AN ANALYSIS OF OPEN ACCESS SCHOLARLY COMMUNICATION IN TANZANIAN PUBLIC UNIVERSITIES

By

FRANKWELL WILSON DULLE

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PROMOTER: PROF MK MINISHI-MAJANJA

CO-PROMOTER: DR LM CLOETE

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DECLARATION

I, the undersigned, hereby declare that the work contained in this PhD thesis entitled "An analysis of open access scholarly communication in Tanzanian public universities" is my own. This thesis contains no material that has been submitted previously, in whole or part, for the award of academic degree or diploma. All the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Signed: Frankwell Wilson Dulle…………………………… Date: ………………….

ABSTRACT

The aim of this study was to investigate factors affecting the adoption of open access in research activities within Tanzanian public universities in order to device mechanisms of enhancing the use of this mode of scholarly communication. The study adopted the UTAUT model to formulate an open access research model comprising of six constructs and five moderators for guidance of this investigation. A triangulation approach for data gathering was adopted. In the first instance, a semi-structured questionnaire was used to collect data from 398 respondents selected using the stratified random sampling from a population of 1088 university researchers from six public universities in Tanzania. The interview involving 63 policy makers and structured records review were also conducted to complement the questionnaire survey. The descriptive and binary logistic regression statistics of the Statistical Package for Social Sciences (SPSS) were used for data analysis.

The study established that majority of the policy makers (90.5%) and researchers (72.1%) were aware of open access. Attitude, awareness, effort expectancy, and performance expectancy were established as the key determinants for researchers' behavioural intention of open access usage while age, awareness, behavioural intention, facilitating conditions and social influence were found to significantly affect researchers' actual usage of open access. It was concluded that researchers' and policy makers' general perceptions about open access were very positive signifying the acceptance of this mode of scholarly communication in the study area. Current poor research conditions and researchers' low Internet self-efficacy such as inadequate information search and online publishing skills were cited as the main hindrances for researchers to use open access in scholarly communication. The study recommends institutionalisation of open access publishing in Tanzanian public universities and other similar research institutions so as to improve the dissemination of research output emanating from such institutions. Six areas for further research to establish more insights regarding the feasibility for open access development in the country are also recommended.

Key Words: *Institutional repositories, open access publishing, public universities, scholarly communication, Tanzania, UTAUT model.*

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LIST OF ABBREVIATIONS

AAU	Association of African Universities
AG	Age
AGORA	Access to Global Research in Agriculture
AJOL	African Journals Online
ALA	American Library Association
ARL	Association of Research Libraries
ARU	Ardhi University
AT	Attitude
AVE	Average Variance Extract
AWR	Awareness
BOAI	Budapest Open Access Initiative
C-TAM-TPB	Combined TAM and TPB
DOAJs	The Directory of Open Access Journals
DOAR	Directory of Open Access Repositories
DTPB	Decomposed Theory of Planned Behaviour
EF	Effort Expectancy

eIFL	Electronic Information for Libraries
ETDs	Electronic Theses and Dissertations
EXP	Experience
FAO	Food and Agriculture Organisation of the United Nations
FC	Facilitating Conditions
GDR	Gender
GNP	Gross National Product
HINARI	Health-Internetwork Access to Research Initiative
IT	Information Technology
ICTs	Information and Communication Technologies
IDT	Innovation Diffusion Theory
INASP	The International Network for the Availability of Scientific Publications
IR	Institutional Repository
ISE	Internet Self-efficacy
KMO	The Kaiser-Meyer-Olkin
LAN	Local Area Network
LR	Logistic Regression

MANOVA	Multivariate Analysis of Mannova
MAR	Missing At Random
MCAR	Missing Completely At Random
MHP	Metadata Harvesting Protocol
MM	Motivational Model
MPCU	Model of PC Utilisation
MUHAS	Muhimbili University of Health and Allied Sciences
NEPAD	New Partnership for Africa's Development
NMAR	Not Missing At Random
OA	Open Access
OAA	Open Access Archives
OAI	Open Access Initiative
OAI-MHP	Open Archives Metadata Harvesting Protocol
OAJs	Open Access Journals
OARs	Open Access Repositories
OARE	Online Access to Research in Environment
OUT	The Open University of Tanzania
PE	Performance Expectancy

PERI	Programme for the Enhancement of Research Information
PLoS	The Public Library of Science
ROAR	Registry of Open Access Repositories
SARUA	The Southern African Universities Association
SCT	Social Cognitive Theory
SE	Standard Error
SEM	Structural Equation Modelling
SMEs	Small Manufacturing Enterprises
SI	Social Influence
SPSS	The Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
SUZA	The State University of Zanzibar
TAM	Technology Acceptance Model
TCU	Tanzania Commission for Universities
TPB	Theory of Planned Behaviour
TPU	Tanzanian Public Universities
TRA	Theory of Reasoned Action

UDOM	The University of Dodoma
UDSM	The University of Dar es Salaam
UK	The United Kingdom
UNEP	United Nations Environmental Programme
USA	The United States of America
UTAUT	The Unified Theory of Acceptance and Use of Technology Model
WHO	The World Health Organisation of the United Nations
WWW	The World Wide Web

CHAPTER ONE

BACKGROUND TO THE STUDY

1.0 Introduction

This thesis reports on the analysis of open access scholarly communication in Tanzanian public universities (TPU). The study focuses on the assessment of the adoption of open access in terms of access and dissemination of scholarly information in research activities. The current Chapter introduces the research topic by first explaining the broader concept of scholarly communication and its role in the research process. The Chapter also highlights scholarly communication problems inherent to developing countries and then proceeds with the explanation of the concept of open access and its potential in improving scholarly communication in such countries. Next the research problem is formulated based on the background information and this is followed by the aim and specific objectives of the study. Research questions addressed by the study are derived from the specific objectives. The scope and delimitations as well as the significance of the study are discussed after the research questions. Thereafter, definitions of the key concepts that are used throughout the study are presented. This is followed by the outline of the research process adopted by the study and finally, the structure of the thesis which is presented at the end of the Chapter.

1.1 Scholarly communication

Scholarly communication is a broader term reflecting various processes through which scholars exchange information with each other in the course of knowledge creation. Thorin (2003) divided scholarly communication into three main distinct aspects:

➢ the process of conducting research, developing ideas, and communicating these ideas informally with other scholars and scientists;

➢ the process of preparing, shaping, and communicating to a group of colleagues what will become formal research results and;

➢ the published formal product that is distributed to libraries and other places in print form or electronically.

Likewise, the American Library Association (ALA, 2003) defines scholarly communication as the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community and preserved for future use. According to Correia and Teixeria (2005), the functions of scholarly communication include author evaluation, author recognition, knowledge validation and quality control, historical record, and archiving of scholarly content. From the above definitions and functions of scholarly communication, it is evident that for a complete cycle of scholarly communication there are four core processes: the creation of scholarly content, validation, documentation, and dissemination. Scholarly communication is achieved either through informal channels and means such as personal contacts through lectures, conferences, seminars or by means of publishing scholarly work in recognised channels such as refereed journals, books or other publications [such as conference proceedings, theses and dissertations] (Rao, 2001; ALA, 2003).

The system of scholarly communication has evolved over time since it came into existence. The current system of scholarly communication is said to have originated as an exchange of letters and lectures among scattered peers until 1665 when the first print journal known as Philosophical Transactions was launched by the Royal Society of London (Thorin, 2003; Swan, 2007). Economic and technological changes are cited as the major reasons contributing to the notable evolution of the current scholarly communication system (Thorin, 2003; Moller, 2006; Swan, 2007). From the onset of the first journal, scholarly publishing was dominated by scholarly societies until after World War II when commercial publishers joined the industry as a result of scholarly societies' failure to cope with the rapid increase of research output emanating from universities (Yiotis, 2005). Unlike the scholarly societies which had no or little interest in making profits through journal sales, the commercial publishers utilised their control of the scholarly publishing industry to raise the journal prices until they were beyond the ability of the libraries and other institutions serving the scholarly community (Thorin, 2003; Yiotis, 2005; Moller, 2006). Due to the rapid increase of scholarly output and the inflated journal prices it has become practically difficult even for libraries in rich countries to subscribe to every journal that is required by their clients.

Information and communication technologies (ICTs) developments have also contributed to the evolution of scholarly communication by affecting the documentation format of scholarly content and its dissemination. ICTs have dramatically changed research practices in terms of scholarly communication by enhancing: communication among scientists, access to information of all kinds, and by provision of a greater variety of publication and dissemination platforms (Moller, 2006). According to Willinsky (2003), seventy five (75%) percent of journals are currently available online and among them more than 1000 peer-reviewed journals are said to be available in digital format only. Publishers have used ICT developments to change the accessibility legal framework for electronic journals from copyright law for print format to contract law for digital format publications (ALA, 2003; Swan, 2007). Under the contract law, publishers sign contracts with individual libraries or consortia for accessibility to bundles of journals at an agreed cost for several years. In such an arrangement, even those journals that are not needed by a specific research community are paid for. In the real sense, this kind of arrangement has not solved scholarly content availability to the research community. This is due to the fact that "more burden has been added to libraries as a result of the publishers negotiating three or five year deals, tying libraries into long-term commitments in cash" (Swan and Brown, 2004: 5). Under these circumstances, libraries from resource poor countries may not be able to enter into these contracts. As a response to the frustrating journal prices and the enabling information and communication technologies, the scholarly community is coming up with alternative scholarly publishing systems aiming at wider distribution of scholarly content without price or other copyright restrictions to end users (Bjork, 2004; Correia and Teixeria, 2005; Yiotis, 2005; Moller, 2006). The evolution of scholarly communication is detailed further in Chapter Two.

1.1.1 Role of scholarly communication in the research process

The advancement of research through which information and new knowledge is generated depends on the existing body of knowledge which can be said to be the work of a multitude of researchers interacting with each other through the process of scholarly communication (Sooryamoorthy and Shrum, 2005). During the research process, researchers use information as an input and generate further information in the form of new ideas (innovations) as an output (Kaaya, 1999). The existing pool of the generated information during past research fuels the present research and ensures

that one's work is not duplicated. According to the Alliance for Taxpayer Access (2007), the more widely scientific results are disseminated, the more readily they can be understood, applied, and built upon for further scientific insights and breakthroughs. The process of scholarly communication is thus essential for the progress of scientific research. This implies that doing research without disseminating the findings is a waste of the limited research resources. It is therefore not surprising that most research funding agencies demand the evidence of dissemination of research findings from their grants' awardees to account for the funds spent in undertaking research. Similarly, employers such as universities use scholarly output of their academics as the main criteria in considering such staff for promotion (Xia, 2006; Christian, 2008). This view is also shared by Correia and Teixeria (2005) who point out that the award in terms of research contracts, tenure and promotions is among the motivations for scholars to publish. The fact that research output generation is also used as an indicator of the performance of individual nations and their institutions further demonstrate the importance of dissemination of scholarly output (Abrahams, Burke and Mouton, 2009; Moahi, 2009).

Ideally, scholarly communication system should disseminate research results so that any scientist could easily access them without barriers of costs (Swan, 2007). Indeed that was the essence of scholarly communication and probably the reason why the scholarly societies were more concerned with making scholarly output available to the research community rather than making profits out of journal sales (Yiotis, 2005; Moller, 2006; Swan, 2007). Therefore, any scholarly communication system delaying information dissemination or imposing access barriers to scholarly work contribute to the slow progress of science (ALA, 2003; Alliance for Taxpayer Access, 2007; Swan, 2007). Limiting access to scientific research results to a small fraction of the worlds' scholarly community with subscription capability and thus leaving the rest of the scholarly community without such access as practiced in the current scholarly communication system is detrimental to the progress of knowledge. This is due to the fact that those without access to scholarly content may not effectively conduct research and thus their contribution to the progress of knowledge is likely to be negatively affected. The following section highlights some of the problems experienced by developing countries in terms of scholarly communication.

1.1.2 Scholarly communication problems in developing countries

Scholars in both developed and developing countries have a role to play in the scholarly communication process for the advancement of knowledge. According to Chan (2004), scholarly communication can only be considered complete when two sides of the world – developed and developing countries participate in that process. The process of scholarly communication is however more constrained in developing countries than it is in the developed countries (Moller, 2006; Yiotis, 2006; Christian, 2008; Nwagwu and Ahmed, 2009; Tise, 2010). In Tanzania for example, studies by Dulle *et al* (2001) and Chailla (2001) reveal that researchers (those from Sokoine University Agriculture inclusive) faced problems in accessing scientific literature. According to Dulle *et al* (2001), 86.1% of 230 researchers were reported to have been facing a variety of problems in accessing scientific literature such as unavailability of current literature.

As far as research output visibility is concerned, scholars from developing countries have also been reported to contribute insignificantly to the global scholarly literature. According to Chan and Costa (2005: 142), "new knowledge is largely created in developed countries". The authors cite an example given by King (2004), indicating that researchers from eight countries (the USA, the UK, Germany and Japan as leading among the eight countries) produced 85 per cent of the world's most cited publications, while another 163 countries, mostly from developing countries, accounted for less than 2.5 per cent. Chisenga (1999) also cites a survey of the United Nations Economic Commission for Africa showing that Africa generates only 0.4 per cent of global content and that if South Africa's contribution is excluded the figure becomes merely 0.02 per cent. Supporting the above statistics, Nwagwu and Ahmed (2009) also reported that Africa South of Sahara contributed only 0.7% of the global research output. Statistics based on the Thomson Reuters Web of Science further reveal that the research output in Africa has not improved as desired (Adams, King and Hook, 2010). According to Adams, King and Hook (2010), from 1999 to 2008, the whole of African continent generated 27, 000 papers per year as compared to a similar output from a single country like The Netherlands in Europe.

The most commonly reported problems affecting scholarly communication in developing countries have been outlined and discussed in several studies (Kapange,

1999; Muthayan, 2003; Durrant, 2004; Lor and Britz, 2004; Moller, 2006; Harle, 2009; Mutula, 2009). Based on the cited studies, the following are the highly reported scholarly communication problems facing the developing world countries:

i.   Low funding for research and higher education;
ii. Low staff morale due to low salaries and unrewarding research system;
iii. Brain drain;
iv. Overburdening of researchers with teaching and administrative loads;
v.   Low exploitation of information and communication technologies (ICTs);
vi. The serial crisis and;
vii. Perceived bias against the existing mode of publishing.

The second, third, fourth and fifth factors mainly contribute to the low scholarly output, the remaining factors either limit researchers' access to scholarly work and/or dissemination of their research output. Low funding for research and higher education in most developing countries is a result of structural adjustment policies of 1980s and 1990s which led to a shift from higher to basic education (Mutula, 2009). According to Ntiamoah-Baidu (2008), low funding for research and higher education has a multiplier effect on the other factors affecting the scholarly communication process as listed above. For example, as a result of low research funding in most African countries, few research projects are done resulting into less research output as compared to developed countries. Similarly, low government investment in research and higher education in the developing countries results into low morale of staff to undertake research. The same reason also encourages brain drain (migration of researchers from developing to developed countries) which further reduces research capacity in developing countries. Low funding of higher education has also an implication on postgraduate training which could also boost research output in developing countries. In Tanzania for example, apart from supporting undergraduate studies, the government does not provide loans for postgraduate students which results into limited output from postgraduate research. Countries with high enrolments of postgraduate students and especially those that mandate scientific article publication for such students to qualify for graduation are likely to increase the publication output than those which solely depend on faculty research output. Less investment in postgraduate training by most African countries also implies a reduction

in number of qualified researchers who could contribute in raising the research output in the continent (Ntiamoah-Baidu, 2008).

The focus of this study, which is on the dissemination and accessibility of scholarly information, necessitates further elaboration on the last three factors. The following subsections highlights on problems that directly affect access and dissemination of scholarly content in developing countries.

1.1.2.1 Low exploitation of ICTs

Although the situation is improving in certain developing countries, it is generally accepted that ICTs development in most third world countries including those from Africa is at its infancy as compared to the developed world (Gerhan and Mutula, 2007; Harle, 2009). Low exploitation of ICTs due to its underdeveloped infrastructure accompanied by inadequate knowledge for its exploitation in facilitating information access and dissemination by scholars in developing countries contribute to scholarly communication problems experienced in such countries (Muthayan, 2003; Lwoga *et al*, 2006; Papin-Ramchan and Dawe, 2006; Christian, 2008; Tise, 2010). Therefore, scholarly communication benefits accrued from the digital environment by researchers from the developed countries exceed by far what scholars from developing countries realise. Problems of power supply and slow Internet connectivity due unaffordable bandwidth in many African universities significantly contribute to inaccessibility to global information resources by many scholars from the developed world as well as the dissemination of scholarly content (Kiondo, 2004; Harle, 2009; Eke, 2010). This means that few scholars can use ICTs to access scholarly work made available on the web by other scholars. At the same time they may not make their work available to be accessed online by their peers. On the other hand, lack of skills for effective usage of ICTs where it exists also limits access and dissemination of scholarly work in developing countries. A study by Muthayan (2003) for example, reveals that researchers and librarians believed that the existing facilities and resources were not being used optimally because many academicians and postgraduate students had inadequate information technology skills. Kiondo (2004) also established that lack of skills mitigated effective usage of information resources at the University of Dar es Salaam.

1.1.2.2 Journal prices and information explosion

The rising of journal prices and the growing volume of literature make it difficult for developing countries to subscribe to adequate information resources and hence scholars from these countries experience limited access to scholarly information (Moller, 2006; Frandsen, 2009; Harle, 2009; Nwagwu and Ahmed, 2009). Chan and Costa (2005:142) cite Aronson who reported on a survey conducted by the World Health Organisation (WHO) indicating that "of the 75 countries with a Gross National Product (GNP) per capita per year less than US$1,000, 56 percent of their institutions have had no subscriptions to journals over the last five years; of countries with a GNP between US$1-3,000, 34 percent of their institutions had no subscriptions and a further 34 per cent had an average of two subscriptions per year" (Aronson, 2004). From that observation, developing countries' researchers' accessibility to information is limited since their institutions are not able to sustain subscription to journals. According to ALA (2003) and Joint (2009), there is a general tendency for scholarly journal prices to rise at rates well above general inflation rates in the economy and also above the rate of the increase of library budgets. It is thus not surprising for most developing countries' libraries to fail to maintain journal subscriptions due to the poor economies of such countries.

1.1.2.3 Perceived publishers' bias on scholarly output from developing countries

The present mode of scholarly publishing is said to marginalise scholarly contributions from developing countries (Durrant, 2004; Lor and Britz, 2004). It is claimed that research output from developing countries is not accepted for publication by publishers in the developed countries as they consider such scholarly work as not complying with quality standards they set (Lor and Britz, 2004). According to Kawooya (2006:4), "the biases by developed countries' publishers highly contribute to African research content being unavailable and invisible in Western electronic databases". As a result of the existing publishing system, most African researchers as well as those from other developing countries do not get round to publishing their research findings, and that if they do it is often in grey literature or in their countries or in their regional (e.g. Pan-African) journals. Thus, their contributions are not adequately visible in the developed countries and even in the developing countries due to low circulation of such publications (Durrant, 2004; Lor and Britz, 2004).

While the truth of these observations remain debatable due to the fact that some scholars from the developing countries are prolific authors in western publications, it is also possible that those authors whose papers are rejected simply do not meet the required standards. Most important, is for developing countries to devise mechanisms of establishing adequate and up to standard publishing outlets that are accessible worldwide so that even authors from the developed world are attracted to publish in such outlets.

The above observations imply that knowledge created in developing countries if well captured may increase the visibility of scholarly literature from such countries beyond what is currently recorded. Chisenga (1999) and Okemwa (2004) for example, acknowledge the existence of knowledge creation in Africa and observe that its low visibility to the world largely lies much on documentation related problems. The documentation of research output in the Eastern, Central and Southern Africa region including Tanzania also reveal some deficiencies likely to contribute to the low level of visibility of scholarly information in the global information infrastructure (Matovelo and Chailla, 1999; Mook, Munyua and Nampala, 2005; Tanzania Agricultural Research Project (TARP II) Report, 2005). The above sources indicate that the greater proportion of researchers' output is documented as grey literature. The major problem associated with grey literature is the limited dissemination of its content to the wider audience especially when documented and archived in print format (Chailla, 2001; Chisenga, 2006).

In recognition of the importance of scholarly literature and problems faced by scholars in developing countries, efforts have been initiated to improve scholarly communication in such countries. Initiatives such as the Programme for the Enhancement of Research Information (PERI) of International Network for the Availability of Scientific Publications (INASP); Health Inter-Network Access to Research Initiative (HINARI) of the World Health Organisation; Access to Global Online Research in Agriculture (AGORA) of the Food and Agriculture Organisation (FAO) of the United Nations; the Electronic Information for Libraries (eIFL); the Ptolemy Project from the University of Ontario; and the Online Access to Research in the Environment (OARE) scheme of the United Nations Environmental Programme (UNEP) were initiated mainly to enhance the flow of information from developed

countries to developing countries (Durrant, 2004; Kirsop and Chan, 2005; Chege, 2006; Moller, 2006; Harle, 2009).

