Digitisation of Theses and Dissertations in Academic Libraries in Tanzania: Lessons Learned from the Muhimbili University of Health and Allied Sciences Library

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Abstract

Digitisation projects are becoming increasingly popular in academic, public and special libraries. Libraries are either digitising previously acquired hard copies or building digital libraries or institutional repositories by submitting electronic copies to the repositories. Thus, digitisation of library materials is critical to increasing material visibility and accessibility. Digitisation has received attention with the goal of allowing greater access. Nevertheless, it is sometimes hampered or limited by a number of factors; they include existing policies, structures, skills and financial capability. The goal of this paper was to gain a better understanding of the strategies, challenges and issues involved in the digitisation of theses and dissertations through lessons learned from the Muhimbili University of Health and Allied Sciences (MUHAS) library. This study sought to determine the successes as well as the difficulties encountered during the digitisation of theses and dissertations at MUHAS library and to recommend possible way-forward strategies. This paper used a mixed-methods approach, including participatory observation and in-depth interviews to highlight the challenges and successes of the MUHAS digitisation project. Purposive sampling was used to identify key informants who were previously and currently involved in MUHAS digitisation activities. In this study, six former project employees and eight current project employees were interviewed. The MUHAS Institutional Repository (IR) has 2,590 publications, 1,492 of which were theses and dissertations, accounting for 58% of all publications uploaded to the IR. On the other hand, hard-bound theses and dissertations converted to digital form accounted for 55% of all theses and dissertations. The project was the first in Tanzania to establish an institutional repository and the first to develop and implement an institutional digitisation policy. Nonetheless, the project significantly aided in raising the university's research profile, as MUHAS was ranked first in the country in 2016. The lack of skilled personnel, slow internet connectivity, negative perceptions of library staff and insufficient equipment and facilities hampered the project. Nearly 85% of the institutional collection of theses and dissertations were successfully digitised by the MUHAS digitisation project. Regardless of the difficulties encountered, the project gained valuable experience on how to mitigate the ideal difficulties and issues.

Introduction

Digitisation projects are becoming increasingly popular in academic, public and special libraries. Libraries are either digitising previously acquired hard copies, or building digital libraries or institutional repositories by submitting electronic copies to the repositories. Thus, digitisation of library materials is critical to increasing material visibility and accessibility. Digitisation has received attention with the goal of allowing greater access, but it is sometimes hampered or limited by a number of factors. These include existing policies, structures, skills and financial capability (Kipaan, 2012). Given the fact that lending restrictions in libraries have significantly impacted access to theses and dissertations, digitisation of these library materials offers a great opportunity for libraries to build collections with unrestricted access. Tanzania is rapidly digitising printed library materials (Muneja, 2010). However, this move has received a lot of attention and importance in academic libraries in Tanzania, where most digitisation projects are being carried out. Most academic libraries have prioritised digitising theses and dissertations among other library materials. At the Muhimbili University of Health and Allied Sciences Library (MUHAS), the digitisation project began by focusing on the conversion of print theses and dissertations in 2012. Many other academic libraries in Tanzania have embarked on digitisation projects. Nevertheless, little is known and documented about challenges and accomplishments experienced along the way.

Practical experiences from the MUHAS library digitisation project are highlighted in this paper. These include how it has evolved since the project's inception in 2012. This paper attempts to contribute to the body of knowledge regarding the challenges and opportunities associated with digitisation of such research materials as theses and dissertations, as well as presenting strategies for successful digitisation.

Study Objectives

The general objective of this paper was to gain a better understanding of the strategies, challenges and issues involved in the digitisation of theses and dissertations through lessons learned from MUHAS.

Specific objectives

This study specifically aimed at:

i.   determining the successes in the digitisation of theses and dissertations at MUHAS library;

ii.   ascertaining the difficulties encountered during the digitisation of theses and dissertations at MUHAS Library; and

iii. recommending strategies and prospects for digitising theses and dissertations in Tanzanian academic libraries.

Literature Review

Current issues and problems in digitisation

Information from governments, private sectors and scholars is increasingly appearing online and being demanded electronically. This creates a new environment and posing new challenges to the library and archival profession (Asogwa, 2011). It increases the pressure on information professionals; it also creates an urgent need to keep up with developments in the global archival environment. Many African libraries are still occupied with materials recorded in physical formats. Traditional librarians are in charge of acquiring, organising and preserving print documents, as well as assisting readers in finding the information they need (Asogwa, 2011). This movement has changed rapidly in developing countries as a result of advancements in computer technology. Physical materials are gradually giving way to electronic print; online repositories are replacing the need for users to visit library or archive buildings to access their collections. Therefore, digital archiving and creation of digital archives have emerged as a new practice in the library and archival profession. This is made possible by technological advancement, which provides more opportunities and challenges to librarians, archivists and information professionals.

