.

Collections

The CL was asked whether the available collections in the digital library were meeting the needs of the users and the criteria that were used to select items for the digital library. In response he stated that the digital library had four collections namely: Bunda Malawiana with 34 documents, Bunda Theses and Dissertations with 237 documents, BSc Degree Projects with 265 documents and Bunda Past Examination Papers with 379 past papers. In total the digital library had 915 documents. The CL indicated that these collections were serving the needs of the users and there were no immediate plans to create more collections.

The researcher also wanted to find out how the collections were being used. Therefore, both students and academic staff were asked to indicate the collections they used. The Bunda Past Exam Papers was indicated 56 times representing 61.5% of the total undergraduate respondents. The next most frequently used collection was Bunda Malawiana with 52 (57%) times, BSc projects 15 (16.5%) times and Bunda Theses & Dissertations 10 (11%). These usage patterns indicate that first and second year undergraduates had immediate information needs for their examinations and coursework. This concurs with the results of the research done by Sheeja (2010) on the undergraduate students' perceptions of the Cochin University of Science and Technology digital library, where it was found that almost all the students used the digital library for learning by accessing past examination papers, syllabi, and other materials pertaining to their study. Reasons provided for using these collections were as follows: referred by lecturers during assignments, interested to read documents written by Malawians, hard copies of Malawiana documents are very few hence supplemented by the digital library and to find out how previous projects were written.

In terms of postgraduate students both Bunda Malawiana and Bunda Theses & Dissertations received the highest frequency of 5 (50%) each, Bunda Past Exam papers 4 (40%) and BSc Projects 3 (30%). Reasons given for use are: literature review and general guidance for thesis preparation, checking relevant information specific to Malawi for their academic work and preparation for their examinations. This shows

that the immediate element of information needs for postgraduate students is research followed by examination.

While Academic staff indicated the highest usage frequency on Bunda Theses & Dissertations 34 (79.1%), Bunda Past Exam Papers 33 (76.7%), BSc projects 30 (69.8%) and Bunda Malawiana 29 (67.4%). Reasons given for usage of these particular collections were students' project supervision, formulation of exam questions, research and teaching.

These usage patterns signify that the digital library is a critical information resource for the College as it was directly serving the core functions of the College as an academic institution which are teaching, learning and research.

In terms of selection of items to be added to the collection, the CL indicated that no criterion was used to select materials. All the documents that belong to the categories of the four collections are taken into the collection. This aim for comprehensive coverage is nearly impossible due to the challenges with digitization equipment and staff. It is important to have a set of selection criteria for prioritizing documents to be scanned and added to the collection. For example, not all student projects may be necessary for the digital library collection, perhaps only those rated as best could be added to the digital collection. However, prioritisation of material to be digitised is a complex issue. The research done by Bultmann et al. (2006, p.109) found that some organizations had too much material and found it difficult to prioritize, while others found that although a list of criteria had been established, there was still too much material meeting the set criteria.

In terms of format for documents available in the digital collection, the SLA reported that the digital library has documents in text-PDF format only. However, the other formats such as images, video and sound are equally important sources of information for teaching, learning and research and these could benefit the users if they were incorporated into the digital collection.

Preservation

When asked about preservation strategies that were in place for the Bunda College digital library both the CL and SLA stated that they had a back-up of the digital library. This is in agreement with Davidson (2009) who observed that although some digital preservation activities may be undertaken, it is more likely that most information technology departments will limit their activities to traditional backup services. Greenstone was designed in such a way that updates to new versions are carried out without any effect on the digital library data. However, preservation also entails ensuring that the digital data is transferable to