Although the above noted initiatives have been useful to recipient countries in the short term, they have been questioned on their sustainability in the long term. This is due to the fact that in most cases once donor funding ends most of such programmes also collapse. In addition, most of the programmes in question have not addressed the problem of low visibility of scholarly output emanating from the developing countries but sustain the information flow from developed countries to developing countries despite the truth that accessibility to research output from the latter is equally important. It is only a few programmes such as the Bioline International and INASP that have also addressed the visibility of scholarly information from the developing countries. According to Chan (2004), research knowledge from developing countries is critical, because true global understanding of science, particularly in the areas of biodiversity, emerging diseases, and sustainable environment would be incomplete without a knowledge flow from developing to developed countries and vice versa. The emergence of open access (OA), a new form of scholarly communication based on the Internet technologies, provides the potential for developing countries to revolutionise the manner in which scholars throughout the world can access and disseminate scholarly information.

1.2 Open access scholarly communication

Open access means making scholarly content available online to any interested party without copyright or price restrictions. The following two definitions provide a comprehensive explanation of open access. The Berlin Declaration of Open Access (2003) defines open access as a new mode of scholarly communication through which "the author(s) and right holder(s) of such contribution grant(s) to all users a free, irrevocable, worldwide right of access to, and a license to copy, use, distribute, transmit, and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship". According to this definition, a complete version of the work including a copy of the permission to use the scholarly content in question should be deposited in at least one online repository using suitable technical standards to enable open access, inter operability, and long-term preservation of such materials.

According to the BioMed Central Open Access Charter (N.d.), open access is also defined as the process of scholarly communication through which articles are made universally and freely accessible via the Internet, in an easily readable format and deposited immediately upon publication in at least one widely and internationally recognised open access repository. With regard to copyright aspects, this definition also requires copyright owners to grant users of their works, a permission to use such content without any limitation so long as proper attribution of authorship and correct citation is provided.

The two definitions are very similar and both emphasise on the removal of any copyright or price restriction on scholarly information so that knowledge is disseminated as widely as possible. Attribution to the author of scholarly content and proper citation of the used works are the two main conditions to be fulfilled by users of open access articles as emphasised in both definitions. Contrary to the current system of scholarly publishing which restricts dissemination of scholarly content to subscribers only, the key focus of open access is the wider and unrestricted dissemination of scholarly content.

Open access aims at liberating scholarly communication by using the full potential of ICTs in dissemination of scholarly content. As a result, a strong movement involving researchers and sponsors of research has emerged seeking for the unrestricted access to information for all scientists, students and the interested public through open access (Bjork, 2004; Correia and Teixeria, 2005). This mode of scholarly communication is considered to be a more responsible way of distributing knowledge and is reported to offer evidence of a more efficient, economical and with a potential of reducing problems of access to and distribution of scholarly content (Bjork, 2004; Yiotis, 2005; Moller, 2006). According to Yiotis (2005) open access is an acceptable worldwide means for an equitable dissemination of information resources by removing scholarly access restrictions in the form of copyright protection or fee-based dissemination policies. This form of scholarly communication is achieved through two main channels: Open Access Journals (OAJ) for electronic refereed journals and self-archiving (Chan and Costa, 2005; Harnad, 2005a; Bailey, 2006). The following subsections elaborate on the two main channels of open access publications.

1.2.1 Open access journals

Open access journals also referred to as "Gold Road" to open access, are peer-reviewed journals made available free of charge to the public through the Internet (Harnad, 2005a). Unlike the business publishing model, in open access publishing the end user is not charged to access journal articles. Instead, various funding strategies such as direct author fees, institutional membership to sponsor all or part of author fees, funding agency payment of author fees, grants to open access publishers and institutional subsidies are used to cover the costs for publication and distribution of OA content for free access by the end user. Some of the open access journal avenues for direct access include: the Directory of Open Access Journals (DOAJs); the Directory of Free Full Text; Free Medical Journals Directory; the High Wire Press; and the Open J-Gate (Hirwade and Rajyalakshmi, 2006). It is also possible to access open access journal articles indirectly by using search engines such Google or Google scholar.

1.2.2 Self-archiving

Self-archiving also referred to as "Green Road" to open access is making articles freely available in digital form on the Internet by authors (Budapest Open Access Initiative, 2002; Harnad, 2005a). There are three most common ways of self-archiving on the Internet: authors' personal websites, disciplinary (research-specific), and institutional repositories of individual universities/institutions (Bjork, 2004; Bailey, 2006). The Registry of Open Access Repositories (ROAR) and the Directory of Open Access Repositories (DOAR) provide the list of open access compliant archives from disciplinary and institutional archives worldwide. As is the case with open access journals, articles from ROAR or DOAR may be accessed through direct search of respective repositories/directories or indirectly using search engines.

1.2.2.1 Author's personal websites

These are as simple as a few linked web pages with associated e-print files in HTML, PDF, Word processing or other formats. According to Bailey (2006), such websites are often indexed in major search engines such that a searcher with specific information about the desired e-print can get the required information. However, the stability of e-prints from personal websites is variable and its permanence is not assured since responsible authors may decide to withdraw or change their content as they desire (Correia and Teixeria, 2002).

1.2.2.2 Disciplinary repositories

These include e-prints from one or multiple scholarly disciplines and are usually hosted at a central server. Some of the existing disciplinary archives are: ArXiv – the oldest disciplinary archive which covers physics, mathematics, non-linear-science, computer science and quantitative biology; E-LIS for library and information science disciplines; DLIST for library, information science and technology disciplines; and Repec covering the economics disciplines (Hirwade and Rajyalakshmi, 2006). The disciplinary archives are formally affiliated with institutions or professional organisations and their stability and permanence is more assured than authors' personal websites (Correia and Teixeria, 2002; Bailey, 2006).

1.2.2.3 Institutional repositories

Institutional repositories include e-prints or other types of digital works by authors in a single academic department or school or the whole institution. The digital works in institutional archives may comprise electronic theses and dissertations (ETDs), e-prints, learning objects, presentations and technical reports by authors of respective institutions (Bailey, 2006). As for disciplinary archives, the institutional archives stability and permanence is assured due to the fact that they are managed and hosted by respective institutions.

1.2.3 Open access development trend

Even though open access adoption in different countries does not merit its potentials, globally there have been some positive developments on this mode of scholarly communication over the years. The success of the new method of scientific communication and its acceptance among researchers and academics can be appreciated from the following data as Correia and Teixeria (2002:7) cite Odlyzko and Harnad):

> ➢ *In the beginning of 1999, arXiv.org contained 100,000 articles and the number of articles downloaded yearly exceeded 7 million, indicating that each article is downloaded at least 70 times, on average (Odlyzko, 2002)*
> ➢ *Two years later (2001), the number of articles made available by arXiv.org was some 150,000 and is growing at about 30,000 papers per year (Harnad, 2001).*

According to Moller (2006), the Directory of Open Access Journals held 1888 journals, while the Open Access Initiative (OAI) compliant repositories listed at the OAI registry stood at 644. The cited study further reveals that there were 336,838 articles in physics, mathematics and computer science hosted at ArXiv (Moller, 2006). In comparison to the above data, by January 2007, the situation was as follows: The Directory of Open Access Journals had 2526 journals and the Directory of Open Access Repositories (DOAR) listed 836 OAI compliant repositories. At the same period, there were 401,931 e-prints hosted at ArXiv repository. A further analysis reveals that at the end of June 2007 open access journals as listed by DOAJs had increased to 2727 while repositories at DOAR increased to 909. According to Swan and Brown (2004), the number of full text articles in the repositories that were harvested by OAIster was over 1.5 million and the number had increased by 23% in five months at the time of writing their paper. It is noted further that "up to April 2009 OpenDOAR lists 1,375 repositories and ROAR 1,312 while OAIster harvests 1,103 repositories and provides access to 20,678,710 records" (Cassella and Calvi, 2010: 8).

Although open access content still represents just a small fraction of an estimated 2.5 million articles published annually (Brody, 2006; Odlyzko, 2006; Gargouri *et al*, 2010), such a development may not be ignored taking into account that open access is a new mode that is emerging from a well established scholarly communication system. It is also worth noting that a transition from the existing system of scholarly

communication is not a smooth process. On the one hand, commercial publishers would like to ensure that the existing scholarly communication system continues for their survival, while on the other hand the scholarly community would wish to get liberated from being exploited by the former. There is an ongoing debate on whether open access will succeed or not but it is increasingly argued that the liberation of scholarly communication for the progress of science largely rests on authors, librarians, employers and research funding agencies as they are the main fundamental change agencies since at best publishers would defend the existing system to continue (Johnson, 2002; Swan, 2007; Voss, 2007). On their part, authors have the power to decide to publish in open access journals or post their pre- and post-print articles in open access repositories, while employers and funding agents may influence authors to make their scholarly content openly accessible by putting in place favourable policies for open access development. Librarians on the other hand, could play a leading role in advocating open access to ensure it is well known by the authors, employers and research funding agencies.

1.2.4 Open access and its potential to developing countries

Open access avails more opportunities than the traditional scholarly communication system for developing countries to improve accessibility to and dissemination of scholarly content in both developed and developing countries (Chan and Costa, 2005; Yiotis, 2005). Through open access, the visibility of and accessibility to research articles published in open access journals or open access repositories from both developing and developed countries can be made easy and without restrictions. Removal of information access restrictions through open access implies that developing countries scholars' problems of access to scholarly work may greatly be eased. This will be particularly the case for scholars with access to the Internet. Similarly, much of the research output documented as grey literature in developing countries will stand a better chance of visibility and accessibility through open access. According to Ware (2004), open access reforms scholarly communication by enabling institutions to enhance their prestige through making visible the fruits of their faculty's academic and research output. Correia and Teixeria (2002) support the above view by pointing out that developing countries are availed with more opportunities to disseminate their research findings through open access than the existing business model of scholarly publishing. Through open access, a wide range

of materials such as (e-prints-pre-prints and post-prints - journal articles), manuscripts (working papers, technical reports, e-scripts), conference proceedings, electronic theses and dissertations (ETDs), all of which remain invisible [in developing countries] in the conventional publishing system may be made available for free access through the Internet (Correia and Teixeria, 2002).

According to Chan and Costa (2005:151-2) the benefits of open access particularly open access repositories to developing countries will include: improved access to institutional research output; improved citation and research impact; and cost effectiveness in information dissemination on the part of the institutions. The increased research impact of open access articles due to citations has also been acknowledged by many scholars (Harnad, 2003; Antelman, 2004; Brody, 2006; Houghton and Sheehan, 2006). In the current system of scholarly communication, developing countries may be considered to have low research impact due to limited visibility of research output from such countries. Despite the promising potential of open access to improve scholarly communication in developing countries, the new form of scholarly communication is little exploited in such countries when compared to developed countries (Durrant, 2004; Lwoga and Chilimo, 2006; Moller, 2006; Papin-Ramchan and Dawe, 2006).

1.3 Public universities in Tanzania

Universities are regarded as key institutions in the process of social change and development through their roles in the production of highly skilled labour and research output [innovations] to meet the perceived economic needs. According to the Tanzania Commission for Universities (TCU, 2005), the academic and research activities at universities provide a critical support of national development through training of competent and responsible professionals. TCU also considers the institutions in question to often constitute the backbone of a country's information infrastructure, in their role as repositories and conduits of information through libraries, computer networks and Internet service providers.

During the inception of this study, there were eight fully fledged public universities in Tanzania namely, the University of Dare es Salaam (UDSM), Sokoine University of Agriculture (SUA), Open University of Tanzania (OUT), Mzumbe University (MU),

Muhimbili University of Health and Allied Sciences (MUHAS), Ardhi University (ARU), the State University of Zanzibar (SUZA), and University of Dodoma (UDOM) (TCU, 2007). The eight public universities were established at different times as described briefly in the following subsections.

1.3.1 University of Dar es Salaam

Located in Dar es Salaam city, UDSM is the oldest public university and came into existence in 1970 after the University of East Africa was split into three independent universities for Kenya, Uganda and Tanzania (UDSM, 2007). The university offers more than 60 degree programmes (including postgraduate training at various levels) in different fields. Remarkable ICTs development at the university started in the mid 1990s (Casmir, 2006). The University of Dar es Salaam is regarded as the pioneer of ICTs investment among the public universities with a unique computing centre. The University is connected to the Internet at http://www.udsm.ac.tz.

1.3.2 Sokoine University of Agriculture

SUA was established in 1984 and is located in Morogoro municipality about 200 kilometres West of Dar es Salaam (SUA, 2008). Before its establishment, SUA was a Faculty of Agriculture of the University of Dar es Salaam. The university currently offers 33 degree programmes including postgraduate training at various levels in different agricultural related disciplines. ICTs developments at the university also picked up during 90s. According to the university's ICTs policy (2002), the university was connected to the Internet in 1998. The university website is http://www.suanet.ac.tz.

1.3.3 Open University of Tanzania

Situated in Dar es Salaam city, OUT was established in 1993 and is the only university in the country that provides distance learning. The university offers 33 degree programmes (postgraduate inclusive) in different fields (OUT: 2007). OUT is connected to the Internet at http://www.openuniversity.ac.tz.

1.3.4 Mzumbe University

Located about 25 Kilometres from Morogoro municipality, MU was established in 2001 as a product of transformation of the Institute of Development Management, a

management training institute (MTI) created by the government in 1972 (MU, 2007 & 2009). The university offers 26 degree programmes including postgraduate training at various levels in different management related fields. As is the case with other public universities in Tanzania, the ICTs services at the University were started in the 1990s. This university is also connected to the Internet at http://www.mzumbe.ac.tz.

1.3.5 Muhimbili University of Health and Allied Sciences

MUHAS is located in Dar es Salaam city. Prior to its elevation to a university in 2007, MUHAS was the University College of Health Sciences of the University of Dar es Salaam since 1991 (MUHAS, 2007). Before 1991, it was a Faculty of Medicine of the University of Dar es Salaam since 1963. The new university offers 48 degree programmes including postgraduate training in health and allied sciences at various levels. The university is connected to the Internet at http://www.muhas.ac.tz.

1.3.6 Ardhi University

ARU is a new university located adjacent to the University of Dar es Salaam. The university was established in March 2007 from the transformation of the then University College of Lands and Architectural Studies which was a constituent college of the University of Dar es Salaam since 1996. Before 1996 it existed as a higher learning institution known as Ardhi Institute since 1974. The University offers 26 academic programmes including postgraduate training in land and architectural disciplines at various levels (ARU, 2007). Ardhi University is also connected to the Internet at http://www.aru.ac.tz

1.3.7 State University of Zanzibar

SUZA is the only public university located in the Zanzibar Islands and was inaugurated in May 2002 (SUZA, 2009). This is among the smallest public universities in Tanzania. It offers only three undergraduate degree programmes. The university is connected to the Internet at http://www.suza.ac.tz.

1.3.8 University of Dodoma

 UDOM is located in Dodoma municipality, the central part of Tanzania. It was established in 2007 and is envisaged to be the largest public university with an estimated 40,000 students upon its completion (Lipili, 2007; UDOM, 2007). The

University started with an enrolment of 1200 undergraduate students in September 2007.

Unlike the other two universities (ARU and MUHAS) established in 2007 which have been operating as higher learning institutions before being elevated into full fledged universities, UDOM was just a few years old as an institution during the inception of this study. It was thus not surprising to note that this was the only public university in Tanzania with no Internet connectivity during the inception of this study. However, by September 2009, UDOM had Internet connection with a well organised website accessible at http://www.udom.ac.tz (UDOM, 2009).

Noted from the above description is that except for the State University of Zanzibar and University of Dodoma, the remaining public universities have been in existence as higher learning institutions for more than ten years. Differences in the establishment dates of these universities imply differences in the prevailing research infrastructural developments at the respective universities. For example, the University of Dar es Salaam being the oldest has one of the most advanced ICTs and library infrastructures among all the universities in Tanzania. An analysis from the respective university websites during the start of this study revealed that apart from the University of Dodoma, most other universities had basic ICTs infrastructure in place. As for Zanzibar State University, it was noted that despite having its own website, most of the web pages for the university were still under construction. This was an indication that ICTs infrastructure development at Zanzibar State University was probably at its infancy. As is the case with UDOM, the State University of Zanzibar had most of its web pages developed and functional by September 2009.

Having Internet connectivity at most of the public universities in the country suggests that researchers from such institutions could benefit from open access initiatives by either accessing or disseminating scholarly information.

1.4 Problem statement

Like in many other developing countries, accessing and disseminating scholarly content is a major problem in Tanzanian public universities. In the first instance, researchers are unable to gain access to recent subscription based scholarly content due to limited university funding and libraries in particular (Dulle *et al*, 2001; Chailla, 2001). Apart from benefiting from several externally financed electronic information resources which are also deemed inadequate and unsustainable, most university libraries in Tanzania do not subscribe to journals from commercial publishers due to financial constraints (Lwoga *et al*, 2007). There is also low visibility of research output emanating from Tanzania and public universities in particular, as a result of most of the research results being documented as grey literature or in local journals with low circulation. For example, between 1999 and 2008, Tanzania research output included in the Thomson Reuters National Science Indicators database was merely 3,000 papers as compared to 47,000 and 6,500 papers for South Africa and Kenya respectively during same period (Adams, King and Hook, 2010).

Despite the potential for open access to resolve the above problems, this mode of scholarly communication is not yet fully exploited in Tanzania (Lwoga and Chilimo, 2006; Lwoga *et al*, 2006; the Southern African Regional Universities Association (SARUA, 2008). It should be noted for example, at the beginning of the current study in 2006, Tanzania had no any open access repository or open access journal registered in the Directory of Open Access Repositories (DOAR) and/or the Directory of Open Access Journals (DOAJs). By the end of May 2010, Tanzania had only 2 open access journals (both biomedical journals) and none of open access repositories. This compares to 41 open access journals and 40 open access repositories that were registered in DOAJs and DOAR respectively for the whole of African continent.

From the onset of this study and by end of July 2010, the review of literature also suggested that there were very few studies conducted in Tanzania that addressed the aspect of open access scholarly communication in detail. This aspect has not been adequately addressed in the country apart from studies by Lwoga *et al* (2006) and (SARUA, 2008). The study by Lwoga *et al* (2006) examined the potential of open access in sharing knowledge in agricultural research institutions. The SARUA study, involving eight universities [including the University of Dar es Salaam] in the Eastern

and Southern African universities, was an exploratory investigation on the awareness and acceptability of open access. To the knowledge of the researcher, by the time of writing this thesis, there was no specific, detailed study addressing the adoption of open access scholarly communication in Tanzanian public universities. Therefore, there was a need to conduct specific country study in order to understand possible factors for the slow adoption of open access in Tanzania so as to come up with proper strategies for an effective promotion of open access to enhance its uptake in Tanzanian public universities. This investigation was thus conducted in response to the above observations.

1.5 Aim and objectives of the study

The aim of this study was to investigate factors affecting the adoption of open access in research activities within public universities in Tanzania so as to recommend a model to enhance the use of this mode of scholarly communication.

1.5.1 Specific objectives of the study

The specific objectives of the study were to:

i)   Review developments in scholarly communication and open access adoption at global level.

ii)   Investigate the general awareness and usage of open access with a focus on Africa and Tanzanian public universities in particular.

iii) Find out factors that facilitate the adoption of open access in research activities in Tanzanian public universities.

iv)   Find out researchers' and policy makers' perceptions on open access scholarly communication in Tanzanian public universities.

v)   Determine factors that hinder the adoption of open access in research activities in Tanzanian public universities.

vi)   Suggest strategies to resolve the hindrances to the adoption of open access in research activities in Tanzanian public universities.

vii) Formulate a research model of technology acceptance regarding open access usage in research activities in Tanzanian public universities.

viii)   Validate the research model that best describes open access usage behaviour and behavioural intention by Tanzanian public universities' researchers.

1.5.2 Research questions

In order to address the above objectives, the study sought answers to the following questions:

1.5.2.1 What forces are behind the emergence of open access?

1.5.2.2 To what extent has open access been adopted internationally?

1.5.2.3 To what extent are researchers and policy makers aware of open access and what is the extent of open access adoption in research activities in Tanzanian public universities?

1.5.2.4 How is the open access awareness and usage in Tanzanian public universities rated in comparison to other countries in Africa and elsewhere?

1.5.2.5 What factors facilitate the use of open access outlets by researchers in accessing scholarly literature?

1.5.2.6 What factors facilitate the researchers' use of open access outlets in disseminating research output?

1.5.2.7 What are the researchers' and policy makers' general perceptions on open access publishing?

1.5.2.8 How do the researchers and policy makers perceive the establishment of open access repositories at their institutions for the dissemination of scholarly content?

1.5.2.9 What factors hinder the use of open access scholarly content in research activities?

1.5.2.10 What factors hinder the dissemination of research findings through open access avenues?

1.5.2.11 How can the identified hindrances be resolved for more adoption of open access to improve scholarly communication?

1.5.2.12 What are the important dependent variables expected to influence researchers' open access usage behaviour and behavioural intention?

1.5.2.13 Which moderators are expected to affect the influence of dependent variables towards independent variables?

1.5.2.14 How useful is the research model in terms of its predictiveness and fitness to the collected data?

1.5.2.15 What are the significant variables that influence researchers' open access usage behaviour and behavioural intention?