Approaches to African digitisation projects

The majority of African digital initiatives are collaborative in nature. The Digital Imaging Project of South Africa (DISA), for example, is a collaboration of South African librarians, archivists and scholars. Another example is Kwetu.Net which has brought together African governments and universities as partners to create an East African full-text database (Amollo, 2011). The University of Nigeria launched a digitisation project to preserve its intellectual property. This includes research theses, conference proceedings, seminar papers, colloquia, research publications and inaugural lectures (Ezeani, 2009).

According to Asogwa (2011), the success of digital projects in Africa is dependent on good project management rather than expensive technology. Technology should not drive digital projects; rather, goals should be established first, followed by the selection of appropriate technology. When embarking on digitisation projects in developing countries, certain factors must be considered. These include such factors as planning, setting goals, developing digitisation policies, legal/copyright issues, selection criteria and metadata quality, among others.

Digitisation can be done in-house or outsourced. Digitising in-house implies that an institution's department captures the images, providing hardware and software, trained personnel and overhead. Outsourcing entails contracting with a vendor who will receive the images, convert them and return the originals as well as the necessary digital files. When embarking on a digitisation project, both in-house and outsourced options should be considered (Note, 2011). The scope, nature, fragility and uniqueness of the materials, the project budget and institutional resources will all influence whether digitisation is done in-house or outsourced

Note (2011) asserted that information professionals take their roles as overseers of the collections entrusted to them seriously; they have to ensure that information assets are safe and accessible to users. The increased demand for online access to collections, combined with limited fiscal and staff resources, makes balancing the two a constant challenge. Defining explicit goals at the start of a digitisation project will ensure its success and sustainability. Before beginning the project, staffing and financial resources must be assessed and the project's goals must be realistic in relation to the resources available.

Africa's digitisation challenges
Several studies have affirmed that only a few university libraries in Africa, particularly in Tanzania, have embarked on digitising their information assets (Baro *et al.*, 2013). The primary goal of the existing digitisation projects is to increase global access to local content. However, digitisation projects face such challenges as unstable internet connectivity, lack of funding, erratic power supply, gathering materials for digitisation, lack of IT personnel, lack of digitisation policies and copyright issues (Amollo, 2011; Asogwa, 2011; Eke, 2011; Ezeani, 2009). Digitisation has the potential to revolutionise how libraries access, store, disseminate and preserve information. Academic libraries digitise their collections to increase public awareness, education and research initiatives.

Scientific literature exists in South Africa, Nigeria, Togo and Uganda, as a result of several studies on the digitisation of theses and dissertations in Africa. According to a South African study (Nyide, 2014), the University of KwaZulu Natal digitisation project lacked a guiding digitisation strategy and policies. Furthermore, there were no clear communication lines, resulting in unexpected project delays. This is consistent with Schöpfel and Soukouya's (2013) assertion that despite the global nature of open access, the challenges and solutions are local. Another study conducted in selected tertiary institutions of learning in South Africa, by Kagoro *et al.* (2017) found that library dissertations and theses

digitisation lacked adequate staff, funding, sponsors and effective government support. In Tanzania, academic libraries are running their own digitisation projects. However, Muneja (2010) asserted that the predominant challenges associated with digitisation projects are lack of digitisation skills, digitisation policies, awareness about Intellectual Property Rights (IPRs) and long-term strategic plans. As a result, this study aimed at providing practical experiences and evidence undergone in digitising theses and dissertations through the MUHAS library digitisation project, which was founded in 2012 and is still ongoing.

Study Methodology

This paper adopted a mixed methods approach coupled with participatory observation and in-depth interviews to highlight the issues and successes of the MUHAS digitisation project. Purposive sampling was used to identify key informants who were previously and currently involved in the digitisation activities at MUHAS. This study interviewed six former project employees and eight current project employees. The study is more qualitative than quantitative.

Results and Discussions

Tanzanian country profile of the digitisation project

Tanzania has 34 universities and 15 university colleges, but only 14 registered institutional repositories have been established in the country. These findings suggest that many institutions of higher learning have yet to embrace the open access initiative, which aims at making institutional research outputs freely accessible and disseminated online. Thus, the findings of this paper focus on the path to take and the challenges that institutions may face as they embark on digitising such research materials as theses and dissertations.