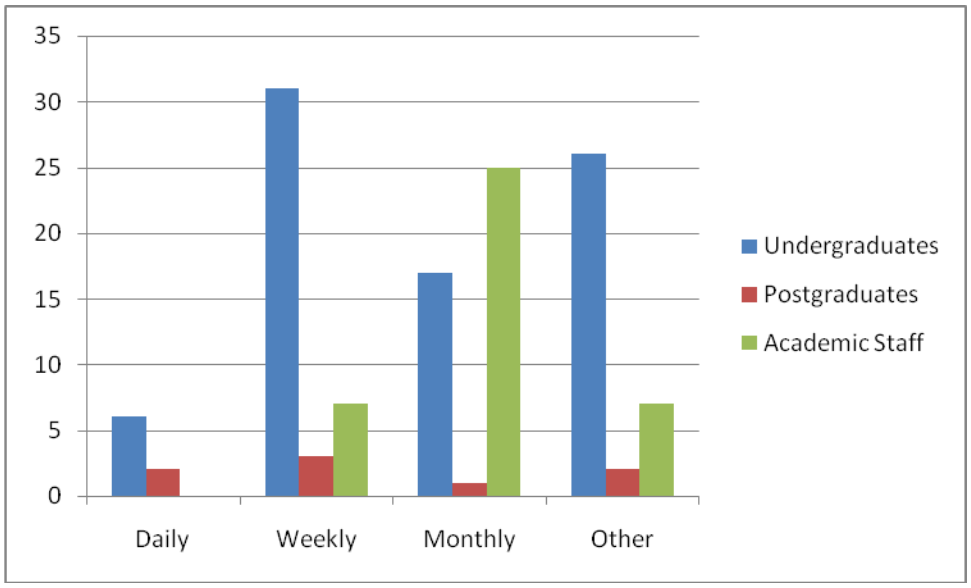
new forms of media as technology changes. This remains the duty of the developers of the software to conduct research and be proactive on how Greenstone digital libraries will survive in future as the forms of media technology change.

Usage of the Digital Library

As one of the objectives of this research was to find out usage of the digital collection and this was achieved by asking the undergraduate, postgraduate and academic staff study groups, questions about frequency of use, search terms used and search abilities.

As illustrated in the figure 6, 31 (38.75%) and 3 (37.50%) of both undergraduates and postgraduates respectively, indicated weekly as the highest usage frequency. In contrary to this 25 (64.10%) academic staff indicated monthly as the highest frequency. According to the comments given by academic staff, suggests that the less usage frequency by academic staff is attributable to inaccessibility of the digital library through the intranet. There are only two computers designated for the digital library access in the library and these cannot cater for the whole community of staff and students.

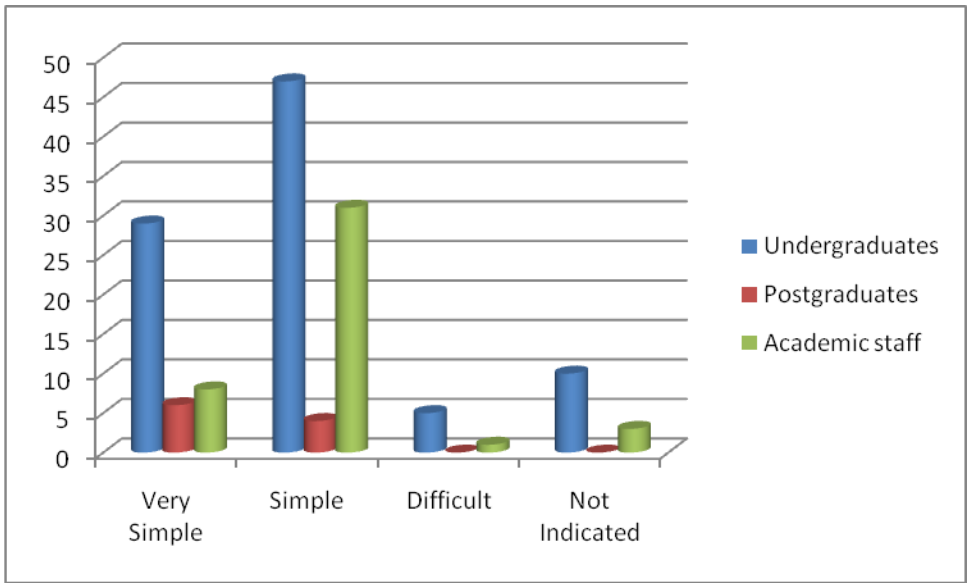
Figure 6. Usage frequency



When asked about their ability to search the digital library, the three study groups responded as follows: The highest number of undergraduate respondents, 47 (51.65%) indicated that they found it simple to search. On the other hand 6 (60%) postgraduate respondents indicated that they found it very simple to

search. While 31 (72.09%) academic staff indicated that they found it simple to search. The point generally is that the digital library is simple to search which is a credit to the Bunda College Staff who designed it in this manner. However, 5 (5.49%) undergraduates and 1 (2.33%) academic staff member indicated that it was difficult to search as indicated in figure 7. When asked about the reasons for the difficulty, they indicated as follows: orientation was not effective, do not understand how the system operates, network problems, it is a new development and do not use it frequently. These responses indicate that orientation has not been done continually to cater for those who might have missed it during the first year orientation programme and those who did not effectively grasp the database search strategies. The one academic staff respondent indicated that the digital library is slow to retrieve documents. This agrees with Zhou (2010) who observed that multipage PDF may have a large file size which increases download time. However, LA1 stated that efforts are being made to reduce the size of PDF documents before inserting them in the digital library.