1.6 Scope and limitations of the study

The study investigated the potential of open access as an alternative approach for effective scholarly communication in public universities in Tanzania. The limitation of this study to Tanzanian public universities rather than incorporating similar universities from other African countries was necessary due to limited financial resources for undertaking this research in more than one country. Public universities were also targeted by this study on the understanding that being publicly funded they are obliged to make their research findings available for free to the public. This is due to the fact that one of the most convincing reasons given by open access proponents is that research output from publicly funded research should be accessible free of charge to the public (Comba and Vignocchi, 2005).

During the inception of this study, there were eight public universities in Tanzania, some of which have several constituents or university colleges. This study was based at the main campuses of the six universities [ARU, MUHAS, MU, OUT, SUA and UDSM] that offer postgraduate training and which have Internet connectivity and at least 10 years of existence as higher learning institutions. The reason for excluding constituent and university colleges was due to time and resource constraints to cover such institutions scattered in different and distant geographical locations in the country.

Since open access is based on Internet technologies, institutions without such a facility may not benefit from open access hence were not suitable for this study. Similarly, it is expected that universities that have existed as higher learning institutions for at least 10 years and run postgraduate programmes have comparatively well established research infrastructure, generate more research output and hence are likely to benefit more from open access initiatives than new institutions. The two

public universities, SUZA and UDOM were excluded in the study for not fulfilling the above criteria. The generalisations of the research findings are therefore only applicable to the universities covered by the study. The study recommendations are however likely to be applicable to other institutions operating under a similar research environment to the study at hand.

It should also be noted that this study did not consider other factors inhibiting research and scholarly communication in general such as whether or not researchers had adequate resources for conducting research. The focus of the study is limited to access and dissemination of scholarly content and thus recommendations made in Chapter Seven (section 7.3) are addressing the constraints of these two aspects for the improvement of open access scholarly communication.

1.7 Significance of the study

The focus of this study was to determine the adoption of open scholarly communication in Tanzanian public universities. The expected outcomes of the study were therefore to:

> ➢ Gather information that could give insight into the adoption of open access in scholarly communication in the respective universities;
> ➢ Collect information that could be used in laying strategies to improve access and exchange of scholarly information in Tanzanian public universities and;
> ➢ Gather information for the development of a suitable model of scholarly communication in Tanzanian public universities and other similar institutions in the country and beyond.

The ultimate intention of the study was to recommend suitable measures for effective exploitation of open access potentials to improve scholarly communication in the universities involved in the study based on the emerging findings. The study findings might thus help universities in the study area to make informed decisions on improving scholarly communication for high quality and more research impact. Likewise, other academic and research institutions in the country, the region and in the developing world at large with similar operational environment but which are not covered by the study may also benefit from the study findings.

There is a divided opinion in the scholarly community regarding suitability of open access against the existing business mode of scholarly publishing. This study also contributes to the ongoing debate by shedding light on attitudes of researchers in the study area towards open access. Furthermore, this study is expected to contribute to knowledge in the field of library and information science regarding open access particularly within Africa where similar studies are scanty.

1.8 Definition of key concepts

The purpose of this section is to provide a brief overview of key concepts used throughout this study. Wherever necessary, detailed explanation of such concepts has been provided in the relevant chapters.

Grey Literature

According to the Encyclopaedia of Information and Library Science (1993:1357), grey literature refers to literature "that has not undergone the formal publishing process [not listed and not priced] and is normally difficult to trace especially if not available online". Within the context of this study, grey literature includes: theses/dissertations, conference proceedings, research reports and any other publications that have not undergone the formal publication process but are of research interest.

Information and Communication Technologies

Simply defined, ICTs is the electronic means of capturing, processing, storing and communicating information (Herselman and Hay, 2003; Potgieter and Herselman, 2004). Within the scope of this study, ICTs means the Internet and the World Wide Web (WWW) used as avenues for information access and dissemination.

Internet and World Wide Web

Internet is considered as the world's largest computer-network that is often described as a network of networks linking local computers to other distant computer networks communicating with each other using a shared set of protocols (Mowery and Simcoe, 2001; Igun, 2005). The WWW is defined as "the universe of global network, an abstract space with which people can interact, chiefly populated by interlinked pages of text, images and animations, with occasional sounds, three dimensional worlds, and

video" (Berners-Lee, 1996). According to (Igun, 2005: 82), the WWW is "the Internet's most popular application and usually the two terms are used interchangeably". In this study the Internet and World Wide Web will also be used interchangeably.

Open Access

Open access is defined as the mode of scholarly communication aiming at wide distribution of scholarly content with neither price nor any other copyright restriction (Chan and Costa, 2005; Yiotis, 2005). Within the context of this study two main avenues of open access are distinguished namely: Open Access Journals (OAJs) and Open Access Archives/or Open Access Repositories (OAAs)/ (OARs).

➢ *Open Access Journals*

In this study, open access journals refers to peer-reviewed journals which make research articles freely available online (adapted from De Beer, 2005).

➢ *Open Access Archives*

Within the context of this study, an open access archive, also referred to as open access repository, is defined as a repository with a wide range of scholarly materials including, e-prints and electronic dissertations and theses (EDTs) that are made available on the Internet free either in the institutional repositories, or subject specific repositories or personal web pages. E-prints may be a pre-print (draft of a paper before it has been published) or a post-print (after it has been published) including materials such as journal articles, chapters from scholarly books or conference papers, or any form of research output (such as e-scripts-working papers and technical reports) made available online (Correia and Teixeria, 2005).

Note: The process of depositing or publishing in open access archives by scholars is referred to as self-archiving.

Open Access Scholarly Communication

In the context of this study, open access scholarly communication means the process through which scholars access and/or disseminate scholarly information through Open Access Journals (OAJs) and/or Open Access Archives (OAAs) as defined above.

Public Universities

Mwamila and Diyamett (2006) define a university as an institution of higher learning, a place where people's minds are trained for clear thinking, for independent thinking, for analysis and for problem solving at higher level. For the purpose of this study, public universities are considered as institutions of higher learning owned by the government and accredited by the TCU. The institutions are charged with training and research. They offer a level of academic education at the undergraduate or postgraduate levels or both.

Researchers

Kothari (2004:1-2) defines research as "the systematic method consisting of enunciating the problem, formulating hypothesis, collecting the facts or data, analysing the facts and reaching certain conclusions either in the form of solution(s) towards the concerned problem or in certain generalisations for some theoretical formulation". Researchers are thus individuals involved in conducting research. Within the context of this study, researchers are comprised of fulltime university affiliated academicians involved in various research undertakings at their respective universities.

Scholars

These are individuals undertaking research as well as being involved in the scholarly communication process as defined in section 1.1. In other words, these are the people considered to have accumulated research knowledge in their areas of speciality and have been involved in dissemination of their research findings using either peer-reviewed publishing outlets such as journals, books, or other formal dissemination means including theses/dissertations and conference proceedings.

1.9 Overview of the research methodology

This research generated both quantitative and qualitative data. Therefore, the study adopted the survey methodology as the main approach in order to collect the desired data. The study targeted 544 respondents selected through stratified random sampling from 1088 fulltime senior researchers of six public universities in Tanzania. Semi-structured questionnaires and interviews as well as document analysis were used to collect the data for the study. Document analysis involved literature review and

structured records review. Semi-structured questionnaire was administered to researchers and interviews to policy makers from the six universities in the study. The collected data were analysed using the Statistical Package for Social Sciences (SPSS - v.15) for descriptive and binary logistical regression analyses respectively. A detailed discussion on the research methodology is provided in Chapter Four. Table 1.1 summarises the data collection tools adopted for each of the specific objectives.

Table 1.1: Research objectives, research questions and possible sources of data

Research objective	Research question	Data collection tools/information sources
Review developments in scholarly communication and open access adoption at global level.	What forces are behind the emergence of open access? To what extent has open access been adopted internationally?	➢ **Literature review**
Investigate the general awareness and usage of open access with a focus on Africa and Tanzanian public universities in particular.	To what extent are researchers and policy makers aware of open access and what is the extent of open access adoption in research activities in Tanzanian public universities? How is the open access awareness and usage in Tanzanian public universities rated in comparison to other countries in Africa and elsewhere?	➢ **Literature review** ➢ **Questionnaire** ➢ **Structured records review**
Find out factors that facilitate the adoption of open access in research activities in Tanzanian public universities.	What factors facilitate the use of open access outlets by researchers in accessing scholarly literature? What factors facilitate the researchers' use of open access outlets in disseminating research output?	➢ **Literature review** ➢ **Questionnaire** ➢ **Interview**
Find out researchers' and policy makers' perceptions on open access scholarly communication in Tanzanian public universities.	What are the researchers' and policy makers' general perceptions on open access publishing? How do the researchers and policy makers perceive the establishment of open access repositories at their institutions for the dissemination of scholarly content?	➢ **Literature review** ➢ **Questionnaire** ➢ **Interview**
Determine factors that hinder the adoption of open access in research activities in Tanzanian public universities.	What factors hinder the use of open access scholarly content? What factors hinder the dissemination of research findings through open access avenues?	➢ **Literature review** ➢ **Questionnaire** ➢ **Interview**
Suggest strategies to resolve the	How can the identified hindrances	➢ **Literature review**

hindrances to the adoption of open access in research activities in Tanzanian public universities.	be resolved for more adoption of open access to improve scholarly communication?	➢ **Questionnaire** ➢ **Interview**
Formulate a research model of technology acceptance regarding open access usage in research activities in Tanzanian public universities.	What are the important dependent variables expected to influence researchers' open access usage behaviour and behavioural intention? Which moderators are expected to affect the influence of dependent variables towards independent variables?	➢ **Literature review**
Validate the research model that best describes open access usage behaviour and behavioural intention by Tanzanian public universities' researchers.	How useful is the research model in terms of its predictiveness and fitness to the collected data? What are the significant variables that influence researchers' open access usage behaviour and behavioural intention?	➢ **Questionnaire** ➢ **Interview** ➢ **Regression analysis**

1.10 Thesis structure

The thesis is comprised of seven chapters as outlined below.

Chapter One: Background to the study

This Chapter provides general introduction to the study. It introduces the concept of scholarly communication and open access before stating the problem of the study. The Chapter also presents the aim and objectives of the study, research questions, the scope and limitations of the study, significance of the study, definition of key concepts, a brief outline of the research design, and the thesis structure.

Chapter Two: Review of scholarly communication focusing on open access

The Chapter presents the review of literature related to open access. The purpose of this review is to position the study within similar works as well as explore the available knowledge in the study discipline.

Chapter Three: Technology acceptance and usage theories/models: their application in open access adoption context

This Chapter formulates a research model comprised of key determinants and moderators based on the review of the existing technology acceptance frameworks. Also discussed in this Chapter are the key determinants postulated to influence behavioural intention and usage of open access by researchers, together with moderators of such determinants.

Chapter Four: Research methodology

This Chapter presents the procedures that were used to carry out this study. It presents the details of the entire research process including sampling procedures, data collection methods and statistical procedures used in data analysis.

Chapter Five: Presentation of research findings

This Chapter presents the study findings from descriptive analysis (objectives 2-6) and inferential statistics (objectives 7-8). Various formats of data presentation such as figures, tables, and narrations are adopted for clear understanding of the research results.

Chapter Six: Interpretation and discussion of research findings

The Chapter interprets and discusses the results emerging from the study. Also explained in the Chapter are the results' implications and possible reasons for the specific findings obtained.

Chapter Seven: Summary, conclusions and recommendations of the study

This is the final Chapter of the thesis. The Chapter presents the overall summary, key conclusions and recommendations of the study, including areas for further study.

1.11 Chapter summary

This Chapter introduced the research topic by first highlighting the concept of scholarly communication and its role in the research process. The current scholarly communication system has been noted to pose problems of access and dissemination of scholarly content in both developed and developing countries but the latter countries are most affected. The concept of open access as a new mode of scholarly communication was described and was pointed out to have the potential to provide a solution to the notable problems of access to and dissemination of scholarly literature

in developing countries. It has been argued that despite such a potential, the new mode of scholarly communication is less exploited in the developing countries as compared to developed countries. It has also been noted that there are very few studies in developing countries especially in Africa that have addressed the aspect of open access and thus a need for this study is recommended. Based on this background, the research problem is formulated followed by the aim as well as specific objectives of the study. Research questions addressed by the study are derived from the specific objectives. Thereafter, the scope and limitations as well as the significance of the study are provided. The definitions of key concepts that are used throughout the study are also provided. The research process used by the study is outlined and finally the thesis chapter structure is presented at the end of this Chapter. The following Chapter explores scholarly communication with a focus on open access.

CHAPTER TWO

REVIEW OF SCHOLARLY COMMUNICATION FOCUSING ON OPEN ACCESS

2.0 Introduction

The Chapter reviews and discusses literature related to this study. Literature review is central to the research process because it provides a general understanding of the research problem as well as serves as a benchmark against which the researcher can compare and contrast the research results (Aina, 2002a; Gray, 2004). The following sections review and discuss literature on issues around scholarly communication with a focus on open access. Specifically, the Chapter addresses the following research areas which are based on the study objectives:

- ➢ Review developments in scholarly communication and open access adoption at global level;
- ➢ Investigate the general awareness and usage of open access with a focus on Africa and Tanzanian pubic universities in particular;
- ➢ Find out factors that facilitate the adoption of open access in research activities;
- ➢ Find out researchers' perceptions on open access scholarly communication and;
- ➢ Determine factors that hinder the adoption of open access in research activities.

Based on the above themes, the Chapter discusses scholarly communication development and factors contributing to the emergence of open access. This is followed by highlights on open access movements as stimulators of open access developments. Also presented in the Chapter is a comparison of open access development by continents followed by the analysis of scholars' awareness and usage of open access in research activities. Finally in the Chapter, is a discussion of motivating and impeding factors for open access usage, and scholars' perceptions on open access scholarly communication.

2.1 Developments in scholarly communication and open access adoption

The scholarly communication system has witnessed profound changes mainly due to economic and technological forces over the past three centuries (Rao, 2001; Thorin, 2003; Moller, 2006). Among other factors, the launch of scholarly journals was facilitated by the discovery of printing technology that made it possible to make many copies of research output for distribution to a wider research community than it was possible when researchers had to communicate through hand written manuscripts. The introduction of scholarly journals in print format also simplified the core functions of scholarly communication (registration, certification, awareness and archiving) than was the case when scholars had to communicate through hand written manuscripts. According to Prosser (2005), such functions are important to the scholarly communication process for authors as well as readers depending on the role they play at any given time. Registration is important for authors by ensuring that they are acknowledged as the ones who carried out a specific piece of research and/or made a specific discovery. Certification benefits both authors and readers by ensuring quality and validity of specific works. On the other hand, while awareness ensures that the author's work is known to other scholars, archiving it makes it possible for the research output to be documented and retained for future prosperity (Prosser, 2005).

Based on the above functions of scholarly communication, the launch of scholarly journals was therefore an important breakthrough in terms of scholarly communication improvement. The appearance of the print journal was just a beginning of further reforms in the scholarly communication. The serial crisis and ICTs as discussed in the following subsections are considered as the main forces behind the changes in scholarly communication witnessed today.

2.1.1 The serial crisis

Until the late 1950s, the scholarly publishing system was dominated by the scholarly societies and journals were quite affordable since they were not very costly to libraries and the research community in general (Yiotis, 2005). After World War II (during 1960s and 1970s), the expansion of universities accompanied by the rapid increase of research output resulted into scholarly societies' failure to absorb all the generated scholarly content (Johnson, 2000; Yiotis, 2005; Cassella and Calvi, 2009). The exponential growth of information, resulting from increased specialisation within

all disciplines also brought about further expansion of new journal titles leading to the so called information explosion (Moller, 2006). Enterprising commercial publishers became interested in the potential profits to be made from publishing in the context of a well-established creative source and an equally well-established pattern of consumption. Due to their low capacity, the scholarly societies offloaded journals to commercial publishers who eventually dominated the publishing industry. According to the American Library Association (ALA) (2003), throughout the second half of the 20th century, the commercial firms assumed increasing control over the scholarly journal market, especially in scientific, technological, and medical fields. Taking advantage of their market control, such firms had escalated prices for scholarly journals at rates well above the general inflation rates in the economy and also above the rate of increase of library budgets (ALA, 2003; Moller, 2006; Yiotis, 2006; Swan, 2007; Voss, 2007).

According to Yiotis (2005: 57), "by the mid-1980s, commercial publishers began a major process of consolidation and mergers that enabled them to gain monopolies of all publishing in their designated fields…, libraries could no longer maintain the constant level of serials subscriptions". The average increases in journal prices over the period from 2000 to 2004 for example varied from 27 percent to 94 percent depending on the publisher (the lowest being Cambridge while Sage had the highest prices (Harris, 2005).

The combined effect of exponential growth of scholarly content and the skyrocketing journal subscription costs as noted above led to the so called 'serial crisis', a situation whereby libraries could no longer subscribe to every journal required by their user community. Libraries tried to cope with price increases through a variety of strategies including subscriptions cuts and reductions in monographic purchases. With an estimate of 2.5 million articles published annually, it is highly acceptable that no university or research institution, even the richest ones can afford to subscribe to all or most of the scholarly information that its researchers need to use (Brody, 2006; Odlyzko, 2006). Indeed, despite the increase in the volume of literature created, journal subscriptions by libraries have been falling over time even though libraries expenditure increases especially in the developed countries. According to Moller

(2006: 44), "libraries have been paying more and more while subscribing to fewer resources year after year".

To support that view, Moller presents statistics from the Association of Research Libraries (ARL) as follows:

> *"In 1993, Australian university libraries purchased a combined total of 200,666 scholarly journals. By 1998 total subscription had dropped to 112,974, a decline of 43.7%. During the same five year period the average cost for journals increased from A\$286 to A\$485" (Figures from the Committee of Australian University Librarians (CAUL) reported in Tredea (2000) as cited by Moller, (2006: 44).*

In a survey of 5,500 senior researchers, Rowlands and Nicholas (2005) found that over 745 respondents acknowledged the fact that high prices have made it difficult for them to access the journal literature further implying the serial crisis to have had a severe impact on scholarly communication. This is true for researchers in both developed and developing countries although such a problem is more critical to the latter countries due to limited financial resources as noted under section 1.1.2 of Chapter One. As will be noted in the following subsections, the serial crisis and ICTs developments have played key roles in the ongoing transformation of the scholarly communication process.

2.1.2 Impact of ICTs on scholarly communication

Developments in ICTs have played a key role in the transformation of scholarly communication. According to Moller (2006), ICTs have dramatically changed research practices in terms of scholarly communication by enhancing communication among scientists; access to information of all kinds; and by providing a greater variety of publication and dissemination platforms. As far as access and dissemination of information is concerned, ICTs, particularly the Internet is probably one of the most revolutionary developments with profound impact on scholarly communication since the advent of writing (Ng'etich, 2004). According to Adogbeji and Akporhonor (2005), the Internet has made the access, retrieval and dissemination of information from non-local and distant resources not only easy but also possible to any end user regardless of geographical location.

Three key aspects of the Internet as a tool to support scholarly communication can be summarised as follows:

- ➢ The Internet provides researchers with opportunities to access substantial resources in the form of electronic journals, electronic books and other e-resources;

- ➢ As a means of communication, the Internet acts as a medium of exchange of information and ideas among scholars and researchers more efficient and quicker than traditional modes of communication and;

- ➢ The Internet provides an alternative publishing platform for material in print media as well as material in other formats that could not be put in print media and hence making the dissemination of research results more efficient (Ng'etich, 2004).

In short, developments in ICTs have dramatically altered the landscape of scholarly communication in terms of accessibility and dissemination of scholarly content. Efforts involved in accessing scholarly work have been dramatically reduced. For example, browsing and retrieving information from the Internet can be done in quite short time as compared to accessing the same information in print media whereby an individual is required to visit a physical library and trace the required piece of information. It is similarly true for publishing. With the advance in ICTs, preparation of a manuscript as well as its final publication and its availability to the intended user has been made much easier. According to Swan and Brown (2004: 5), "the ability to digitise information to a common standard has allowed scholarly research to be made available theoretically to anyone in remote location(s) so long they have access to a computer linked to the World Wide Web". Similarly, several studies reveal that the motivation for use of the Internet in scholarly communication revolve around faster access to and dissemination of electronic information resources as a result of enhanced publishing and communication by the technology in question (Ray and Day, 1998; Rusch-Feja, 1999; Adogbeji and Akporhonor, 2005).

While publishers have used the noted technological developments to change their business styles to increase sales, the scholarly community has also used similar developments to cope with the serial crisis by developing alternative scholarly communication that could ensure wide dissemination of scholarly content. The

following subsections highlight the terms 'Big Deals' and 'Open Access' as coping strategies to the serial crisis being adopted by commercial publishers and the scholarly community respectively through capitalising on ICTs developments.