Profile of MUHAS library digitisation project

The MUHAS is Tanzania's largest and oldest medical higher learning institution, training health professionals in various cadres. It began in 1963 as the Dar es Salaam Medical School. The MUHAS library now receives around 200 dissertations per year from postgraduate students enrolled in various postgraduate programmes. Being Tanzania's first and best public university for health sciences, it was also the first higher learning institution to recognise and embrace the open access movement and technological opportunity to establish a digital repository aimed at improving access to library resources, research reports and publications. It was also expected to raise the University's profile by exposing research outputs online, including thesis and dissertations produced by postgraduate students. MUHAS believed that its institutional repository (IR) would help in increasing citation rates and the impact of its research. The

repository, however, is not intended to replace but rather to supplement traditional research publishing channels. The IR was established with the goal of providing secure, stable and long-term storage of information materials. The MUHAS IR has 1492 dissertations, which account for 58% of all IR research publications. A total of 828 hardbound theses and dissertations between 1968 and 2012, were converted into digital copies and submitted into the IR. From 2013 to 2021, the MUHAS IR policy reinforced postgraduate students to submit electronic copies of their theses and dissertations which later were uploaded into the IR. In this case, a total of 664 theses and dissertations were entered into the IR. This means that hard bound dissertations digitised accounted for 55% of all dissertations entered into the MUHAS IR.

In 2013, a total of 912 publications were submitted in the IR, of which 461 were theses and dissertations and 452 were journal articles. Among other years, 2013 was considered the most successful year for populating the MUHAS IR. The MUHAS IR currently has 2,590 publications, 1,492 of which are theses and dissertations, accounting for 58% of all publications uploaded to the IR. The library has a total of 1,754 print theses and dissertations. This indicates that the project was successful in digitising 85% of the total collection of theses and dissertations.

Human resources of the digitisation project
The MUHAS library digitisation involved a total of nine staff members, six of whom were volunteers who scanned hardbound theses and dissertations and uploaded electronic copies. Two of three library employees were involved in reviewing and approving uploaded theses and dissertations before they were made public online. The digitisation pace was slowed significantly by a staff shortage that began in 2015, when the majority (6) of volunteers stopped working with the MUHAS library. Currently, eight staff members from the ICT section in the Directorate of Library Services manage the MUHAS IR populating activities.

Table 1:   Distributions of theses and dissertations by communities in MUHAS IR

S/N	Name of the Community	Total Number of Theses and Dissertations
1	ICT & Information Science	2
2	Institute of Traditional Medicine	43
3	School of Dentistry	33
4	School of Medicine	791
5	School of Nursing	70
6	School of Pharmacy	70
7	School of Public Health & Social Sciences	483
	GRAND TOTAL	**1,492**

Source: MUHAS IR (2022)

The findings show that the majority of the theses and dissertations uploaded in MUHAS IR were from the School of Medicine. This accounted for 53% of all theses and dissertations uploaded into the MUHAS IR. This could be due to the fact that the School of Medicine is the mother (oldest) of all schools and the largest at MUHAS. This school also has the largest number postgraduate enrolments compared to other schools. This has resulted in the production of many theses and dissertations at the university.