Figure 7. Search abilities



The question on the search terms used to search the digital library was aimed at establishing whether the respondents were able to maximize use of the digital library by using various search terms. Responses from the study groups were as follows**:**

Figure 8. Search terms used

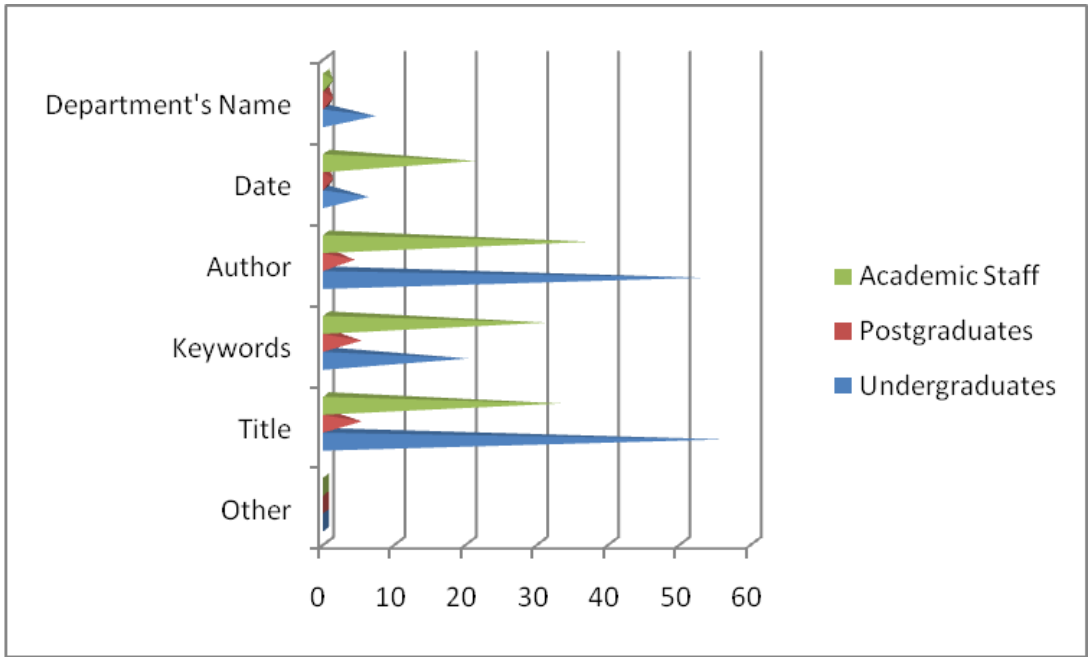


Table 8, shows that academic staff is the most skilled category as evidenced by flexibility in the use of multiple search terms. It is obvious that this is the group with the most experience in terms of research, hence with effective searching ability. This is signified by the revelation that the undergraduate group is the least skilled group in the use of multiple search terms.

Access

Although it was indicated in the Bunda Greenstone Project Report that the digital library was to be accessed through the intranet first and later, through the Internet, it was established that it was not yet available either through the intranet or the Internet as previously planned. In this case all the users had to access it in the library. 12 (27.9%) of the academic staff commented that they need to access the digital library remotely. These comments agree with Jones (1999) who indicated that a goal of the digital library is that all resources are stored online and always available in a networked environment. Inaccessibility of the digital library through the intranet has greatly affected usage of the digital library as revealed by usage frequency shown

in figure 6. Thong, Hong & Tam (2002) have linked access and perception of ease of use. They state that if a digital library is very difficult to access, either because of lack of computers or necessary software, users will tend to perceive it as difficult to use. Similarly in this research one reason given for difficulty in searching the digital library is network problems.