2.1.3 The "Big Deals"

The serial crisis, resulting from the information explosion accompanied by the unaffordable journal prices have affected publishers as they sell less of their publications due to the diminishing purchasing power of many libraries. Taking advantage of ICTs developments, publishers have transferred most of their print journals to electronic versions and in turn changed their marketing strategies into the so called "Big Deals" to ensure that they sell most of what they publish. Through the "Big Deals", parts or all of a publishers' journal lists are offered to a library (or group of libraries within a consortium) at a reduced price per journal than the library had been originally paying and with additional journals that were not subscribed before (Pelizzari, 2003; Swan and Brown, 2004). Although the 'Big Deals' have helped publishers to offset the impact of the serial crisis by selling most of their publications, to a large extent, the new marketing strategy has not provided much relief to libraries and the scholarly community at large. Critics of the "Big Deals" argue that although such deals have been praised for making available additional content to which scholars had never had access to much of such content is sometimes outside the scope of the researchers' interests. This is due to the fact that in most cases, it is the publisher and not libraries or users who determine what to exclude or include in the "Big Deal" package. Libraries have the option to take or leave the whole package of journals offered by the Vender. Furthermore, pressure on library budgets as a result of big deals has not lessened as Swan and Brown noted:

> *"Library budgets have continued to see only modest annual increases whilst publishers have negotiated three or five year deals with year on year increases in charges, tying the libraries into long-term commitments in cash. … these big deals with the large publishers have resulted in very large proportion of a library's budget being committed in this way, leaving little over for other purchases" (Swan and Brown, 2004: 5).*

With such observations, the "Big Deals" may not be a practical solution to the existing scholarly communication problems but rather a different marketing strategy practiced by commercial publishers. Indeed, it has been practically difficult for most

developing countries to go for the "Big Deals" since it seems still unaffordable by most of such countries. This is evidenced by the fact that most of the "Big Deals" that have been adopted in developing countries have been possible through external supported programmes that are also deemed to be unsustainable (Chan, 2004; Kirsop and Chan, 2005; Chege, 2006). The "Big Deals" have thus not reversed the dissatisfaction of the scholarly community regarding the business mode of scholarly publishing and hence the emergence of open access as an alternative to such publishing system. The following subsection discusses the emergence of open access and why it is viewed as liberator of scholarly communication.

2.1.4 Emergence of open access

According to Prosser (2005), the primary demand on any scholarly communication system is to facilitate communication between scholars. To the contrary, the business mode of scholarly publishing has imposed barriers to information access to such an extent that only a few who can afford subscriptions can gain access to the scholarly content (Moller, 2006; Yiotis, 2006; Swan, 2007; Voss, 2007). This leaves the poor majority without access to the global research output. Therefore, the subscription-based publishing system has failed to serve the interests of the scholarly community. Although the subscription-based publishing system is seen as most detrimental to the scholarly community, some scholars have also argued that such a system is in danger of collapsing. If journal publishers continue to hike subscriptions beyond affordability, journals will eventually cost so much money that only a fraction of major libraries and institutions would be able to subscribe to such journals (Voss, 2007). The sustainability of journal publishing will thus not be possible due to low sales resulting from a small market base.

Following initial reactive phases characterised by cancelling subscriptions and adoption of the "Big Deals" as noted in the previous sections (2.1.1 and 2.1.2) above, a new move towards an alternative scholarly publishing system (open access) has recently emerged. The digital publishing and networking technologies harnessed by an increasing dissatisfied library market as well as authors have led to the birth of open access (Johnson, 2002; Pelizzari, 2003; Bjork, 2004; Correia and Teixeria, 2005; Yiotis, 2005; Moller, 2006). Open access is viewed as one of the means of addressing the escalating journal prices as well as circumventing a growing limited access to an

increasing volume of literature (Lynch, 2003). Correia and Teixeria (2005) and Yiotis (2005) provide the detailed historical emergence of open access claimed to have started in early 1990s. The changes in scholarly communication process are also summarised by Houghton and Sheehan (2006) as illustrated in Figure 1. This figure describes the scholarly communication transformation by highlighting the relationship between the changes in scientific publishing business models. The enabling information technology environment, changing research practices and modes of production led to the emergence of open access.

Infrastructure Platform

| Paper | Internet | High Bandwidth /HPC | E-science Grid |

Publishing Business Model

| Subscription | Hybrids | Open Access |

Print	Online delivery		
	Big Deals	Delayed Open Access	Archives & Institutional Repositories
		Author/Institution pays	Author/Institution pays
		Author's choice Hybrid: mixed funding	Services overlays: ● Peer review services ● Indexing & abstracting ● Evolving quality control ● New analysis of record ● New evaluation metrics

Transitional Phase

Figure 1: Changes in scholarly communication (Houghton and Sheehan, 2006: 3)

Figure 1 sums up the process of scholarly communication evolution process as discussed in sections 2.1.1 to 2.1.4 above. In short, the enabling ICTs made it possible for publishers to shift from the conventional print to electronic publishing. The electronic publishing facilitates the online distribution of scholarly content resulting into commercial publishers to adopt the "Big Deals" in order to maximise their sales of scholarly content as a way of coping with the "serial crisis". The scholarly community has also capitalised on the online environment to introduce open access publishing. In response to the scholarly community, some publishers have introduced

hybrids (using both commercial and open access modes of scholarly publishing). Using hybrid system, in transition to open access publishing, some publishers have opted to make openly accessible to some of their publications after a certain period of time (in most cases after six months or one year) of publishing their publications. In certain cases, publishers provide authors an opportunity to pay for publishing costs if they wish their articles to be made openly accessible immediately after publication. The ideal open access scholarly publishing is made possible through immediate opening to journals upon publication using various models to support publishing process as noted in Chapter One (section 1.2).

Prosser (2005) summarised the differences between the business model and open access in fulfilling the needs of scholarly communication system also revealing superiority of open access over the former in many aspects as illustrated in Table 2.1.

Table 2.1: Comparison of how subscription-based and open access models fulfil the needs of a scholarly communication system

Function	Subscription-based, closed access	Open access
Registration	Traditional, on publication of peer-review paper	On completion of article, by depositing in repository
Certification	By independent scholars	By independent scholars
Awareness and accessibility	Abstracting services, table of contents, alerts, etc	As for subscription-based journals, but with additional avenues (such as open access repositories) and aggregators (e.g. OAIster) making information widely visible.
Archiving	At publisher	Distributed - publisher, local and national libraries.
Reward structure	Dependent on reputation of journal	Dependent on reputation of journal - with open access possibly leading to greater impact, therefore greater citation and journal reputation.
Access to wider readership	Limited - university walk-in, document delivery, pay-per-view	Unlimited - access for anybody with Internet connection.
Ability of funding bodies and institutions to manage research programmes	Access limited to what funding body or institution can subscribe to	Unlimited access.
Profits and Surplus	Large for some commercial and society	Potentially smaller (although not necessarily for all

	publishers	publishers).

Source: Prosser (2005: 13)

As noted from Table 2.1, open access meets the needs of scholarly communication better than is the case in commercial publishing. Due to open access prospects, increasing number of researchers, librarians, academic institutions, research funding bodies, societies, and governments are looking at open access as a future model of scholarly communication. Support and promotion of open access may be noted in the engagement of the scholarly community in various open access movements described in the following section.

Among the arguments for open access movement proponents is that the existing publishing industry restricts the flow of information leading to the underdevelopment of scientific research that in turn affects the welfare of the society in general (Pelizzari, 2003; Comba and Vignocchi, 2005). Proponents of open access also put forward a number of other reasons as to why the business model of scholarly publishing is not desired. They point out that the existing publishing industry is considered exploitative to the research community in the sense that research institutions pay three times to access scholarly information they generate. In the first instance, the research institutions fund the research project, then the same institutions pay salaries to academics who conduct research and carry out the peer review at no cost to the publishing industry, and finally, the research institutions purchase scientific publications resulting from research output from the research community that is handed over to publishers free of charge (Lynch, 2003; Comba and Vignocchi, 2005).

2.1.5 Open access development initiatives

Although the scientific community has undoubtedly welcomed the idea of open access scholarly communication, it is acknowledged that it will take some time before open access is completely adopted (Johnson, 2002; Fullard, 2007). This is due to the fact that open access is disrupting the already well established system (Johnson, 2002). As noted in section 2.1, the business mode of scholarly publishing has existed for more than three centuries and publishers are already making huge profits from

such a venture while authors have become used to such a system. The emerging open access publishing is thus likely to meet some resistance from commercial publishers as well as authors themselves. This is because on the one hand, publishers would like their business mode to continue for them to remain in business, and on the other hand, authors will need some time before they are ready to adopt the new system, this is true for the adoption of any innovation (Rogers, 2003). In realisation of the above facts, various initiatives, statements and declarations have been instituted at international and national level to speed up the spread of open access in terms of self-archiving, creation of new open access journals and the conversion of subscription-based journals into open access publications. Below is a review of some of the key initiatives, statements and declarations towards open access from early 1990s.

2.1.5.1 The Open Archive Initiative (OAI)

Despite the move towards open access being traced back before 1990, the development of WWW in 1990 by Tim Berners-Lee seems to have stimulated open access movements (Suber, 2006). Thereafter, a series of events pioneered by individual scholars and organisations took place before major international movements started during late 1990s. The Open Archive Initiative (OAI) with a mission to develop and promote "interoperability standards" that aimed at facilitating the efficient dissemination and discovery of digital content was launched in 1999 (Suber, 2006). The OAI can be considered as the first major initiative with international focus towards the wide spread of open access. According to Xu (2005), the OAI developed Open Archives Metadata Harvesting Protocol (OAI-MHP), enabling data providers to expose structured data to the Internet so that it can be harvested by search engines such as Google. Before the OAI-MHP, finding relevant information from different repositories was difficult, unless the user happened to know in advance the title of the paper and the author as well as the source to find the required information. Initially, the OAI was concerned with the interoperability of well-defined e-prints but now it also includes a broad range of digital objects-datasets, video, databases, theses, technical reports and other grey literature (Chan, 2004).

2.1.5.2 The Budapest Open Access Initiative (BOAI)

The Budapest Open Access Initiative was launched by the Open Society Institute (OSI) in 2002 (Harnad, 2005b). Viewed as the defining statement of open access, the initiative in question focused on accelerating progress in the international efforts to make scientific and scholarly research freely available. The BOAI aimed at encouraging the researchers/grant recipients to publish their work according to the principles of open access paradigm by putting their resources on the Internet. This initiative also aimed at developing means and ways of evaluating open access contributions and online journals in order to maintain the standards of quality assurance and good scientific practice. The Budapest Open Access Initiative further advocates open access publications to be recognised in promotion and tenure evaluation of scholars by their institutions.

2.1.5.3 Other international open access initiatives

Apart from the above two main initiatives, there are several other initiatives at international level. Examples of such international initiatives include the Public Library of Science (PLoS), and Bioline International (De Beer, 2005; Chan, 2004). The Public Library of Science (PLoS) was launched in 2001 with an open letter to publishers of biomedical journals. The open letter expressed concerns on behalf of all biomedical researchers about restricted access to scientific and medical literature and required the researchers to undersign the open letter so as to boycott scholarly publishing in journals for journals that do not make the published articles available for free six months after publication (De Beer, 2005).

Established in 1993, the Bioline International is a collaborative initiative of scientists and librarians of the University of Toronto libraries, Canada, Brazil and UK. Its main objective is to make "visible the otherwise lost science that is inaccessible due to distribution barriers" (Chan, 2004: 292). According to Chan (2004), in January 2004, Bioline International made a strong commitment to the open access movement and converted its entire website to a fully open access provider of quality bioscience journals published in developing countries. The Bioline International makes it possible for published information from peer-reviewed journals to be available via the Internet from a number of developing countries including Brazil, Cuba, India, Indonesia, Kenya, South Africa and Zimbabwe.

2.1.5.4 Country level open access initiatives

The move towards open access is also seen at individual country level. Several institutions including national and international funding bodies have declared their support and commitment to open access in scholarly and scientific literature. For example, governments in the UK and USA indicated their desire for public funded research results to be made publicly accessible (Chan, 2004; De Beer, 2005). Some funding bodies like the Max Plank Society in Germany and the Wellcome Trust in UK are also promoting the view that the cost of open access dissemination is part of the cost of research. In that respect, researchers who receive funding from such organisations are supposed to provide open access to the research publications (Chan, 2004). In order to enforce that commitment, the Wellcome Trust of UK for example, instituted policy statements requiring researchers receiving their research grants to either publish in open access journals or be deposited in a central archive (Chan, 2004; De Beer, 2005).

The above are just a few among many initiatives, declarations and statements in support of open access. The Timeline of the Open Access Movement as compiled by Suber (2006) and updated regularly provide a full list of events regarding open access development at international and country level. It should however be noted that within the African continent, high-level policy actors such as the New Partnership for Africa's Development (NEPAD) or the Association of African Universities (AAU) have not yet come up with open access declarations and statements (De Beer, 2005; Suber, 2006). Also, except in South Africa, no research bodies within individual countries in Africa have come up strongly to support open access (De Beer, 2005; Chan, Kirsop and Arunachalam, 2005). Initiatives, declarations and statements from high level policy making bodies are crucial to all countries as they are likely to contribute to open access development. As demonstrated in the following sub-section, it seems those countries which are far ahead in the adoption of open access are also highly involved in various open access movements.

2.1.6 Open access adoption disparities among continents

Overall, continents represented by developing countries have made little progress in terms of open access adoption. As observed in Table 2.2, the repositories proportion by continents suggests that those continents with many developing countries are the ones with fewer repositories.

Table 2.2: Proportion of repositories by continent – worldwide

Continent	Number of repositories	Percentage estimate (%)
	End of August 2007	
Europe	477	50.4
North America	290	30.6
Australasia	65	6.7
Asia	62	6.5
South America	43	4.5
Africa	10	1
Total	947	99.7 (not adding to 100% due to round up of figures)
	By end of July 2009	
Europe	686	48.1
North America	404	28.3
Asia	167	11.7
Australasia	77	5.4
South America	68	4.8
Africa	24	1.7
Total	1426	100
	By end of May 2010	
Europe	822	49
North America	433	25.8
Asia	214	12.8
South America	83	5
Australasia	78	4.7
Africa	40	2.4
Central America	6	0.4
Total	1676	100

Source: OpenDOAR

Ranked according to the total number of repositories in each continent, it is noted from Table 2.2 that by the end of May 2010, Europe was leading by having 822 repositories, followed by North America (433 repositories), then Asia (214), South America (83), Australasia (78), Africa (40) and Central America (6). Even though

there are some developed countries without or with few repositories, developing countries have been lagging behind the developed countries. For example, a further analysis reveals that there were 371 repositories in the USA, 140 in Germany and 176 in the United Kingdom while there were 214 in Asia and 40 in Africa based on statistics of May 2010. The two continents (Africa and South America) dominated by many developing countries had a total 123 repositories as compared to some of the listed single developed countries. Similarly, the data obtained from the Directory of Open Access Journals (DOAJs), indicate that by the end of August 2007, among the 2810 journals in DOAJs, only 13 journals were identified as being published or hosted in Africa. These statistics are compared to the current data revealing a total of 41 open access journals published or hosted in Africa that were available in the DOAJs towards the end of May 2010. During the referred period, DOAJs had a total of 5070 registered open access journals.

Within developing countries, Brazil, India, and South Africa are the only countries paying more close attention to the benefits of open access (Chan, Kirsop and Arunachalam, 2005; Fang and Zhu, 2006; Sahu and Parmar, 2006). According to Sahu and Parmar (2006), India was listed fifth in the list of open access journals at global level and the second after Brazil among non-high income countries. The above findings may also be supported by data extracted from DOAR by the end of July 2009. Based on the extracted data, the top three developing countries in terms of the number of registered interoperable repositories are listed in the following order (number of repositories in blackest): India (36), Brazil (33), and South Africa (16).

The above observations reflect the relationships between open access development and research output of individual continents or countries. A similar trend is true with regard to ICTs infrastructure development in respective continents and/ or countries. The general trend is that, continents or countries with pronounced research output and well developed ICTs infrastructure are also the ones which are far ahead in open access development and vice versa. ICTs infrastructure development is more acceptable as the possible cause for the differences in open access development in respective continents and countries due to the fact that the scholarly communication in question is dependent on the Internet technologies. The fact that much of the research output from developing countries is published as grey literature suggest that the

notable difference in terms of number of repositories between developed and developing countries could have been relatively lower. This would happen if the developing countries adopted open access repositories in documenting their research output that is currently invisible in the business mode of publishing as noted in Chapter One (section 1.1.2).

It is also evident that continents with large number of repositories are comprised of countries that are highly involved in open access advocating. Examples include the USA (290 repositories) for North America, Germany (115 repositories) and the UK (104 repositories) for Europe. This is also true for individual developing countries such as Brazil and India that are featuring well in open access development (Sahu and Parmar, 2006; Chan, Kirsop and Arunachalam, 2005). It is thus important for high level policy making bodies at regional and individual country level in continents such as Africa to advocate for open access in order to improve the adoption of this mode of scholarly communication in the continents and countries in question.

2.2 The global awareness and usage of open access

The usage of open access is highly dependent on scholars being aware of this mode of scholarly communication. However, in certain situations users benefit from open access initiatives without their knowledge of this form of scholarly communication (Papin-Ramchan and Dawe, 2006; Fullard, 2007). This is especially true when users gain access to both free and subscribed content while searching for information on the Internet. It should be noted however that, for an individual to publish in open access outlets, prior knowledge of this publication mode is important. This has raised interest of many scholars of open access usage studies to address the awareness aspect before further investigating the acceptance and usage of this mode of scholarly communication by the scholarly community. Even studies that did not assess awareness, still acknowledge that non-usage of open access was probably due to lack of open access awareness by the respondents (Lawal, 2002; Gadd, Oppenheim and Probet, 2003). Subsections 2.2.1 - 2.2.3 provide a general review of awareness and usage of open access before focusing on Africa and Tanzania in particular.

2.2.1 General awareness of open access

Open access concept is still not widely known among researchers from different geographical localities and research disciplines. Some of the studies indicate that open access was an unknown concept to many researchers (Pelizzari, 2003; Swan and Brown, 2004; Rowlands and Nicholas, 2005; Kim, 2006; Papin-Ramchan and Dawe, 2006; Schroter and Tite, 2006; Christian, 2008); Greyson *et al*, 2009). A study by Christian (2008) for example, reveals that while only 3% of 66 respondents at the University of Lagos were aware of the open access concept, 22.7% others knew very little about it and majority (74%) of the respondents were completely unaware of open access. Another similar study involving 27 universities in Canada reveals that from among 32 survey respondents, 66% had some kind of familiarity with the term open access (Greyson *et al,* 2009).

Studies reporting some kind of open access awareness reveal that it is below or slightly above 60% of the respondents that are aware of open access (De Beer, 2005; Pickton, 2005; Macfie, 2006; Moller, 2006; Ouya, 2006; Lwoga *et al,* 2006; SARUA, 2008; Sanchez-Tarrago and Fernandez-Molina, 2009; Utulu and Bolarinwa, 2009; Greyson *et al*, 2009). It should be noted even where open access awareness is reported, the level of understanding was not uniform for different open access terms. For example, a study by Swan and Brown (2004), established that subject repositories or archives were the most known types to the respondents who claimed to be aware of open access repositories than open access journals. A similar study by Allan (2005) found that among the 24 randomly displayed terms related to open access, only the general terms were found to be well known while the specific ones were not. Likewise, a half of the respondents who claimed to know about open access, only a few of them were aware of digital repositories (Pickton, 2005). Utulu and Bolarinwa, (2009), also acknowledge that among 189 respondents 65% were aware of pre-prints as compared to 60 % and 48.3% who reported to know open access journals and post-prints respectively. Another recent study by Sanchez-Tarrago and Fernandez-Molina (2009) similarly reveals different knowledge of open access related initiatives among scholars from a group of health researchers in Cuba. According to this study, while 44.8% of the respondents (N = 160) were reported to be aware of open access journals, only 20.7% knew about open access repositories. The results from this study also revealed that 62.7% of the respondents were aware of Pub Med Central and

47.9% about BioMed Central. Surprisingly, only 4.3% of the respondents were aware of PLoS which is considered as the largest open access publishing house for biomedical sciences (Sanchez-Tarrago and Fernandez-Molina, 2009).

A study by Rowlands and Nicholas (2005) reveals a variation of open access awareness among regions with Eastern Europe, Asia and Africa showing much higher levels of awareness than North America or Western Europe. Such findings are a bit contradictory when compared to the actual adoption of open access. For example, while North America is ranked second after Europe in terms of repositories hosted in those continents as noted from Table 2.2 (section 2.1.6), the level of open access awareness is reported to have been low. Similarly, Asia and Africa are among the continents with quite few repositories, but yet the reported level of open access awareness is quite high. The possible explanation of such contradictory findings is that researchers from such continents happen to know open access through accessing free web based information but have little investment in open access repositories for the dissemination of their scholarly content. There could be other factors than awareness that contribute to having few established institutional repositories in Asia and Africa that need further investigation. The above observations testify that open access is still not well understood by the scholarly community and hence there is need for more awareness campaigns.

There are several ways through which researchers who claimed to know about open access got the information. The study by (Pelizzari, 2003), indicate that colleagues, professional literature, and libraries have been the main sources of learning about open access to those who claimed to be aware of it. On the other hand, self-archiving by their peers, open access debate, institution or library and established subject-based archives promotions were established as being the main means through which researchers were exposed to open access (Swan and Brown, 2005). The most common ways in which open access related terms had been discovered include searching the Internet, participation in debates or via colleagues in their disciplines (Allan, 2005). A similar study by Sanchez-Tarrago and Fernandez-Molina (2009) found that the respondents were informed about open access through colleagues (40%) and professional literature (37%) in their fields of research.