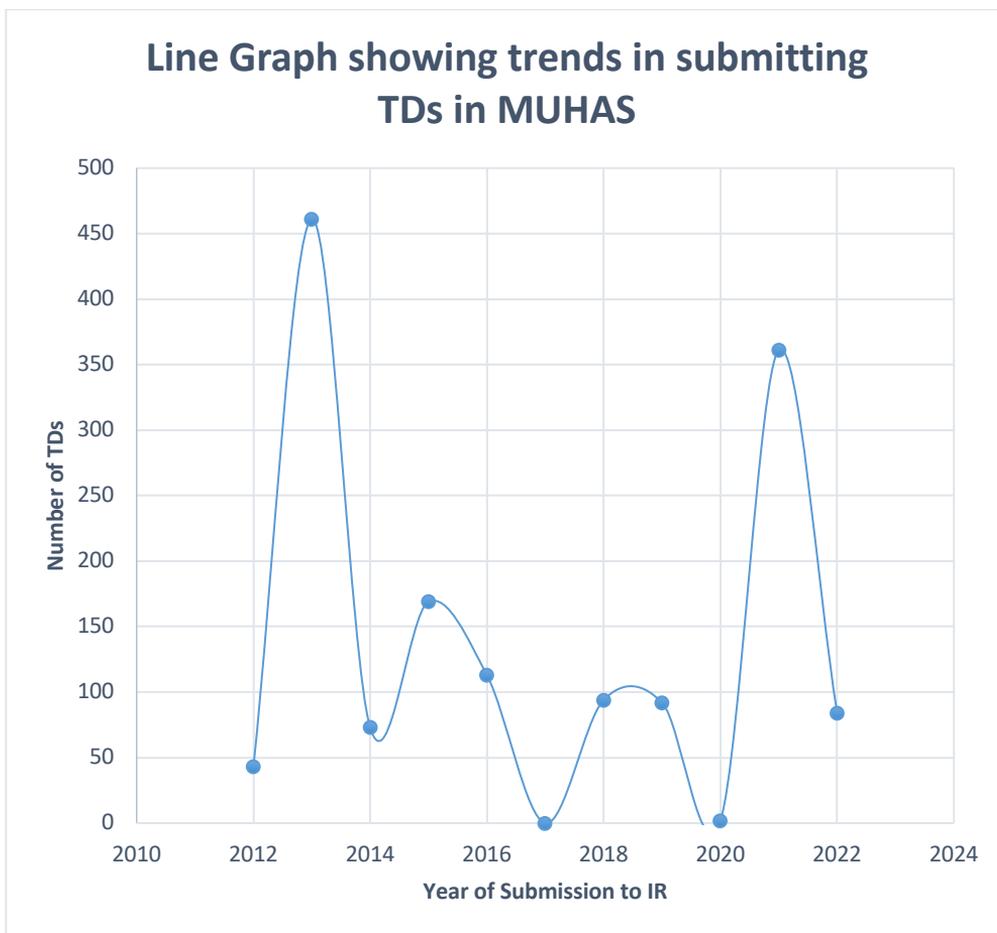***Trends in the number of theses and dissertations submitted to the MUHAS IR***
The study sought to determine the trends in populating the IR with theses and dissertations. It was determined that knowing the progression from when the MUHAS library began its digitisation project to where they are now was critical. This highlights what occurred during the execution of the entire project activities, as well as where they fell short and where they succeeded.

Table 2: Trends in populating TDs in MUHAS IR

Year Submitted to the IR	School of Medicine	School of Public Health	School of Nursing	School of Pharmacy	School of Dentistry	ITM	ICT & Info. Science	Total TD in Yearwise
2012	27	0	2	8	6	0	0	43
2013	216	187	22	20	13	2	1	461
2014	44	8	3	1	0	17	0	73
2015	108	29	3	17	3	9	0	169
2016	44	50	5	5	2	7	0	113
2017	0	0	0	0	0	0	0	0
2018	67	17	7	0	2	1	0	94
2019	42	33	5	10	1	1	0	92
2020	1	1	0	0	0	0	0	2
2021	210	109	22	7	6	6	1	361
2022	32	49	1	2	0	0	0	84
Total	**791**	**483**	**70**	**70**	**33**	**43**	**2**	**1492**

Source: MUHAS IR (2022)

Based on these findings, the year 2013 had the highest (461) number of theses and dissertations uploaded to MUHAS IR, followed by the year 2021. According to these findings, no theses and dissertations were submitted in 2017 and the year 2020 saw the lowest submission of only two publications. These findings are supported by the fact that in 2017, the MUHAS IR experienced an indexing error that prevented staff from uploading theses and dissertations and the IR was unavailable for most of that time. These findings also revealed that the first five years of the digitisation project (2012-2016) accounted for more than half (58%) of total MUHAS IR submission activities for theses and dissertations.

Figure 1: The year in which theses and dissertations were produced and uploaded to MUHAS IR

The time in which these research publications were produced and uploaded to the IR was found to be necessary; the goal was to ascertain the trends in which there have been more output of theses and dissertations at MUHAS. This will assist in forecasting the increased workloads to plan for the sustainability of its digitisation project.

Table 3: The year that theses and dissertations were produced and uploaded to MUHAS IR

Years Range	School of Medicine	School of Public Health	School of Nursing	School of Pharmacy	School of Dentistry	IT M	ICT & Info. Science	Total TDs in Years Range
1968-2000	122	16	3	5	0	9	0	155
2001-2010	172	165	14	9	12	2	1	375
2011-2022	497	302	53	56	21	32	1	962
Total	791	483	70	70	33	43	2	1492

Source: MUHAS IR (2022)

These findings indicate that the majority of theses and dissertations uploaded to the MUHAS IR were produced between 2011 and 2022. This has made up 64% of all theses and dissertations archived in the IR. These findings indicate that there were more postgraduate graduates than in previous years at MUHAS. This is a major concern for higher education institutions and library staff involved in digitisation projects. They should expect and plan for increased workloads in archiving these important research publications in their repositories. This might require more human and financial resources to succeed. This is due to the fact that higher learning institutions, including MUHAS, continue to enrol more students in postgraduate programmes than ever before.