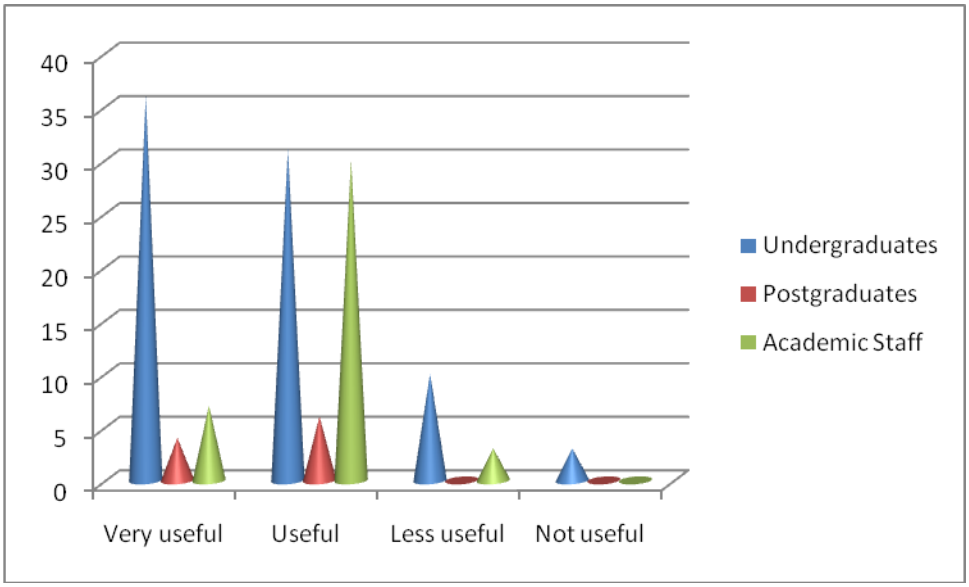
Usefulness

The researcher wanted also to establish the respondents' opinions regarding the usefulness of the digital library and their preference between the digital library and print sources.

This was achieved by asking whether the search results generated by the digital library were very useful, useful, less useful or not useful.

As seen in the figure 9, the highest number of undergraduates 36 (45%) indicated very useful, while the highest number of postgraduates 6 (60%) indicated useful and the highest number of academic staff 30 (75%) indicated useful. Van House, Bishop & Buttenfield, (2003 p.1) stated that a good digital library is useful. This therefore, signifies that the Bunda College Digital Library is generally good. Thong, Hong & Tam (2002) defined perceived usefulness as the extent to which a person believes that using the system will enhance his or her job performance. They further state that perceived usefulness is proposed to have a direct impact on adoption intention, because users will be more willing to use a system if it can provide valuable functions. On the other hand the usefulness of a DL depends critically on its content being relevant to and usable by its clientele (Van House, Bishop & Buttenfield, 2003). This, therefore, means that the users of the digital library perceive the content to be important for effective performance of their actual activities, in this case teaching, learning and research.

Figure 9. Usefulness of the digital library



Preference between the Digital Library and the Printed Documents

The researcher wanted to find out the preferences of respondents between the digital library and printed documents and the reasons behind the preferences.

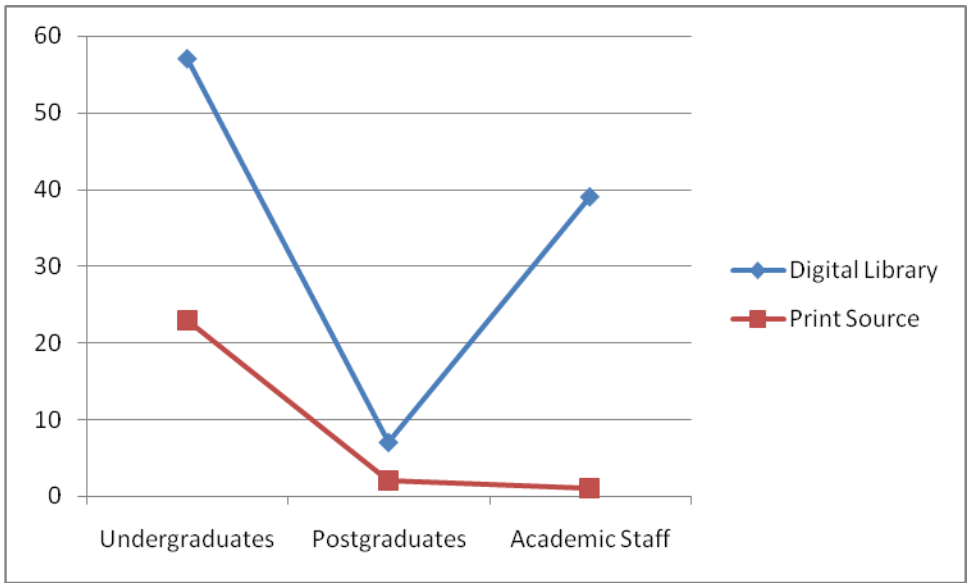
The results as shown in figure 10, indicate that 57 (62.64%) undergraduate, 7 (70%) postgraduates and 39 (90.70%) academic staff have a preference for the digital library. This reflects the findings of Sathe, Grady & Giuse (2002) who established that the majority of students preferred electronic resources to print. Reasons given in the present study were as follows: soft copies are easy to handle, easy to access, easy to search, they are never lent out, they are downloadable, interactive, capable of multiple simultaneous access, accessible 24/7, instant information retrieval, a lot of information, user friendly, pages intact, we are in a digital age and convenience. All these comments reflect the benefits of a digital library as observed by (Arms 2000; Rubin 2010, p.238).