In concurrence with the above findings, several other studies have acknowledged other ways through which respondents were exposed to open access. These include: university/library websites; contact from institutional repository staff member; publicity through campus newspapers; results of a web search engine/Internet; direct publicity from publishers; word of mouth from associates; and participation in an initial meeting of institutional repository (Kim, 2006; Moller, 2006). In other words, the common communication methods [mass media (Internet, newspapers)] or interpersonal (face to face channels, meetings)] were the main means through which researchers got informed about open access. Though mass media channels are more rapid and efficient way of communicating about an innovation to the target audience, interpersonal channels are believed to be more effective in persuading an individual or a group to adopt an innovation (Peccione, 2001). It should be noted however that, the two main categories of communication methods usually complement each other and a combination of them may yield better results than is the case when relying on only one of them.

2.2.2 General usage of open access

Usage of open access in both disseminating and accessing scholarly information has attracted the attention of many scholars in recent years. Varying levels of involvement of researchers in open access publishing were reported by Allan (2005), Swan and Brown (2005), Macfie (2006), Kim (2006), Schroter and Tite (2006), Kaur and Ping (2009), Sanchez-Tarrago and Fernandez (2009), and Utulu and Bolarinwa (2009). A recent study by Sanchez-Tarrago and Fernandez (2009) for example, reveals that among 60 respondents only 35% acknowledged to have published in open access journals. Swan and Brown (2005), Kim (2006), and Utulu and Bolarinwa (2009) conducted studies that reveal more involvement of researchers in open access publishing. Kim (2006), reports more than half of the respondents claimed to have made their research or teaching materials publicly accessible through web sites. Similarly, Swan and Brown (2005) found out that close to half of the respondents had published at least one open access article during the last three years from the time of their study. The study by Utulu and Bolarinwa (2009) established that the respondents had acknowledged of having disseminated their scholarly content using either pre-prints (30%) or post-prints (23.3%) and 35% in open access journals.

The general tendency is more involvement of researchers in accessing rather than publishing scholarly content in open access outlets. Supporting this view, Mann *et al* (2008) observed that despite that 66% of the respondents from their study claimed to have used freely available material from open access outlets, only a minority (28%) affirmed to have published their papers using similar means. More support for such findings are reported by Gadd, Oppenheim and Probet (2003) who also revealed that even among those who had never self-archived papers, a good number of them had used others' self-archived works. A survey by Deoghuria and Roy (2007) also established that out of 125 respondents, 80% used open access to access literature and 20% used open access for publishing their research output. The findings reported in an article by Utulu and Bolarinwa (2009) further support the above observations. In the cited article, it is noted that 40% of the respondents claimed to have accessed scholarly content using pre-prints or post-prints and 46% through open access journals. This is compared to 30% and 23.3% of the respondents who reported to have disseminated their scholarly content using pre-prints and post-prints respectively against 35% who had published in open access journals. Although in the short term such a trend may be considered undesirable, in the long term the increasing usage of open access materials may also influence users of open access materials to publish their materials in open access domain. Gadd, Oppenheim and Probet (2003) for example, argue that those who have self-archived previously were more likely to have used other authors' self-archived materials. This means that by accessing open access materials such users become more aware of open access avenues for scholarly dissemination and may easily be convinced to make their research findings openly accessible. It is thus more likely that less effort may be required to promote open access to individuals who are already benefiting from open access initiatives than those who do not.

Open access usage has been found to differ in different research disciplines (Lawal, 2002; De Beer, 2005; Swan and Brown, 2005; Macfie, 2006; Zuber, 2008; Melero *et al*, 2009). Lawal (2002), found that among nine different research disciplines, researchers from the chemistry discipline were the most non-users of e-prints archives. On the other hand, De Beer (2005) discovered the fact that the academic departments in the humanities and social sciences are the ones that were very prominent in either engaging in self-archiving or hosting or promoting open access

journals. Furthermore, Swan and Brown (2005) observed that most computer scientists used such services, followed by life and medical scientists. Researchers in the field of medicine were also rated low in the use of open access (Macfie, 2006). An investigation by Zuber (2008) further provides more insights on the adoption of open access by scholars from different research disciplines. The cited study reveals that various research disciplines' performance in terms of their tendency to publish in institutional repositories were as follows (in decreasing order of performance): engineering, business, education, technology, physical sciences, humanities, social sciences, biology and agriculture, medicine, law, fine arts and communication, and athletics. Similar observations were made by a recent study in which it was established that institutional repositories in Spain were populated by content dominated by thematic areas of humanities and social sciences followed by engineering, life sciences, natural sciences and finally, fine arts and performing arts (Melero *et al*, 2009).

One possible conclusion from the above studies is that there is no consistency in terms of differences by disciplines as far as open access usage is concerned. Ideally, one would expect disciplines with a long history of subject repositories, such as physics (ArXiv) and economics (Repec) to have been leading in open access involvement, but that does not always seem to be the case. Such results suggest that more other research disciplines are increasingly being involved in open access scholarly communication than it used to be the case a few years ago. It is thus important to understand the actual involvement in open access publishing by researchers from different research disciplines in order to design appropriate campaigns to specific research groups.

2.2.3 Open access awareness and usage in African countries

Apart from several international studies that have addressed the awareness and usage of open access at global level including Africa (Rowlands and Nicholas, 2005; Swan and Brown, 2004 & 2005; Hess *et al*, 2007), there are generally few similar studies with a focus on African countries. From the referred international studies, it is noted that despite covering Africa and other developing countries, these studies are more skewed to developed countries due to a small sample of respondents drawn from the former countries as compared to the latter. For example, based on Swan and Brown

(2005) study, among 1296 respondents of their study, Africa was represented by only 4% while other countries such as the UK and US were represented by 18% and 21% of the total respondents respectively. From such observations it is difficult to obtain a clear picture of open access awareness and usage in Africa without reviewing specific studies in such countries. This section looks at studies done in Africa specifically addressing the current state of open access awareness and usage in the continent.

As noted above, within Africa there are only a few studies that have addressed the aspect of open access scholarly communication. Ouya (2006) investigated the opinions of journal editors (in the Sub-Saharan Africa Region) on open access publishing in general and their views regarding opening up access of their content to the global scholarly community. The survey questionnaire was used as a data gathering method. Generally, journal editors were found to be aware of open access as they perceived it to be beneficial. This study was narrow in scope in the sense that it targeted only journal editors and no attention was paid to open access repositories. The study recommended the need for an investigation to solicit opinions about open access self-archiving in a more closely targeted survey. A similar study targeting the author community as a whole and open access in its totality could provide more information regarding the awareness and usage of open access in the region.

A study by De Beer (2005) attempted to assess the awareness and levels of investment in open access modes of information dissemination, and to create a benchmark of South Africa's current involvement in various open access initiatives. A self-administered questionnaire was used to assess levels of awareness of open access initiatives as well as to ascertain the degree of open access usage. The data were collected from 300 purposively selected individuals in the computer/information systems, and library/information sciences. A structured record review was used to assess the extent of research output made available in the websites of academic departments and units at Stellenbosch University. The study concluded that the respondents were well informed about open access scholarly communication, but they generally lacked extensive awareness of specific open access initiatives. The use of open access avenues in order to access the works of others showed a higher level of activity when compared to the level of activity in making their own works available, and that open access adoption in South Africa had been disparate, uncoordinated and

decentralised. As is the case with a study by Ouya (2006), De Beer did not address self-archiving as the other option of open access. Among the recommendations of the referred study was the need for a more comprehensive, cross-discipline open access scholarly communication survey in South Africa. Similar studies in other African countries may also provide some insights regarding open access uptake in the continent.

Moller (2006) reports the results of a study carried out in South Africa focusing on open access journals and their prospects in the country in question. Using a survey questionnaire, the data were collected from biomedical researchers, managers of university based research, government agencies and science councils. The study gathered opinions and perceptions of the respondents regarding open access publishing. It was observed that more than one third of the respondents claimed to know open access publishing. Few researchers indicated to have published in an open access journal. Moller's study targeted only biomedical researchers and was concerned with open access journals. The study did not address open access archives and hence it is difficult to understand the overall picture of open access uptake in the country.

A study by Fullard (2007) involved 145 respondents among the 500 targeted South African biomedical authors. It investigated the extent to which stakeholders in the local research system were aware of open access publication and the prospects for the adoption of the new scholarly communication system in South Africa. The study found that close to 61% of the biomedical researcher group could not explain properly what open access implied (88 of 145) while only 3 of the 8 official research organisations were clear about what open access means. With regard to the prospects of open access, the findings reveal that there was little likelihood for academics to publish in open access journals in the near future. It could have been interesting if such a study could have also investigated the prospects for self-archiving to reveal the general picture for open access acceptance in the country. One of the recommendations put forward by Fullard was the need for further research within the local settings in order to provide a firm standing for the advocacy of open access.

In 2008, SARUA conducted a study entitled "Opening access to knowledge in Southern African Universities from selected Eastern and Southern African countries". The study examined the issue of access to knowledge constraints and the potential contribution that open access approaches can make to increasing research output. A qualitative approach was adopted to explore the views, perceptions and attitudes of respondents in getting a picture of the key concerns they have had in respect of constraints to accessing and disseminating knowledge. Eight universities including the University of Botswana (Botswana), University of Dar es Salaam (Tanzania), Eduardo Mondlane University (Mozambique), University of Malawi (Malawi), University of Mauritius (Mauritius), University of South Africa and University of Pretoria (South Africa), and the University of Zambia (Zambia) were selected for the study. A purposive sampling approach was used to select the key informants situated within pre-determined criteria for the study. Out of 104 targeted interviewees, 89 (85.5%) respondents participated in the interview.

The above study revealed that 71% of the respondents reported to have been aware of open access. It was also established that 77% of the respondents stated their explicit support for introducing open access approaches to promoting access to knowledge. Recognition of research output published in open access formats and channels, perceptions of poorer quality associated with open access published materials, the fear of breaching intellectual property rights and the fear of their research being plagiarised were reported by the respondents as the main barriers for their adoption of open access. The study recommends the need for the introduction of measures to create favourable university policy environments with respect to how policies on promotion and reward recognise open access published output. The need for institutional and technical capacities' development to empower universities to publish their research output in the electronic environment is also emphasised by the study in question. The SARUA study having included one of the public universities in Tanzania provides a good basis for comparison of the findings expected to emerge from the study at hand.

Utulu and Bolarinwa (2009) report results from a study on open access initiatives adoption by academics from the Universities of Ibadan and Lagos in Nigeria. The two universities were selected on convenient sampling basis. Using the survey

methodology, 250 copies of the questionnaire were distributed to the respondents selected from a population of 2,224 academic members of staff from the study area. From the distributed copies of the questionnaire, 189 (75.6%) were returned out of which 180 were found useful for analysis. Categorised in the two main research disciplines, 58.3% of the respondents belonged to sciences and 40% were from humanities disciplines while the remaining 1.7% of the respondents did not indicate their research disciplines.

The key finding from this study is that the academics awareness of open access with respect to open access did not tally with the actual usage of information resources from such open access outlets by these respondents as users as well as readers of scholarly publications. The research findings indicate that on average, the awareness of open access by the academics was above 50% while the actual usage of different OA outlets to access and disseminate scholarly content by these respondents was less than 50%. Another pertinent finding from this study is that the respondents were found to prefer usage of open access journals than open access repositories. This is considered as a sign for the increasing acceptance of open access journals as a formal media for dissemination of scholarly content even in the developing world (Utulu and Bolarinwa, 2009). Even though the findings from the current investigation may not be generalised to the rest of Nigerian and other African universities due to the sampling technique that was used, the study provides a good basis for planning and conducting similar comprehensive and more representative studies for understanding of the adoption of open access by academics in universities and similar institutions in Nigeria and elsewhere.

A study by Alemu (2009) was conducted to examine the role of open access in fostering knowledge sharing and collaboration in Ethiopia. Using the qualitative approach, this study interviewed 14 respondents (researchers and librarians) selected purposely from four organisations based in Addis Ababa, the capital city of Ethiopia. This study aimed at finding out the respondents' awareness and the state of open access uptake at respective institutions involved in the study. The overall findings revealed that researchers and librarians involved in the study had very low awareness of open access and that this mode of scholarly communication was not practiced in the institutions under the study. The fact that this study targeted small sample size that

was purposively selected from among many research institutions in Ethiopia suggests the need for a more comprehensive study for better understanding of open access adoption in this country.

In Tanzania, a study by Lwoga *et al* (2006) addresses the application of open access and community of practice (CoP) for improvement of capturing and sharing of agricultural information among various stakeholders. Low awareness on open access as well as low publishing rate in open access journals and open access repositories among the respondents were the key observations by the study. Overall, the study concluded that the knowledge sharing activities among agricultural researchers in Tanzania were not satisfactory mainly due to poor knowledge sharing culture and inadequate ICTs infrastructure. While the above study has contributed to the understanding of general awareness and publishing in open access avenues by Agriculture scientists in the country, a similar study to investigate the extent to which such researchers use open access materials as well as involving researchers from other disciplines may shed more light regarding the adoption of the new scholarly communication system in the country.

From the foregoing review it is noted that most of the available empirical studies in Africa have been done in South Africa. The other pertinent observation is that majority of the studies focused on few research disciplines and had a bias towards open access journals with little attention to self-archiving. Consequently, a full picture of researchers' awareness and usage of open access scholarly communication is not well documented in Africa as whole and Tanzania in particular.

2.3 Factors facilitating open access adoption

Understanding the factors that influence scholars' decisions regarding the adoption of open access is critical for the future development of the new mode of scholarly communication. Facilitating factors sometimes referred to as motivating factors or determinants to the use or performance expectance (researchers' subjective assessment as to what extent open access outlets can enhance their personal performance) are considered as factors that attract scholars into making use of open access in disseminating and accessing scholarly information. The facilitating factors are important for the advocates of open access to capitalise while promoting open access.

The existing strengths may also help open access proponents to focus on the factors that are meaningful in speeding up the adoption of open access to specific population of authors and avoid futile efforts. The following subsections address the facilitating factors on scholars' adoption of open access.

2.3.1 Free and improved access to scholarly information

Free access and unlimited dissemination of scholarly content is the main guiding principle of open access (Chan, 2004). Although reported differently by various scholars, increased accessibility to scientific literature (Hajjem, Harnad and Gingras, 2005; Schroter, Tite and Smith, 2005), redressing the serial crisis (Allan, 2005), unrestricted access to information (Kennan and Wilson, 2006), and easy access to scholarly information (Xu, 2005; Warlick and Voughan, 2006; Hess *et al*, 2007; Frandsen, 2009; Bernius *et al*, 2009), all imply free and improved access to information. According to Prosser (2005), it is in the area of accessibility that open access shows a clear advantage over subscription-based access and has been cited as the main motivation for scholars to access open access literature.

It is interesting to note that due to free access principle, the aspect of open access has received substantial support regardless of whether such scholars had published in open access avenues or not (Schroter, Tite and Smith, 2005; Swan and Brown, 2005; Kim, 2006; Hess *et al*, 2007; Utulu and Bolarinwa, 2009). In situations where access to subscribed-based information resources is limited, open access is likely to contribute greatly to the improvement of access to information. With open access, the

reader's information needs will be met immediately without restricted access to full-text. When a paper is openly accessible, the reader will not have to worry about subscriptions, loans, or pay-per-view. Free access for readers therefore serves as the most enticing point in the promotion of open access.

2.3.2 Increased research impact

According to Harnad (2003a & b), research impact is the degree to which research output is seen, read, used, built-upon, cited and applied by other researchers. Authors wish their papers be widely circulated, read, cited and built upon to increase their research impact (Chan, 2004). Open Access has been acknowledged for its ability to increase research impact by increasing the usage of research papers through providing access to users without subscription and increasing awareness by being indexed in open access services (Swan and Brown, 2005; Brody, 2006). Several other studies also indicate that articles made available through open access are cited more than the subscribed versions (Antelman, 2004; Harnad and Brody, 2004; Hajjem, Harnad and Gingras, 2005; Houghton and Sheehan, 2006; Bernius *et al*, 2009; Davis, 2009; Joint, 2009; Sanchez-Tarrago and Fernandez-Molina, 2009; Gargouri *et al*, 2010). According to Antelman (2004) the relative increase in citation for open access articles ranged from 45% in philosophy, 51% in electrical engineering, 86% in political science, to 91% in mathematics disciplines. Other findings show that open access articles received between 25-250% more citations than articles that are not made freely available through the web (Hajjem, Harnad and Gingras, 2005; Brody, 2006). According to Gargouri *et al* (2010: 2), the OA advantage over subscribed versions of papers is due to "a quality advantage, from users self-selecting what to use and cite, freed by OA from the constraints of selective accessibility to subscribers only". In other words, an open access article similar in quality to a subscribed version has more chances of being accessed and cited than the one with restricted access. This is due to the fact that a freely accessible article can be accessed by any potential user while the subscribed based version can only be accessed by those with ability to pay.

In support of the above observations, scholars' interest to publish in open access avenues is acknowledged to be motivated by the expected research impact of their research output if disseminated in such outlets. For example, the dissemination of results to a wider audience (Schroter, Tite and Smith, 2005; Swan and Brown, 2005;

Sanchez-Tarrago and Fernandez-Molina, 2009), increased accessibility and readership (Swan and Brown, 2004; Rowlands *et al*, 2004; Hajjem, Harnad and Gingras, 2005; Kennan and Wilson, 2006*;* Kim, 2006; Sanchez-Tarrago and Fernandez-Molina, 2009), and more frequent citations (Swan and Brown, 2004; Chan, Kirsop and Arunachalam, 2005; Swan and Brown, 2005; Kennan and Wilson, 2006) are among the key motivations for scholars to disseminate their scholarly content in open access outlets. It should be noted that all the above cited motivations for scholars to publish in open access outlets are related to the increased research impact of their scholarly output. The business model of scholarly publishing restricts access to research findings. By so doing it fails to provide the potential authors with access to scholarly content and this implies lost usage and citations for the subscribed-based scholarly content. Automatically, the research impact of authors whose articles are hidden through restricted access in the business mode of scholarly publishing is minimised (Brody, 2006). The opposite is true for open access scholarly publishing. Research impact of openly accessible materials is thus also considered as among the key motivations for researchers to accept open access.

2.3.3 Increased speed of research content dissemination

The speed of research content dissemination is the rate at which an article of a publication is accessible to the reader after its development. The amount of time between acceptance of an article and its publication is an important aspect in the scholarly communication process. This is due to the fact that delays in publishing may increase the chances for the research to be out of date when published or that a rival research group may publish similar results before the originator of the research. One of the motivations for scholars to choose open access as their research dissemination avenue is to make their results accessible the soonest possible (Swan and Brown, 2005; Brody, 2006; Carr *et al*, 2006; Sanchez-Tarrago and Fernandez-Molina, 2009). According to Prosser (2005), open access through depositing of pre-prints by authors in local or subject-based repositories gives the most rapid publication possible with minimal chances for authors to claim originality of similar research output. The difference between other online publishing and open access publishing is on the possibility for posting of pre-prints in open access repositories before the official version of a publication. This is contrary to the traditional online publishing system whereby an article is made available to the public only when it is officially accepted

and/ or published. Hence in principle, open access has more advantage over other the traditional publishing system regarding earlier dissemination of information content even before the official version is published.

2.3.4 Social influence related factors

Social influence reflects the extent to which researchers are provided with support when publishing in the open access outlets and the extent to which peers might already be using this form of publication system (Hess *et al*, 2007). The motivation for authors to publish in open access avenues may be influenced by their organisations or research funding agencies or their peers in the research community. Authors' organisations may motivate their employees to use open access by putting in place the necessary facilitating conditions such as Internet accessibility and technical know-how for effective usage of the technology. Increasingly, there is also some evidence that organisations or research funding agencies that recognise open access publications for tenure award of their employees, and/or support author publication costs in open access avenues to enhance the adoption of open access (Prosser, 2005; Warlick and Voughan, 2006; Deoghuria and Roy, 2007; Hess *et al*, 2007; Suber, 2008). According to Deoghuria and Roy (2007), out of 125 scientists, 64% and 20% considered approval by their funding agencies and employers respectively as crucial for them to publish in open access avenues.

Although peers' influence has not received much support from empirical studies, it is believed that authors are more likely to be motivated to use open access if their colleagues or leading scientists of other disciplines are also using that system of scholarly publishing. The statement that close colleagues who already publish in open access outlets may be a motivation for using open access for information dissemination was negated by majority of the respondents in the studies reported by Deoghuria and Roy (2007), Hess *et al* (2007) as well as Sanchez-Tarrago (2009). The cited two studies, however, established that majority of the respondents were publishing or could publish in open access outlets if leading scientists in their/or other disciplines disseminate their findings using the same approach. These observations imply that organisations or research funding agencies and professional colleagues may negatively or positively influence the development of open access depending on whether or not they play a supportive role.

2.3.5 Promotion of institutional research output

Under the subscription based publishing system, the institutional research output is always scattered in many journals due to the fact that authors publish their articles in journals of their choice. In such a situation, it is difficult to single out the institutional research output since some of the journals are not easily visible and/or accessible even to authors themselves in their countries of origin due to either price restrictions or the fact that such journals are not covered by indexers. In addition, most publications such as theses and dissertations, datasets, technical reports and other forms of electronic publications emanating from both developed and developing countries do not have publishing outlets in the existing business model of scholarly publishing (Chan and Cost, 2005). Such publications are thus not always easily visible to reflect the institutional research output.