Success stories from the library digitisation project
In 2012, the MUHAS IR was one of the first institutional repositories (IRs) established among Tanzanian higher learning institutions. The establishment of the IR was a library initiative, as the library pioneered its conception the way up to the top institutional management of MUHAS.

Furthermore, the MUHAS library pioneered development of the institutional repository policy. The policy serves to provide a framework for digitising MUHAS research publications including theses and dissertations. In line with the study findings, the policy is the first one in Tanzania that has been developed at the institutional level to guide activities, aspects and issues relating to digitisation initiatives. One of the IR accomplishments was in 2016, when it helped to raise the visibility of MUHAS research outputs to the point where MUHAS was ranked the first among Tanzanian higher learning institutions (SCImago University Ranking, 2016).

Increased accessibility of theses and dissertations at MUHAS

The digitisation project has increased the accessibility of theses and dissertations to the MUHAS community and the general public, particularly scholars. Since theses and dissertations are now available online, students and researchers can access and use them whenever and wherever they want. This is because access to and use of these library collections were previously restricted due to strict lending rules that required hard bound theses and dissertations to be used within library compounds.

Improved services provision at the MUHAS Library

The online availability of theses and dissertations has significantly reduced students' plagiarism practices when embarking on research endeavours at MUHAS. Given that they exist online, they can be detected easily by most of the anti-plagiarism software widely available today. As a result, students can now conduct real research projects and write high-quality theses and dissertations. In support of this, MUHAS recently acquired Turnitin anti-plagiarism software license, which mandates faculty and students' research proposals and publications to be checked for plagiarism. This has been deemed necessary to ensure academic integrity in research publications.

Reduction of theses and dissertations mutilation practices

The digitisation of theses and dissertations has significantly reduced students' mutilation of these library resources. Previously, library users were reported to have a bad habit of tearing up some pages of theses and dissertations; this could have been due to their limited use, which was reinforced by strict lending rules. One library staff commented that "having these resources available online had contributed to a very large extent to the preservation of hard bound theses and dissertations for other reference purposes at the library". These findings point to

the significant accomplishment of the MUHAS library digitisation project in enhancing long-term preservation of these important library resources for learning and research purposes.

Challenges encountered in the digitisation project

Limited skilled personnel for digitising the theses and dissertations

It happened that the MUHAS library had to outsource the staff who were supposed to digitise theses and dissertations under the SIDA library/ICT project. Nevertheless, after the project ended in 2015, it was not possible to keep the staff who were temporarily employed for digitisation activities. This significantly reduced the project's staffing, which had impact on project implementation.

Limited infrastructure

Many participants reported that one of the major challenges that hampered the digitisation of theses and dissertations was frequent IR downtime. The system was frequently unavailable for uploading scanned hardcopies as well as electronic copies submitted by students as required by the MUHAS IR policy.

In addition, another infrastructure bottleneck that the MUHAS digitisation project encountered was server instability due to the lack of a dedicated server for hosting the IR system. As a result, the IR system was frequently moved to another server portion. This resulted in its unavailability and indexing errors that halted the uploading of theses and dissertations for the whole year in 2017.

Slow internet connectivity- low bandwidth

The majority of participants reported that low internet bandwidth slowed the submission of digital copies of theses and dissertations. According to one participant: "There are times when uploading a document in IR takes nearly 10 to 20 minutes to complete the processes, thus affecting the digitisation project to a large extent because the submission process took a long time"

These findings imply that the issue of internet connectivity should be carefully considered when it comes to digitisation projects. In this way, there should be a dedicated internet connection with high speed to facilitate the submission processes of publications into the IR system. This is evident by the fact that the scanned pages of a complete theses and dissertations typically take up a significant amount of storage space. This requires a fast internet connection when submitting such a large file into the IR system. It was observed that the storage capacity of a complete file of scanned theses/dissertations ranged from 30MB to

120MB. This necessitated a stable and fast internet connection when being uploaded into the system.