However, 23 (25.27%) undergraduates, 2 (20%) postgraduates and 1 (2.33%) academic staff have a preference for print sources. Reasons given were as follows: inaccessible during power outage, technical problems associated with digital systems, few computers available for accessing the digital library, less documents in the digital library at the moment, sight problem, don't like using computers for a long time, can study without using computers, not accessible through the intranet, easy to read as compared to electronic information. These reasons also highlight the negatives associated with digital information as

similarly noted by Levy in 1999 who particularly pointed out that there is too much information available through digital libraries which makes it too hard to concentrate and remain focused.

Although a large percentage of the users prefer to use the digital library rather than print resources, challenges such as frequent power interruptions, fewer documents available in the digital library, few terminals for accessing the digital library and lack of access through the intranet leave the users with no choice but to use the print sources more than items in the digital library. This is evidenced by the usage frequency which showed weekly as the highest for undergraduate and postgraduate students and monthly for academic staff.

Figure 10. Preferences between digital library and Print Source



Summary

This chapter has provided details of the research findings, data interpretation, analysis and discussion. Issues that relate to the objectives of the research have been discovered and discussed. The research questions have been addressed in various aspects. Firstly, managerial steps including: planning, funding, staff and marketing. Secondly, technical steps such as digital library equipment, Greenstone digital library software, digitization, preservation, optical character recognition and collections. Thirdly, usage, relevance and preference for the digital library. Several challenges have been identified for the digital library

including: lack of funding, frequent power interruptions, inadequate equipment for digitization, inaccessibility through the intranet, inadequate documents available in the digital library.

Conclusion and recommendations

Managerial and technical skills are essential in as far as the creation and management of digital libraries is concerned. In addition to this, considering the needs of users in the development of a digital library is equally important.

This research established that planning for the digital library was done in an ad-hock manner which resulted in some challenges threatening the sustenance of the project, with funding being the most critical one. A project of this kind relies on funding for its effective and efficient implementation, hence the need for proper planning for various activities of the project including the determination of sources for funding for the project. Generally the research established that digital libraries are fundamental for information dissemination and preservation, justifying librarians' efforts in generating funds for digital library projects.

Face to face communication was deemed to be an effective strategy for marketing the DL, however it may not reach the whole community as staff may not be available for the task at all times. This calls for the intensification of the other means of promoting the DL in addition to face to face communication.

Digital information is more vulnerable to copyright abuse than print, because it can easily be copied, sent or modified. Therefore, clear measures should be put in place to avoid copyright infringements. Positive efforts have been made by Bunda College Library, however, more needs to be done, especially in regard to handling documents authored by people external to the College.

Resources of the digital library ought to be accessible through a network so as to benefit as many users as possible. This also ensures 24/7 access of information which is not currently the case with BCDL. The use of an ordinary computer instead of a server for the digital library should be regarded as a temporary measure. Plans were underway to host the DL in the server that was holding the OPAC, although a stand-alone server could be most appropriate for the digital library bearing in mind that a digital library is a growing entity.

The research found positive elements regarding the implementation of the DL as follows: The direct involvement of the CL in both the management and design of the digital library; use of available resources for the project, staff training; face to face marketing strategy; use of incentives to motivate staff and storing backups in different places in computer terminals and CD-ROMS. These are the good practices that the researcher recommends to other libraries in Malawi.

Finally the researcher recommended that collaboration should be intensified to facilitate the purchase a heavy duty scanner which can be used to scan documents for digital libraries in those institutions. Secondly, the library staff should be engaged in consultancy services as a means of generating funding for the digital library. The library should develop criteria for selecting necessary documents for inclusion in the digital library. The DL should be made available through the intranet to enhance its access by the members of the college community. Lastly, the library should consider employing at least one member of staff specifically for the activities of the digital library on a temporary basis, mainly to scan print documents that urgently need to be added to the digital library as some of its users indicated that the library did not have many documents.

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