Institutional repositories "concentrate the intellectual product created by the university members making it easier to demonstrate its scientific output" (Johnson, 2002). By setting up institutional repositories and asking staff to deposit their publications (e-prints/post-prints and other unpublished materials as noted above), a substantial institutional research output may be visible. Above all, such repositories connect local and international research and provide a better picture of institutional and country's research output (Chan, Kirsop and Arunachalam, 2005; Kamila, 2009). By preserving institutional research output, institutional repositories therefore also create reputation to both staff and institutions through exposing research content that would have been inaccessible globally under the traditional publishing industry.

2.4 Factors hindering the adoption of open access in research activities

Hindering or inhibiting factors or simply obstacles of open access adoption are those aspects that deter scholars to adopt open access. Without knowing such factors, one may face difficulties in formulating strategies towards improving open access adoption. As it is for facilitating factors, it is important to have a clear understanding of obstacles to open access since it is by addressing them that the better uptake of open access maybe achieved. The following subsections discuss the factors hindering open access adoption.

2.4.1 Low awareness

Stakeholders' lack of awareness on the existence and potential benefits of open access in scholarly communication is probably the major constraint contributing to the slow pace of open access development in many countries. According to Papin-Ramchan and Dawe (2006), scholars' awareness of open access and its benefits is a prerequisite for them to exploit the open access-related opportunities. This view is also shared by Fullard (2007) who emphasises the need for stakeholders' awareness of open access before they can subscribe to it. Therefore, low awareness of open access is more likely to contribute negatively to open access development. Lack of familiarity with open access fields and failure to identify appropriate open access journals for publishing purposes were acknowledged as among the contributing factors for the low adoption of open access (Lawal, 2002; Bjork, 2004; Swan and Brown, 2004 & 2005; Xu, 2005; Moller, 2006; Christian, 2008; Grundmann, 2009; Kaur and Ping, 2009; Sanchez-Tarrago and Fernandez-Molina, 2009).

Chan and Costa (2005) also point out that despite the great enthusiasm on the part of university libraries to set up open access repositories, they have not adequately motivated faculties to participate, neither are the university administrators aware of the benefits of open access. As will be noted in the following subsections, increased awareness of open access is likely to be a solution to many other factors considered to affect open access development. It is therefore important for more campaigns to be directed to both faculty and policy makers in order to attain high acceptance and usage of open access.

2.4.2 Quality of open access publications

Scholars attach great value in the quality of publications in considering usage of such materials as well as publishing their research output in those publications (Warlick and Voughan, 2006; Utulu and Bolarinwa, 2009). According to Warlick and Voughan (2006), it appears that the peer review process and impact factor of publications are quite important for authors. Supporting this view, Utulu and Bolarinwa (2009) consider the more acceptance of publishing in open access journals than pre-prints by the respondents in their study as result of recognising the rigour involved in the review of open access journals.

Unfortunately, open access materials are perceived to have low quality in comparison with the traditional publications. Authors are sceptical in publishing in the open access avenues for fear of jeopardising the integrity of their papers (Fang and Zhu, 2006). Also some non-users of self-archived materials claim that they do not use these materials due to the low quality of such materials resulting from lack of quality control of articles in those repositories (Pickton, 2005; Swan and Brown, 2005; Xu, 2005; Warlick and Voughan, 2006; Deoghuria and Roy, 2007; Grundmann, 2009). Such views have however been refuted since in reality it does not mean that a publication has to forego a peer review process to be openly accessible. According to Prosser (2005), the certification (peer-review) process of publications in open access avenues do not differ from those of traditional journals. It should also be noted that the peer review process for open access materials is equally emphasised by the Budapest Open Access Initiative (2002).

It should further be noted that some of the materials (post-prints, theses and dissertations) in open access repositories pass through rigorous review process and therefore any claim to the contrary may not necessarily always be true. Indeed, open access articles are reported to have the quality advantage over the traditional ones since most papers archived in open access repositories belong to high quality journals and some of the open access journals were originally available on subscription basis (Sale, 2006). Correia and Teixeria (2005: 354) also argue that "even though some of the institutional repositories' content may not be formally refereed, they constitute important scholarly work that remains lost in the formal publishing industry". Access to such contents can be quite useful for awareness purposes to avoid unnecessary duplication of research efforts. In fact, most open access studies indicate that scholars access more open access materials than they publish in the same avenues (Gadd, Oppenheim and Probet, 2003; Pelizzari, 2003; De Beer, 2005), suggesting further that in principle open access materials are acceptable by the scholarly community and probably more efforts should be directed to peer reviewing of all materials eligible for inclusion in open access repositories. This is important in further convincing researchers to publish their research output using open access avenues.

2.4.3 Copyright concerns

Copyright concerns about open access are mainly directed to open access repositories. Uncertainties over later publishing open access articles elsewhere, violation of publishers' copyrights, and plagiarism of open access papers are among the cited respondents' deterrents for making their contribution to institutional repositories (Ware, 2004; Foster and Gibbons, 2005; Xu, 2005; Hirwade and Rajyalakshmi, 2005; Pickton, 2005; Fang and Zhu, 2006; Kim, 2006; Grundmann, 2009). Although the expressed copyright fears are pertinent to the development of open access, solutions to some of them depend on appropriate campaigns. For example, by advising researchers to deposit only post-prints in the repositories, selecting target journals that allow prior deposit to the repositories, and checking the target journal's policy before posting a pre-print may address most of the expressed fears.

It should also be noted that the risks of copying, altering and plagiarism are also problems for other digital material (Pickton, 2005). This is the reason for the existence of copyright laws in the conventional publishing system and the creative commons license for open access publishing (Korn and Oppenheim, 2006; Kim, 2007). According to Korn and Oppenheim (2006), creative commons licenses offers creators of digital scholarly content with a range of options that permit authors to retain control of their works on top of encouraging re-uses of copyrighted materials by the scholarly community. While copyright laws insist on fair use (including the need to acknowledge authors) of the subscribed materials, creative commons licenses allows users to use scholarly works with more freedom so long they properly acknowledge authorship as explained in section 1.2 of Chapter One. It is thus a matter of creating awareness to authors on the existence of creative commons licenses to safeguard the usage of their works in order to reduce copyright concerns among the scholarly community. It is also important for every institutional repository to have in place appropriate rights management software and potential depositors need to be made aware of the creative commons licenses that guide usage of content in such repositories.

The practice by many commercial publishers requiring journal authors to sign over exclusive rights of their publications upon the acceptance of their papers has also often scared many scholars as they believe that they no longer have the right to their

own paper. They consider self-archiving of such papers on their own or institutional repositories as a violation of publisher's copyright (Ware, 2004; Chan and Costa, 2005; Kim, 2006; Grundmann, 2009). It should be noted however that increasingly, many journal publishers do allow their authors to self-archive pre-prints/post-prints in different open access archives (Harnad, 2006; Grundmann, 2009). According to Harnad (2006) for example, among 8698 journals from 129 publishers, 93% had already given official green light to self-archiving (full green post-prints (68%), pale-green pre-prints (25%) leaving only 7% of journals which did not allow any kind of self-archiving. Recent statistics from the SHERPA/ RoMEO website indicate that by February 2010, among 700 publishers, 63% of them allowed some kind of self-archiving. Although publishers' guidelines seem clear, it is asserted that the restrictions imposed by such publishers are not always straightforward due to the associated conditions. For example, McCulloch (2006) noted that some publishers who permit post-prints in an institutional repository do not allow depositing such papers in individual pages. There are also those publishers who permit post-prints only on pages not accessible outside the university while some do not permit at all any form of self-archiving of papers once published in their journals. It is thus not surprising for many researchers to remain uninformed about copyright issues leading to their confusion with respect to what is allowed by publishers for self-archiving in open access archives (Grundmann, 2009).

The above observations suggest the need for researchers to be made more aware of the existing publisher flexibilities to allow self-archiving of published materials. Inadequate awareness with respect to authors' rights on their published work is the reason for some of the scholars not to bother in retaining copyright or requesting reproduction permission from publishers so that such articles may be deposited in institutional repositories. More awareness creation efforts may lessen the concerns about copyright issues and thus make many researchers to contribute to the institutional repositories.

2.4.4 Limited recognition and policies for open access publishing

Lack of motivation and policies regarding faculty members' participation in open access publishing contribute to the slow progress of open access. It has been noted by several scholars that among the reasons for faculty staff to hesitate to publish using open access is that open access publications' output is not a criterion for promotion considerations (Warlick and Voughan, 2006; Deoghuria and Roy, 2007; Fullard, 2007; Hess *et al*, 2007). Therefore, the reluctance of researchers to publish in open access avenues is partly due to the unproven status of such a publishing model by many organisations. Unless organisations change their staff promotion criteria so that even open access materials are recognised in the same way as the traditional publications, open access development will remain stagnated. The current system of faculty rewards based on the traditional publishing and disregarding open access publications is not objective. This is due to the fact that the impact factor of journals being used as key criteria for promotion has been criticised because in principle "it does not tell the impact of individual articles but rather is just an average measure of all articles in the journal" (Prosser, 2005:8). Open access papers are considered to have more impact as they are widely accessed and more cited than otherwise would have been the case if under access restrictions. For this reason such publications deserve a consideration in faculty rewarding systems because of the expected high research impact from such publications. This view is also supported by Fullard (2007) who established that majority of the respondents (79% of 145) expressed the need for more recognition of open access journals that meet established quality criteria.

Lack of clear policies supporting open access at individual institutions also contributes to the slow progress of open access. A study by Carr *et al* (2006) compared deposit rates for annual research output in institutional repositories. This study reveals that institutions with self-archiving mandate policies achieved 100 percent open access in a year or two while those without such policies stagnated at 25 percent. If governments, funding agencies and institutions could develop and adopt policies insisting on researchers to disseminate their research output through open access avenues, substantial achievements towards open access development could be attained. Apart from the recognition of open access articles to the researchers' career development, such policies should also provide general guidelines on building and maintaining of institutional repositories.

2.4.5 Inadequate technological supportive conditions

Open access is based on Internet technologies. Unless scholars have access to such technologies, they will be restricted from both access to and dissemination of their research results through open access avenues. Technological requirements such as ICTs infrastructure (computers and software, Internet) as well as technical know-how (such as computer literacy and knowledge of how to use search engines effectively), are among the necessary facilitating conditions for open access adoption (McCulloch, 2006; Hess *et al*, 2007; Kaur and Ping, 2009). The limited availability of the technological requirements in many developing countries therefore contributes to the slow adoption of open access in such countries (Muthayan, 2003; McCulloch, 2006; Papin-Ramchan and Dawe, 2006; Christian, 2008; Eke, 2010). Muthayan (2003) points out that only few institutions with reliable and fast Internet connection would benefit from open access initiatives in South Africa. Similarly, Hirwade and Rajyalakshmi (2005) considered lack of infrastructural facilities and connectivity of high bandwidth as among the inhibitors of open access uptake in India. Furthermore, Christian (2008) observed that low Internet bandwidth as among the main hindrances to the widespread uptake of institutional repositories in the sub-Saharan African region. The potential benefits of open access can thus be realised only when the existing technological infrastructure is adequate and users are able to utilise it effectively.

2.4.6 Open access publishing costs

Open access publishing costs may be viewed in two main aspects: author charges for publishing in open access journals and costs for establishing as well as running of open access repositories. The reliance of open access on author pays model is among the controversial issues of the open access movement. According to this model, authors are charged per accepted articles to cover publication costs in order to subsidize journal expenses that are traditionally supported by subscription fees. There is evidence that many authors are reluctant to pay for open access publishing costs (Rowlands and Nicholas, 2005; Schroter, Tite and Smith, 2005; Swan and Brown, 2005; Warlick and Voughan, 2006). Even if researchers are willing, author pays model poses an additional barrier by restricting publication because some authors (especially those who cannot afford to pay such as junior faculty and students as well

as researchers from developing countries) fail to meet publication costs (Schroter, Tite and Smith, 2005; Sanchez-Tarrago and Fernandez-Molina, 2009).

According to Rowlands and Nicholas (2005), the problem of author fees as a barrier for open access development is partly handled by organisations and research funding bodies through paying publication costs such as page charges and author fees as part of research costs. Indeed, where such costs are covered by research funding agencies, author pays model is not a concern by many researchers (Schroter, Tite and Smith, 2005; Warlick and Voughan, 2006; Fullard, 2007). Therefore, it is a matter of creating more awareness among the authors on the existing opportunities of open access publishing support for them to use such opportunities to disseminate their findings in journals demanding publication fees.

With respect to open access repositories' expenses, it is argued that even where the technological infrastructure and relevant expertise exist, staff costs including time spent in drafting policies, arranging licensing agreements, developing guidelines, publicising the repository, training and supporting users and creating metadata may also be significant (Ware, 2004). Opposing this view, Swan and Brown (2005: 4) argue that "an average-sized research university can set up a functional archive for about ten thousand US dollars". This view is also shared by Chan, Kirsop and Arunachalam (2005) who argue that where the technical infrastructure for setting up institutional archives exists, costs are not prohibitive to establish such repositories because free software is already available. The best known and most widely used open source software are E-prints (made available by the Southampton University, United Kingdom) and D-space that was developed by the US-based Massachusetts Institute of Technology (Chan, Kirsop and Arunachalam, 2005). According to Chan, Kirsop and Arunachalam (2005), annual running costs vary according to the institution's existing levels of provision of IT services, level of interventional support provided by the administrators and how much advocacy activity is to be included. Although such costs may be high for some institutions especially in developing countries, the value of institutional repositories to both institutions and their academics may justify for the expenditure due to the fact that such an amount could be just a portion of the total institutional budget.

2.4.7 Cultural issues

Resistance on the usage of open access may also arise due to cultural differences in different scientific disciplines. More involvement in open access publishing is largely noted in physics, mathematics, computer science and economics because such disciplines are cited to have pre-print cultures already (Bjork, 2004; Xu, 2005; Kim, 2006; Morris, 2009). This situation is however unlikely to continue for a long time as more scholars in other disciplines become aware of open access. A study by De Beer (2005), for example, reveals that humanities and social sciences departments were found to have almost 50% of full-text materials on their websites in comparison to those available from other natural sciences departments with disciplines that are considered to be pioneers of subject-based repositories. To the contrary, the two departments whose disciplines have a long history of subject-repositories, physics and economics (with ArXiv and Repec archives), did not have full-text articles listed on their departmental websites (De Beer, 2005). In the long run therefore, as more and more scholars across disciplines become aware of and accept open access, this problem is likely to diminish. It is however necessary to determine the extent of the problem in specific research disciplines in order to devise mechanisms to handle the possible cultural resistance for open access adoption.

2.4.8 Long-term preservation of open access materials

The guarantee of long-term archiving is an assurance for authors to be associated with a particular piece of their work forever while for the reader it means they will be able to find historical research in the scientific record. Some authors are afraid of publishing in open access avenues because of being uncertain of the long-term availability of their documents (Xu, 2005; Hess *et al*, 2007). However, long-term archiving of electronic articles is a problem not only for open access but also for traditional publishing. According to Prosser (2005), the long-term archiving of electronic publications also applies to both subscription-based journals as much as it does to open access publications.

While long-term archiving of digital documents seems a threat to open access development, commercial publishers are already converting their print journals to electronic versions and taking over the role of archiving journals, a traditional task of libraries during print dominated era (Willinsky, 2003; Prosser, 2005). Since works

that are archived in digital formats by publishers come from the same researchers who are afraid of publishing in open access avenues for not being sure of the continued availability of their scholarly content, it can be expected that their fears to publish in such avenues are likely to be short-lived. It should also be noted that solutions for long-term preservation of digital content are already in place. Some of the open source software such as DSpace, Eprints, Fedora, and CDSpace are commonly adopted in implementing open access repositories to ensure their long-term preservation (Open Source Institute (OSI), 2004; Afroz, 2008; Perera, 2008; Salanje, 2008; Kamila, 2009). Similarly, some of the commercial software that may be used for long-term preservation of scholarly content include: SDB by Tessela, Rossetta by Exlibis, and DIAS by IBM (Hutar and Stoklasova, 2009). Most important, is for institutions to put in place appropriate mechanisms for proper maintenance of the hardware and software as well as ensuring the existence of proper strategies for migration to new systems when necessary so that perpetual access to scholarly content is assured (Beagrie, Cruszcz and Lavoie, 2008; Moahi, 2009). It is thus necessary to educate authors on the existing efforts ensuring the long-term preservation of digital content in order to reduce their worries for the disappearance of scholarly content. In fact some studies have already revealed that the preservation of scholars' work is among the expressed motivations for researchers to publish in institutional repositories (Chan, *et al*, 2005; Xu, 2005; Kim, 2006; Hess *et a*l, 2007). However, despite such developments, in order to increase confidence among the researchers to deposit their scholarly content into institutional repositories, it is important for libraries to retain hard copies of such content until a permanent solution for long term archiving of electronic copies of such documents is sought.

2.5 Scholars' perceptions on open access repositories

Despite the general potentials of open access in improving scholarly communication, the future of its development seems to be more promising for open access repositories than open access journals. This is because over the years, the growth of open access journals seems to be slower than that of open access repositories. According to Regazzi and Caliguiri (2006), between 2001 and 2004 there has been a decline in open access journals that were started against a significant growth of repositories during a similar period. One of the cited reasons for the decline in open access journals is having few publishers of such journals (Regazzi and Caliguiri, 2006). In

terms of open access publication avenues therefore, there is more potential for publishing articles in repositories than is the case in open access journals. For example, while on the one hand, authors have the choice to publish in any of 2810 open access journals, on the other hand, the existing 910 repositories may accommodate more articles than it is possible with the existing open access journals.

In addition to the above observations, worldwide, there are more than 2.5 million articles published annually in peer-reviewed journals and other publications such as conference proceedings that can be published on open access repositories, suggesting that there is more room for the growth of such repositories (Harnad, 2006; Bernius *et al*, 2009). According to Harnad, only 15% of the articles published annually are being spontaneously self-archived worldwide implying that self-archiving is still under-exploited. It is therefore important to investigate researchers' perspectives regarding open access repositories in order to device appropriate mechanisms in promoting their adoption. The following subsections review researchers' perspectives towards open access repositories in various aspects.

2.5.1 Permissions and restrictions on the use of open access content

While using other scholars' works, readers are allowed to use such works within certain limits. Similarly as authors, they expect to allow or restrict access to their work within certain conditions. Several studies have investigated on what readers and authors expect regarding permissions and restrictions on open access publications. Gadd, Oppenheim and Probet (2003) established that majority of the respondents expected to display, save, print and excerpt from open access works freely. Majority of the respondents also indicated that they were not at all expected to sell, lease, modify, or copy the open access articles authored by others. Many respondents also could allow aggregation and annotation of their articles within certain limitations or conditions. The same study reveals that academics as authors would allow free display, printing, saving, excerpting and copying of their works. As authors, the respondents could also permit limited or conditional lease, aggregation, modification, and annotation but could not at all allow the selling of their work. From the study in question, it is noted that restrictions and conditions which majority of the users agreed with were identical to those acceptable by over 50% of authors.

The possibilities to view, print, save, copy and quote are among the expected use of other scholars' works by the research community (Pelizzari, 2003). As authors, majority of the respondents could allow displaying, printing, saving and excerpting of their work by readers (Pelizzari, 2003). Based on this study, majority of the respondents, however, could not allow at all the modification and annotation of their works by other users. From the above study an interesting aspect to note is that what authors expected users of their work to abide by was almost similar to what such authors observed while using other scholars' works. Based on such findings, there is more likelihood for researchers to be convinced to submit their articles in institutional repositories since their interest matches with what they expect other people to do with their works.

2.5.2 Willingness to participate in an institutional open access initiative

Researchers' willingness to participate in building up of institutional repositories is crucial for the success of any repository. Some studies indicate that most of the respondents were willing to contribute to or submit their works to institutional or other repositories (Pelizzari, 2003; Xu, 2005; Swan and Brown, 2005; Kim, 2006; Lwoga, 2006; Jean et al, 2009; Kaur and Ping, 2009; Sanchez-Tarrago and Fernandez-Molina, 2009; Utulu and Bolarinwa, 2009). Pelizzari (2003) found that despite the fact that majority of the respondents showed their willingness to participate in an institutional open access initiative, they were willing to do so only when certain conditions are met. The most frequent cited conditions were the possibility for them to concurrently continue publishing using traditional channels (82%), integrity of their work guaranteed (79%) and protection against plagiarism (71%). Almost 60% of the respondents forwarded the request that their material should be indexed in some way to ensure ease of retrieval. Knowing researchers' conditions for their willingness to contribute their scholarly content into institutional repositories is necessary so that it suits the stakeholders' interests. This is due to the fact that the sustainability and growth of such repositories highly depend on authors' willingness to contribute their publications to such repositories

2.5.3 Mandating scholars' publishing in institutional repositories

Among the proposed means to increase involvement of scholars in institutional repository development and other means of self-archiving is to mandate contributions to such repositories (Pinifield, 2005; Swan and Brown, 2005; Suber, 2008; Grundmann, 2009; Sanchez-Tarrago and Fernandez-Molina, 2009). A study by Swan and Brown (2005) suggests that employers and research funders could impose a mandate on self-archiving without jeopardising the goodwill of their researchers. In fact several studies show that majority of scholars (both self-archivers and non-self-archivers) would comply with an employer or funders' mandate to self-archive and a minority would comply reluctantly or not comply at all (Swan and Brown, 2005; Sanchez-Tarrago and Fernandez-Molina, 2009). According to Grundmann (2009), mandates become useful only when universities' stakeholders are supportive.