Inadequate equipment and facilities

It was reported that the university administration purchased one heavy duty overhead scanner and two normal scanners. These were purchased for scanning and converting hard bound theses/dissertations to digital copies for uploading into IR. It was discovered that library staff were often competing for scanners due to few available scanners when compared to the number of staff involved in the project. The majority of staff complained that this made scanning theses and dissertations take longer. One library staff said: "there were times when we had to wait for colleagues to finish the scanning, which could take up to 3-4 hours"

This demonstrates that the limited scanning devices slowed the digitisation of theses and dissertations significantly. When it came to uploading the scanned theses and dissertations into the IR system, there was also a limited number of networked computers to accommodate all project staff.

Poor perceptions of library staff

The study's findings revealed that library staff believed that the heavy-duty scanner purchased for scanning hard-bound theses and dissertations could be harmful to their health. This discouraged them from using the heavy-duty scanner because they feared it would harm their health. The library administration informed them that the heavy-duty scanner is not harmful to their health because it uses standard laser technology as the photocopier machine; so they should not be concerned about any health effects. However, this study revealed that the heavy-duty scanner was not operational, implying that the staff's negative perceptions remained.

Prospects for effective implementation of digitisation project
Strategic planning

Digitisation projects necessitate extensive strategic planning. A digitalisation project is a complex system of interconnected tasks in which each decision influences the next, rather than a linear process in which one task follows another. Due to the high rates of change inherent in digitisation projects, the complexity of digitisation processes and the level of staff training required, digitisation necessitates close management and planning.

Adequate staffing and ongoing training

Digitisation projects are labour intensive requiring specialised knowledge and are organisationally and logistically complex. This necessitates a long-term commitment to ongoing maintenance, migration and updating. As a result, along the way in project execution, staff should be trained on a regular basis to ensure they have the technical skills and competency to handle digitisation activities effectively. Staff at the MUHAS library, for example, were trained more frequently and one-on-one trainings were tailored based staff's level of skills and competency. The MUHAS library digitisation is currently being integrated into the library's normal operation through the ICT section. It is staffed with eight personnel and oversees and manages digitisation activities, including having the technical expertise to solve technical problems with access to the core server portion dedicated to library systems.

Appropriate funding allocation

Start-up and infrastructure costs, as well as project running costs, must be considered into digitisation projects. These projects typically require adequate funding to ensure the smooth implementation of such project activities as material selection, preparation and conservation of original source materials, metadata creation, digital capture, the purchase of hardware, software and peripheral equipment; image and metadata quality control, technical infrastructure maintenance, which includes hardware maintenance and network costs and ongoing maintenance of images. Having sufficient funding allocated to the digitisation project ensures the availability of necessary infrastructure, equipment, facilities and staffing for the smooth and effective execution of project activities. For example, at MUHAS, the digitisation project was integrated into the library/ICT sub-program of the SIDA Swedish project with MUHAS, which funded a large percentage of the project. Nevertheless, the problem was its sustainability after the project's support ended in 2015.

Quality Control

To ensure the integrity and consistency of the image files, quality control is an important component in each stage of a digital imaging project. The conditions for digital image quality necessitate the identification of the desired end result and production goals. Scanning requirements differ depending on the source media. Information professionals should define acceptable levels of digital image quality based on the characteristics of the source image and the capability of the digital

imaging system to be used, against which the digitisation process output can be judged.

Quality control decisions include determining the percentage of images to be evaluated, selecting an evaluation methodology, controlling the environment for quality control, including configuring the hardware, evaluating system performance, documenting procedures and creating an inspection form and performing the assessment itself. Evaluation guidelines should be incorporated into the project documentation so that future images meet the same standards and are created in the same manner as the originals.

Conclusions

The MUHAS digitisation project is a huge success, especially in terms of archiving theses and dissertations. It managed to digitise nearly 85 per cent of the institutional collection of theses and dissertations. A small percentage remains for those that could not be digitised due to faults in student-submitted CDs or poor conditions of some hardbound theses and dissertations. Despite the fact that the project faced several challenges in terms of staffing, infrastructure and technical constraints, a good experience of how to mitigate the ideal challenges and issues was obtained. For example, the project is now adequately staffed with skilled personnel. A dedicated server portion has been secured for library systems. Besides and the library ICT section has been granted root access to the server in the event of resolving technical issues. Therefore, this has reduced technical dependence on the university's ICT directorate. Given the fact that it was the first to be established and its IR policy developed and institutionalised, the MUHAS library digitisation project is widely regarded as a model for other libraries' digitisation in Tanzania.

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