Kim (2006) also points out that grant-awarding bodies and university or department actions had some influence upon the respondents' decisions to make or not to make their materials publicly accessible. The importance of OA mandates is exemplified by Suber (2008) who reported that due lack of such a mandate, the compliance rate of publishing in open access outlets was only 3.8% for the US National Institute of Health (NIH) grantees in 2006. Suber made a comparison of the NIH compliance rate with that of Wellcome Trust that recorded 100% compliance rate as a result of the mandated OA to its funded research since 2005. This is probably the reason behind Sale's (2006) recommendation that organisations in developing countries should consider the development and implementation of similar policies for institutional repositories to be successful. Such mandates can be more attractive if attached to the research rewarding system. For example, institutions may decide to offer tenure rewards for publications that are also deposited in institutional repositories.

2.5.4 Acceptable institutional repository content

An institutional repository may host varieties of materials depending on the institutional preferences. Pelizzari (2003) found that many respondents were willing to deposit teaching materials (70%), followed by materials that had passed through quality control test (60%) and pre-prints (50%). There was less support for material that had not passed through a quality control test. On the other hand, Pickton (2005) found that complete theses, post-prints and conference papers were the acceptable documents by student researchers for inclusion in the repositories.

Based on the international study findings, Swan and Brown (2005) revealed that post-prints, conference papers, pre-prints, technical reports, working papers, book chapters, dissertation or thesis, in that order of priority, were the most preferred documents for inclusion in the institutional repositories. Majority of the agricultural researchers in Tanzania were also found to be more willing to contribute or submit conference papers, technical reports, working papers, scientific journal articles, newsletter articles, newspaper articles, preprints, and theses in repositories (Lwoga, 2006). In their recent study, Jean *et al* (2009) established that institutional repository end users would like journal articles, conference papers, theses and dissertations and every intellectual property of the university such as lectures, raw data, newsletters and other unpublished works to be included in their institutional repository.

The wide range in types of documents preferred for inclusion in repositories as observed above are in accordance with the acceptable materials in the general digital repositories' collections (Association of Research Libraries (ARL), 2009). This suggests the need for determining the most acceptable repository content for specific research communities. In some research communities, only peer-reviewed documents are acceptable while in other situations even non-peer-reviewed documents are acceptable. However, most documents emanating from developing countries stand a better chance of visibility if deposited in institutional archives since they are not tapped in the existing publishing system. Probably the most important aspect to pay attention to before putting them in the institutional repositories is to consider the possibility of making these documents undergo peer-review process. Views from the academic community regarding this aspect maybe interesting taking into account that

among the criticism against open access, include the review process of open access materials.

2.5.5 Preferred repository type

Scholars wishing to contribute their articles into open access repositories have a number of options including personal web pages, departmental or institutional websites or subject-based websites. Several studies have looked at preferences by various contributors. Gadd, Oppenheim and Probet (2003) reveal that majority of the respondents had made their papers available through institutional repositories. A study by Pelizzari (2003) established that among 35 respondents, majority of the respondents preferred departmental websites followed by personal sites or web pages. Contrary to these findings, Swan and Brown (2005) show that more respondents in their study opted for making their publications available through departmental or institutional websites followed by personal web pages and lastly subject-based repository websites.

Kim (2006) also found that research articles were self-archived mostly in personal web pages, research group web sites and disciplinary repositories in that order of priority. Preference of repository type may have some influence on the success or failure of institutional repositories. For example, in cases where authors would prefer to make their articles available through their personal websites, filling institutional repositories may be problematic. It is thus necessary to establish authors' preferences regarding repository type before starting to establish a repository. Failure to do that may result into establishing a repository that remains empty as a result of authors' unwillingness to deposit their articles due to their different preferences.

2.5.6 Responsibility for institutional repository management

There are different arguments with regard to which unit within the institutional set up is appropriate to manage the institutional archive. A study by Pelizzari (2003) indicates over 70% of the respondents singled out the library as the structure to be given the mandate of managing an institutional archive. According to De Beer (2005) and Kaur and Ping (2009), the respondents in such studies were of the opinion that libraries should own and manage the institutional repositories. Other respondents preferred a pre-existing central structure such as a unit responsible with research co-

ordination; a purpose-built central structure; and a structure with connections to their faculty to be responsible (De Beer, 2005). Kamila (2009) further acknowledges that libraries have strategic roles in shaping institutional repositories the world over. Supporting the central role of research in repository management, ARL (2009) proposes the following key functions by libraries to ensure the success of digital repositories:

> Build a range of new kinds of partnerships and alliances, both within institutions and between institutions;

> Base service-development strategies on substantive assessment of local needs rather than blindly replicating work done at another institution;

> Engage with key local policy issues and stakeholders to encourage institutional engagement with national and international policy issues;

> Develop outreach and marketing strategies that assist "early adopters" of repositories to connect with the developing repository-related service system and;

>   Define a scope of responsibility to guide the development of repository services for varied forms of content (ARL, 2009: 10).

Based on the above studies, institutional libraries seem to be the most acceptable units within the university set up for the establishment and management of institutional repositories. Depending on different organisational set ups, it is still important to reach a consensus regarding the appropriate managing unit of the institutional repository within the university before establishing repositories so as to get researchers' support in building repositories in question. However, regardless of which unit takes the responsibility of an institutional repository management, a close collaboration with other units within the institution is still important to ensure ownership of such repositories by all stakeholders within an institution as emphasised above by ARL (2009).

2.5.7 Copyright retention

The inclusion of a published article in an open access archive raises copyright issues that need special consideration since some publishers do not allow self-archiving of pre- and post-prints' versions of paper submitted for publication and/or published in their journals. How do authors deal with copyright issues when posting their articles into repositories? A number of studies have looked at attitudes of authors on copyright aspects.

Lawal (2002) established that the author population as a whole did not attach much importance to issues of being able to retain their copyright in the article, nor gaining permission to place a pre- or post-print on the web or in some kind of repository. An investigation by Pelizzari (2003) shows that majority of the respondents ceded copyright of their work to publishers willingly or reluctantly, and that just a few individuals affirmed that their publishers did not require transfer of the copyright. Interestingly, majority of the respondents were also prepared to negotiate with publishers to retain copyright so that their publications can be published in an institutional archive. Swan and Brown (2005) revealed that over one third of the respondents of their study claimed that for their last published article, the journal publishers retained their copyright followed by those who retained copyright themselves and those who did not know as to who retained the copyright. The same investigation also reveals that for the last articles self-archived by the respondents, majority of them did not know whether they were required to ask permission from the publisher and for that reason they archived their articles without asking permission from their publishers. Similar findings are noted in a study reported by Kaur and Ping (2009). In the cited study, it is noted that out of ten respondents who deposited their scholarly content in an institutional repository, only one of them was confident about copyright issues.

A study by Rowlands, Nicholas and Huntingdon (2004) showed that generally researchers do not value the opportunity of retaining copyright or requesting for the reproduction permission from publishers suggesting there is a disincentive for open access development. Many authors think that copyright negotiations should be done by libraries as they are responsible with institutional repository management (Kaur and Ping (2009). From the above observations it can be noted that copyright retention

does not appear as an issue for many researchers. More advocacies to researchers on the importance of copyrights can probably enlighten them on the need for retaining copyrights of their publications in order to deposit them in their institutional repositories.

2.6 Chapter summary

The purpose of the literature review in this Chapter was to identify similar studies to the current investigation for the establishment of benchmarks against which the researcher can compare and contrast the emerging research results. The review also identified gaps to be further addressed in this study. From the reviewed literature, there is evidence of several large scale surveys that investigated the researchers' awareness and usage of open access; facilitating and inhibiting factors of open access adoption as well as researchers' perspectives towards open access. Most of the reviewed studies adopted a lengthy questionnaire administered electronically by e-mail or web form, few of the studies adopted face to face interviews and content analysis. In general therefore, most of such studies provide useful results for comparison with the current investigation.

However, noted from the review is that majority of the studies addressed the aspects of either open access journals or repositories separately and in some cases focusing in a few research disciplines. Many studies also concentrated on self-reported usage of open access with little potential of revealing the actual usage. In such cases it was difficult to establish the overall picture of open access adoption. Most important is the fact that majority of the studies were skewed to developed countries.

Despite a few of them having a wider geographic coverage, they had inadequate representation of respondents from developing countries. Very few studies about open access were done in Africa and particularly in public universities in Tanzania. It is generally acknowledged that researchers from different research communities are likely to have different levels of awareness, usage, perceptions and attitudes regarding open access (Comba and Vignocchi, 2005). Thus, the fact that most of the reviewed studies were skewed to developed countries implies that they may not necessarily reflect the existing situation of the local conditions in different developing countries. Therefore, there was a need to conduct specific country studies in order to understand

the peculiar differences across different research environments so as to come up with proper strategies for an effective promotion of open access adoption in such countries. This investigation was thus designed to investigate the factors affecting the adoption of open access in selected public universities in Tanzania. The study took aboard various research disciplines among researchers from different public universities in Tanzania for better understanding of their awareness, usage, perceptions and attitudes towards open access. The following Chapter reviews common technology acceptance models for the purpose of identifying and/or formulating the most suitable research model to guide this study.

CHAPTER THREE

TECHNOLOGY ACCEPTANCE AND USAGE THEORIES/MODELS: THEIR APPLICABILITY TO OPEN ACCESS ADOPTION CONTEXT

3.0 Introduction

This Chapter reviews and discusses theories and models as a basis for formulating a suitable research model (theoretical framework) of the study. Specifically, the Chapter addresses the seventh research objective: to formulate a research model of technology acceptance regarding open access usage in research activities within Tanzanian public universities. Key determinants, which are also referred to as dependent variables in the research model expected to influence researchers' open access behavioural intention and usage behaviour are proposed and discussed. Finally in the Chapter, the moderators that are expected to moderate the influence of such determinants are reviewed and discussed.

3.1 Models defined

A model is defined as a systematic description of a system, a theory or a phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics (The American Heritage Dictionary of the English Language, 2004). Similarly, according to Burch (2003: 266), a model is any abstract representation of some portion of the real world, constructed for the purpose of understanding, explaining, predicting or controlling a phenomenon being investigated. Burch identifies three types of models: 1) Physical models (e.g. a model of the hydrogen atom); 2) Visual models (e.g. a diagram of demographic transition); and 3) Theoretical models (e.g. the theory of evolution). From a scientific perspective, a model can therefore simply be referred to as a set of variables and their logical relationships constructed for the purpose of explaining a subject or the studied phenomenon.

3.2 Theories defined

According to The American Heritage Dictionary of the English Language (2004), a theory is defined as "a set of statements or principles derived to explain a group of facts or phenomena, especially the one that has been repeatedly tested or widely accepted and can be used to make the predictions about natural phenomena". Similarly, Singleton, Straits and Straits (1993) as well as Powell and Connaway (2004) consider a theory as a set of explanatory variables used to describe the causal relationship for the occurrence of events under investigation. In short, a theory is an explanation based on observation, experimentation, and reasoning that has been tested and confirmed as a general principle to help explanation and prediction of phenomena. Theories are developed and tested to guide researchers on which relationships to observe, what variables are likely to affect what is being studied, and the conditions under which a causal relationship is likely to exist.

3.3 Similarities and differences between models and theories

From the above definitions of theories and models, it is evident that the two terms are closely related. The main difference between them is on the rigour to which each of them has been subjected in its testing and verification. In other words, a model needs further testing by empirical observation and experiments for it to qualify into a theory.

While a theory emanates from a systematic and formalised expression of previous empirical generalisations and experimental testing, a model need not necessarily be derived from empirical generalizations and testing (Burch, 2003). Indeed, according to Burch (2003: 280), "some authors distinguish theories and models by assigning the latter a role as intermediary between theory and empirical data but such a difference is regarded not fundamental". Due to their relatedness, most technology acceptance studies have used the two terms interchangeably. For example, the most common technology acceptance theories and models are simply referred to as theories or models (Venkatesh *et al,* 2003; Peter, 2004; Kripanont, 2007; Wu, Tao and Yang, 2007). In this study, although models and theories are considered as playing the same role, the former is treated as an intermediary towards a theory development. In this respect therefore, a theory is considered to emanate from a model that has undergone repeated tests and validation to support empirical generalisations.

3.4 Theories and their role in the research process

Theories play a critical role in the research process from planning, data collection and explanation of the emerging findings. According to Whitworth (2007), theories propose and connect abstract constructs/variables, and research transforms them into the physical data. Researchers who proceed "without a theory or model rarely conduct top-quality research and frequently find themselves in quandary" while reporting their research findings (Neuman, 2006: 77). Theory direction, level of analysis, theory focus, and form of explanation are important aspects that need to be specified at early stages of the study to avoid confusion during data collection, analysis as well as theory testing (Klein, 1994; Neuman, 2006). The following subsections briefly describe the four theory aspects and specify how they are used in the context of this study.

3.4.1 Theory direction

Theory direction may either be deductive or inductive (Leedy and Ormrod, 2005; Neuman, 2006; Al-Qeisi, 2009). To theorise using the deductive approach, the researcher begins with "abstract concepts or a theoretical proposition and outlines the logical connection among concepts and then moves towards concrete evidence" (Neuman, 2006: 59). On the other hand, for the inductive approach, the researcher begins with collecting empirical evidence before developing theoretical concepts and propositions. It should be noted that in the deductive approach the researchers adopts more quantitative questions than qualitative questions while the opposite is true with respect to inductive theorising (Al-Qeisi, 2009). In this study, the deductive approach of theory direction was adopted with respect to testing and validation of the research model. This choice was motivated by the fact that data collection without theory guidance may lead to time and effort wastage for lack of research focus (Whitworth, 2007). According to Leedy and Ormrod (2005: 32), deductive reasoning is also "extremely valuable for generating research hypotheses and testing theories". By employing the deductive approach in this study, only relevant data were collected unlike the inductive approach in which data are gathered with little focus at the beginning as the theory is applied towards the end of the research with the possibility of collecting some irrelevant data. Furthermore, this approach was useful in validating the research model as will be noted in the subsequent chapters of this thesis.

Semi-structured questions involving some open ended questions were also used for data gathering as will be noted in Chapter Four. This implies that to some extent inductive theorising was equally important in the study. This is true for data collected beyond those intended for the validation of the research model. Any mixed research method involving qualitative and quantitative approaches like this one has elements of both deductive and inductive theories (Al-Qeisi, 2009). Both deductive and inductive approaches were considered important in this study as the former "supplies the shape of the argument and induction establishes agreement about one or more stages of in the argument" (Al-Qeisi, 2009: 202)

3.4.2 Levels of analysis

There are three main levels of theories in social inquiry: micro, meso and macro levels. Neuman (2006 & 2007) describes the three levels of theorising as follows: Micro-level theory - focuses on the micro level of social life in short durations (e.g. face to face interactions among individuals or small groups); while macro-level theory focuses on the macro-level of social life (e.g. social institutions, major sectors of societies, or world regions) and the processes that occur over long durations (many years, multiple decades, or a century or longer); and meso-level theory focuses on the relations, processes, and structures at middle level of social life (e.g. organisations, movements, and communities) and events occurring over several months or years. Based on the nature of this study, micro-level theory was more appropriate as the study focuses on individual researchers for data gathering as well as units of analysis to assess the acceptance and usage of open access in public universities in Tanzania.

3.4.3 Focus of theory

The focus of a theory can either be substantive or formal. Substantive theory is a set of prepositions which furnish an explanation for an applied area of inquiry while a formal theory is general and applies across many disciplines (Glazier & Grover, 2002; Abdallah, 2005; Neuman, 2006). While substantive theory offers powerful explanations for a topic area as a result of being tailored to it and incorporating rich details "from specific settings, processes, or events, it is often difficult to generalize to different topic areas using such type of a theory" (Neuman, 2006: 62). On the other hand, formal theories help researchers to recognize and explain similar features that operate across several different topics but are difficult to apply to specific social

settings unless adjustments are made to suit such contexts (Neuman, 2006; Abdallah, 2005). The goal of this research was to formulate a research model for open access scholarly communication in public universities in Tanzania based on the existing technology acceptance theories. The study therefore adopts the substantive theory focus for deeper understanding of researchers' behavioural intention and usage of open access. The research model may be subjected to further validation by other studies for applicability to other research contexts.

3.4.4 Forms of explanation

There are basically three major forms of theoretical explanation that social scientists employ in explaining their research findings. They include: causal, structural, and interpretative (Neuman, 2006 & 2007). According to Neuman (2006: 63), "the causal explanation is a theoretical explanation about why events occur and how things work expressed in terms of causes and effects". The structural explanation is about "why events occur and how things work expressed by outlining an overall structure and emphasizing location, interdependences, distances, or relations among positions in that structure" (Neuman, 2006: 69). Neuman (2007) further describes the structure in question to be like a wheel with spokes like the web with interconnected parts where aspects of social life are explained. A type of theoretical explanation about why events occur and how things work, expressed in terms of the socially constructed meanings and subjective worldviews is what is referred to as interpretative explanation. The interpretive theorist tries to comprehend or mentally grasp the operation of the social world without differing with the understanding of other people. According to Neuman (2006: 72), this type of explanation is about "why events occur and how things work expressed in terms of socially constructed meanings and subjective worldviews". This research adopts the causal explanation. This type of explanation is considered appropriate for this study as it simplifies the understanding of the subject being investigated. As is the case under the current study, using this approach, researchers normally use diagrams to show the causal relations in order to present a simplified picture of the existing relationships of the variables under the study.

3.5 Technology acceptance theories and models

According to Louho, Kallioja and Oittinen (2006: 15), "technology acceptance is about how people accept and adopt some technology to use". The main objectives of many technology acceptance studies are to investigate how to promote usage and also explain what hinders acceptance and usage of technologies (Kripanont, 2007). This is in line with the present study aiming at investigating the factors that affect the adoption of open access in Tanzanian public universities in order to device the means of promoting the adoption of the new mode of scholarly communication. A review of the existing technology acceptance models/theories is therefore important for the researcher to gather theoretical concepts that can be used as a basis in formulating a sound research model for this study.

A number of models/theories designed to facilitate the understanding of factors impacting the acceptance and use of technologies have been documented (Venkatesh *et al*, 2003; Kripanont, 2007; Barati and Mohammadi, 2009; Ghobakhloo, Zulkifli and Aziz, 2010; Jayasingh and Eze, 2010). The following are some of the well known technology acceptance models and theories:

> ➢ Theory of Reasoned Action (TRA);
>
> ➢ Motivational Model (MM);
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> ➢ Theory of Planned Behaviour (TPB);
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> ➢ Decomposed Theory of Planned Behaviour (DTPB);
>
> ➢ Technology Acceptance Model (TAM);
>
> ➢ Technology Acceptance Model (TAM2);
>
> ➢ Combined TAM and TPB (C-TAM-TPB);
>
> ➢ Model of PC Utilisation (MPCU);
>
> ➢ Social Cognitive Theory (SCT);
>
> ➢ Innovation Diffusion Theory (IDT) and;
>
> ➢ The Unified Theory of Acceptance and Use of Technology (UTAUT).

The above models and theories have been reviewed and analysed by several studies (Szajna, 1996; Clarke, 1999; Stacy and Sally, 1999; Lederer *et al*, 2000; Legris, Ingham and Collerette, 2003; Venkatesh *et al*, 2003; Gengatharen and Standing, 2004; Perez, *et al*, 2004; Rosen, 2005; Minishi-Majanja and Kiplang'ati, 2005; Kripanont, 2007; Al-Qeisi, 2009; Van Biljon and Renaud, 2009; Ghobakhloo, Zulkifli and Aziz,

2010; Jayasingh and Eze, 2010). From such reviews and analysis it is evident that each technology acceptance theory or model has different premises and benefits such that researchers are confronted with a choice among a multitude of theories/ models. Despite the specific advantages of each theory, the capability of a theory/model in predicting and explaining behaviour is measured by the extent to which the predictors in the theory could account for a reasonable proportion of the variance in behavioural intention and usage behaviour (Kripanont, 2007). According to Singleton, Straits and Straits (1993), a theory or a model should be judged superior to others if: 1) it involves the fewest number of statements and assumptions, 2) it explains the broadest range of phenomena, and 3) its predictions are more accurate. It should however be noted that while the fewest number of variables is desirable for a theory, its contribution to the understanding of the studied phenomena is equally crucial and hence a balance of the two aspects is quite important. For predictive, "practical application of the model, parsimony (few predictors) may be heavily weighed, on the other hand, if trying to obtain the complete understanding of phenomena, a degree of parsimony may be sacrificed" (Kripanont, 2007: 80).

Due to the existence of several competing technology acceptance theories and models, it has necessitated researchers to compare them in order to identify the most promising ones in respect of their ability to predict and explain individual behaviour towards acceptance and usage of technology. According to Kripanont (2007), most of such studies have made comparison of two or three theories. Contrary to most studies that made comparison of few models, studies reported by Venkatesh *et al* (2003) and Kripanont (2007) compared eight and nine models respectively. While a study by Kripanont (2007), like many other studies that compared technology acceptance models was based on literature review, Venkatesh *et al* (2003) compared the models based on empirical data. A study by Venkatesh *et al* (2003) can therefore be judged to have been a more realistic way of comparing the technology acceptance models.

Venkatesh *et al* (2003) compared 8 models to determine their ability to explain behavioural intention (the explained variance R^2) based on empirical studies conducted at different times (T1 = immediate following training but prior to introduction of new technology; T2 = one month after introduction of the new technology; and T3 = three months after introduction of the new technology). Table

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3.1 presents a summary of technology acceptance theories/models comparisons in terms of their key constructs, moderators and the explained variance.

Table 3.1: Technology acceptance models comparison

Theory/Model	Constructs (Independent variables)	Moderators	Explained variance (R^2)
Theory of Reasoned Action	1. Attitude toward behaviour 2. Subjective norm	1. Experience 2. Voluntariness	0.36
Technology Acceptance Model - a (TAM2)	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1. Experience 2. Voluntariness	0.53
- b (TAM- including gender)	1. Perceived usefulness 2. Perceived ease of use 3. Subjective norm	1. Gender 2. Experience	0.52
Motivation Model	1. Extrinsic motivation 2. Intrinsic motivation	None	0.38
Decomposed Theory of Planned Behaviour (DTPB) - a TPB (including voluntariness)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Experience 2. Voluntariness	0.36
- b TPB (including gender)	1.Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Gender 2. Experience	0.46
- c TPB (including age)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control	1. Age 2. Experience	0.47
Combined Technology Acceptance Model and Theory of Planned Behaviour (C-TAM-TPB)	1. Attitude toward behaviour 2. Subjective norm 3. Perceived behavioural control 4. Perceived usefulness	Experience	0.39
Model of PC Utilisation (MPCU)	1. Job fit 2. Complexity 3. Long-term consequences 4. Affect toward use 5. Social factors 6. Facilitating conditions	Experience	0.47
Innovation Diffusion Theory (IDT)	1. Relative advantage 2. Ease of use 3. Result demonstrability	Experience	0.40

	4. Triability 5. Visibility 6. Image 7. Compatibility 8. Voluntariness of use		
Social Cognitive Theory (SCT)	1.Outcome expectation 2. Self-efficacy 3. Affect 4. Anxiety	None	*0.36*
Unified Theory of Acceptance and Use of Technology (UTAUT)	1. Performance expectancy 2. Effort expectancy 3. Social influence 4.Facilitating conditions	1.Gender 2. Age 3. Experience 4.Voluntariness	*0.69*

Source: (Venkatesh *et al*, 2003; Kripanont, 2007)

From the comparison of models in Table 3.1, there are notable similarities and differences among technology acceptance models in terms of their constructs and moderators as well as their explanatory abilities as follows:

➤ Constructs (dependent variables) range from two (TRA and MM) to eight (IDT);

➤ Some models such as MM and SCT did not include moderators. The UTAUT model has the highest number of moderators (4);

➤ Experience is the most commonly used moderator among all theories/models that employed moderators;

➤ There is evidence that moderators can play significant role on the explanatory ability of models even under situations of similar constructs. For example, TPB employing different moderators changed the explanatory ability of different versions of the model in question from 0.36, 0.46 and 0.47 variances respectively;

➤ UTAUT model integrates constructs and moderators from across other eight technology acceptance theories/models and;

➤ The explanatory ability of technology usage intention in terms of variance ranged from 0.36 (TRA, SCT) lowest to 0.69 (UTAUT) highest.

From the above observations, it is evident that the UTAUT demonstrates the highest explanatory power in explaining behavioural intention and usage of technology.

Therefore, the theory in question contributes to better understanding about the drivers of behaviour of acceptance and use of new technologies than other similar theories and models (Venkatesh *et al*, 2003; Kripanont, 2007; Wu, Tao and Yang, 2007). UTAUT was therefore used as the main basis in formulating the research model of this study. The description and further justification for the suitability of the UTAUT model to this study is presented in the following sections.

3.6 The Unified Theory of Acceptance and Use of Technology

The UTAUT model was developed by Venkatesh and his team basing upon the conceptual and empirical similarities among eight competing technology acceptance models: TRA, TAM, MM, TPB, C-TAM-TPB, MPCU, IDT, and SCT (Venkatesh *et al*, 2003; Rosen, 2005; Schaper and Pervan, 2007; Birth and Irvine, 2009; Van Biljon and Renaud, 2009). The UTAUT model successfully integrated key elements from among the initial set of 32 main effects and four moderators from eight different models (Venkatesh *et al*, 2003; Peter, 2004; Kripanont, 2007). According to Venkatesh *et al* (2003), the UTAUT model was formulated by first, identification and discussion of eight specific models of the determinants of intention and usage of information technology; secondly, those models were empirically compared using longitudinal data from four organisations (Entertainment, Telecomm services, Banking, and Public administration); third, the conceptual and empirical similarities across the eight models were used to formulate the UTAUT model; and fourth, the UTAUT model was empirically tested using the original data from the above four organisations and then cross-validated using new data from additional two organisations (Financial services and Retail electronics).

From the theoretical perspective, the UTAUT model provides a refined view of how the determinants of intention and behaviour evolve over time. This model provides a useful tool for the management needing to assess the likelihood of success for technology introduction as well as helping to understand the drivers of technology acceptance so as to proactively design interventions including training targeted at populations of users that may be less inclined to adopt and use new technology (Venkatesh *et al*, 2003; Kripanont, 2007). As illustrated in Figure 2 (page 92), the UTAUT model postulates three indirect determinants of new technology usage (performance expectancy, effort expectancy, and social influence), and two direct

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determinants of usage behaviour (intention and facilitating conditions). Four moderators, gender, age, voluntariness, and experience were identified to play specific moderating roles to the indirect and direct determinants of technology use behaviour. The following subsections elaborate on the key determinants and moderators of the UTAUT model.

3.6.1 Indirect determinants of technology usage

Indirect determinants of technology usage are those factors that influence individuals to build interest toward technology usage. Such factors are briefly explained under the following sub-sections.

3.6.1.1 Performance expectancy

Performance expectancy is the degree to which an individual believes that the new innovation will help him or her to attain gains in job performance (Venkatesh *et al*, 2003). This concept is similar to perceived usefulness in the Technology Acceptance Model; Combined Technology Acceptance Model and Theory of Planned Behaviour; outcome expectations in Social Cognitive Theory; and as relative advantage for Innovations Diffusion Theory (Venkatesh *et al*, 2003). According to UTAUT model, it is expected that individuals will build interest of using a certain technology if they believe that it will enable them to improve their performance in what they are doing. This means that unless the new technology improves efficiency or quality of an individuals' job, it is less likely to attract their interest on it. The relationship between performance expectancy and intention is moderated by age and gender such that performance expectancy directly affects intention of technology usage and is stronger for men and younger workers than it is for other categories of people (Venkatesh *et al*, 2003; Louho, Kallioja and Oittinen, 2006).
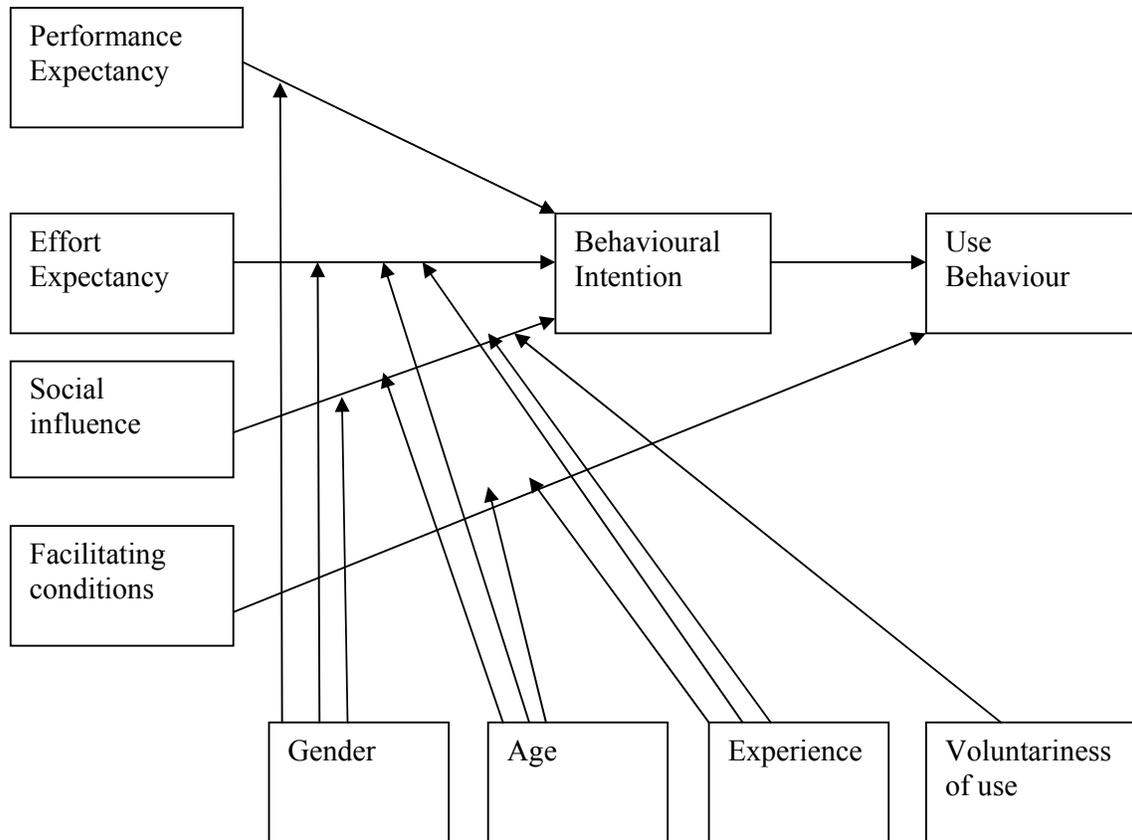
Figure 2: The UTAUT Model (Venkatesh *et al*, 2003: 447)

3.6.1.2 Effort expectancy

Effort expectancy is the degree of ease associated with the use of the system and is considered to be similar to "perceived ease of use (Technology Acceptance Model), Complexity (Model of PC Utilization), and Ease of Use for Innovation Diffusion Theory)" (Venkatesh *et al*, 2003: 450). The model postulates that individuals are likely to show interest in technology usage if that technology is easy to use. This means less complicated technologies can easily attract usage intention of many users than complicated technologies. Age, gender and experience are considered to play significant moderating roles for effort expectancy towards technology usage behavioural intention. Effort expectancy is said to influence behavioural intention and is stronger for women, older workers, and those with limited experience than for other categories of people.

3.6.1.3 Social influence

Social influence is defined as the degree to which an individual perceives it important that other people believe he or she should use the new system (Venkatesh *et al*, 2003). According to Venkatesh and his co-authors, this aspect is regarded as subjective norm in the theories of Reasoned Action, Technology Acceptance Model, Combined Technology Acceptance Model and Theory of Planned Behaviour; social factors in Model for PC Utilisation; and image for Innovation Diffusion Theory. Developers of this theory believe that individuals will be in a position to show interest in technology usage if their peers or superiors value and encourage them to use such technologies. In other words, individuals' intention to use new technology is expected to be high if such individuals expect their peers will look positively at them if they use that technology. Social influence is moderated by gender, age, experience and voluntariness of use. The effect of social influence on behaviour intention is stronger for women, older workers, those with limited experience, and those using the system under mandatory conditions.

3.6.2 Direct determinants of technology usage

According to the UTAUT model, technology usage is subject to individuals building interest (behavioural intention) toward it. In other words, behavioural intention of an individual towards a technology will ultimately lead him/her to use the technology in question. In addition to behavioural intention, the UTAUT model also considers facilitating conditions as the other direct determinant of technology usage.

Facilitating conditions are defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system (Venkatesh *et al*, 2003). According to Venkatesh *et a*l (2003: 453), this definition is also conceptualised as: "perceived behavioural control (Theory of Planned Behaviour); facilitating conditions (Model of PC Utilization); and compatibility (Innovation Diffusion Theory)". In this model, it is postulated that the usage of technology is dependent on the availability of an enabling environment for its application. For example, computer applications may not be expected in an organisation without such facilities. The influence of facilitating conditions towards usage of technology is moderated by age and experience such that its effect is stronger for older workers and those with more experience. In other words, it is expected that

older people would be less interested in adopting the technology than would be the case with young workers. The effect of facilitating conditions on technology usage is also expected to increase with experience "as users of technology find multiple avenues for help and support throughout the organisation, thereby removing impediments to sustained usage" (Venkatesh *et al*, 2003: 453).

3.7 The UTAUT model adoption by technology acceptance studies

Despite its novelty, the UTAUT has been tested and has received acceptance among technology acceptance researchers. The acceptance of this model rests on its high explanatory power. During its development, the UTAUT model test results revealed that it was capable to account for 70% of variance in intention to use technology while other models could explain less than 50% of variance (Venkatesh *et al*, 2003; Rosen, 2005). Some of the technology acceptance studies that adopted the UTAUT model as the main basis for their theoretical frameworks include the following:

> ➢ SMEs adoption of wireless LAN technology: applying the UTAUT model (Anderson & Schwager, 2004);
> ➢ Empirical investigation of the acceptance of electronic negotiation support systems (Kohne *et al*, 2005);
> ➢ The effect of personal innovativeness in technology acceptance (Rosen, 2005);
> ➢ Factors affecting the use of hybrid media applications (Louho, Kallioja and Oittinen, 2006);
> ➢ Open access and science publishing: results of a study on researchers' acceptance and use of open access publishing (Hess *et al*, 2007);
> ➢ Examining technology acceptance model of Internet usage by academics within Thai business schools (Kripanont, 2007);
> ➢ Investigation of factors affecting technology acceptance and use decisions by Australian allied health sciences (Schaper and Pervan, 2007);
> ➢ Validating the Unified Theory of Acceptance and Use of Technology (UTAUT) tool cross-culturally (Oshlyansky, Cairns and Thimbleby, 2007);
> ➢ Using UTAUT to explore the behaviour of 3G mobile communication users (Wu, Tao and Yang, 2007);

- ➢ Application of the UTAUT model for understanding of students perceptions in using course management software (Marchewka, Chan and Kostiwa, 2007);
- ➢ Open access publishing in science: why it is highly appreciated but rarely used (Mann *et al*, 2008);
- ➢ Analysing the use of UTAUT model in explaining an online behaviour: Internet banking adoption (Al-Qeisi, 2009);
- ➢ Preservice teachers' acceptance of ICTs integration in the classroom: applying the UTAUT model (Birth and Irvine, 2009);
- ➢ User acceptance of Internet banking: an extension of the UTAUT model with trust and quality constructs (Cheng *et al*, 2009);
- ➢ Validating the unified theory of acceptance and use of technology in Kuwait ministries: a structural equation modelling approach (Helaiel, 2009);
- ➢ Behavioural analysis of information technology acceptance in Indonesia small enterprises (Suhendra, Hermana and Sugiharto, 2009);
- ➢ Information technologies acceptance and use among universities in Uganda: a model for hybrid library services end-users (Tibenderana and Ogao, 2009) and;
- ➢ Integrating TTF and UTAUT to explain mobile banking adoption (Zhou, Lu, and Wang, 2010)

Majority of the above studies investigated the general acceptance and usage of ICTs in different work environments while only two articles those by Hess *et al*, 2007 and Man *et al*, 2008 which were based on same study were on open access aspects. It is also noted that most such studies adapted main constructs and moderators of the UTAUT. With the exception of three studies, those by Marchewka, Chan and Kostiwa (2007), Birth and Irvine (2009) and Helaiel (2009) established no strong support for UTAUT, the remaining of the above studies found that the UTAUT model was robust (with most of constructs being reliable).

Based on its comprehensiveness and high explanatory power in comparison to other technology acceptance and use models as well as its acceptability, the UTAUT model was adapted for guidance of this study. It should be noted however that although the UTAUT model is very promising in enhancing our understanding of technology

acceptance, it still needs modifications to suit industry type and specific research settings (Kripanont, 2007; Marchewka, Chan and Kostiwa, 2007; Wu, Tao and Yang, 2007). According to Kripanont (2007), instruments that have been developed and repeatedly tested in studies in other business settings may not be equally valid in professional settings such as researchers (Kripanont, 2007). It is probably on similar grounds that Venkatesh *et al* (2003: 470) recommended further work on identification and testing the additional boundary conditions of the UTAUT model in an attempt to "provide richer understanding of technology adoption and usage behaviour in different organisational and technological contexts". As will be noted under the following section, the UTAUT model was modified to suit the specific research environment of this study.

3.8 Fitness of the UTAUT model in gender and IT theoretical perspectives

Literature on gender and IT is currently dominated by three main theories: the essentialist construction theory, the social construction theory, and the individual differences theory (Venkatesh *et al*, 2003; Zafar, 2006; Trauth and Quesenberry, 2007). With regard to IT gender gap research, essentialist theory uses biological differences between men and women to explain differences in their relationship to technology. Any difference in male or female behaviour is believed to be inherent, fixed, group-level and based upon bio-psychological characteristics. These studies conclude that men, as a group as opposed to women as a group, make decisions about technology based upon different criteria (Traut & Quesnberry, 2007). This is contrary to the social construction theory in which gender is broadly viewed as two separate groups of men and women who are affected by different sets of social influences by having different or opposing socio-cultural characteristics, which subsequently affect their relationship to the adoption of technology. On the other hand, according to Trauth and Quesenberry (2007), the individual differences theory of gender and IT examines the individual variations across genders as a result of both personal characteristics and environmental influences in order to understand the participation of women in IT profession.

In order to explain gender differences in technology usage, this research adopts the social construction approach. This approach has been used by several technology acceptance studies including those based on the UTAUT model (Venkatesh *et al*, 2003; Ilie *et al*, 2005; Steinerova and Susol, 2007). The suitability of this theory to the current study is based on the fact that all the universities in the study emphasise gender equity suggesting that the main difference in technology usage in the study area may arise on social grounds, the main focus of the social construction theory.

3.9 The proposed research model

Ndunguru (2007: 47) considers a theoretical framework, which is also referred to as a research model in the current study, as "an assembly of research concepts or variables together with their logical relationships represented in diagrams, charts, graphs, pictographs, flow-charts, or mathematical sets". A theoretical framework explains how the researcher theorises or makes logical sense of the relationships among factors that have been identified as important to the problem being investigated (Kripanont, 2007). In short, a theoretical framework discusses the interrelationships among variables that are considered important to the study and helps in setting up boundaries of studied phenomena. The ultimate intention of developing a theoretical framework is to help researchers to postulate and test certain relationships so as to improve the understanding of the dynamics of the situation.

The basic concept underlying the proposed research model of this study is adapted from Venkatesh *et al* (2003) as illustrated in Figure 3. It is postulated that individual reactions towards using open access may influence their intentions to use open access scholarly communication. Also individuals' intentions to use this mode of scholarly communication may subsequently influence their actual usage of open access. Furthermore, it is postulated that individuals' actual usage of open access will determine their reactions towards continuing using the new mode of scholarly communication.

```
┌─────────────────┐        ┌─────────────────┐        ┌─────────────────┐
│ Individual reactions │    │ Intentions to use open │   │ Actual usage of open │
│ towards using open  │ ──▶ │ access          │ ──▶ │ access          │
│ access          │        │                 │        │                 │
└─────────────────┘        └─────────────────┘        └─────────────────┘
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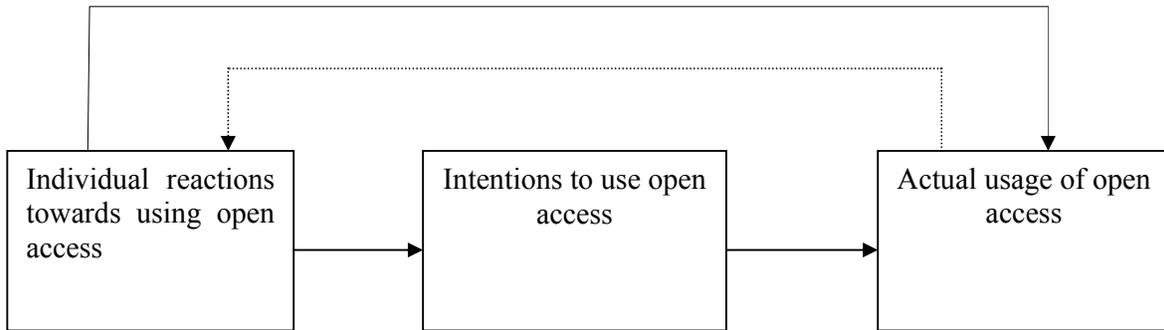
Figure 3: Basic concept of the research model (Venkatesh *et al*, 2003: 427).

The proposed research model is comprised of six core determinants or constructs (independent variables or exogenous variables - attitude, effort expectancy, facilitating conditions, Internet self-efficacy, performance expectancy and social influence); two dependent variables (endogenous variables - behavioural intention and use behaviour) and five moderators (control variables - age, awareness, experience, gender and position) as illustrated in Figure 4. Essentially, the determinants are the perceived factors expected to influence open access adoption while moderators are the conditions likely to shape the effect of the determinants. More constructs and moderators were added based on their demonstrated effects in other studies that further validated the UTAUT as well as the existing open access literature. The following sub-sections describe the proposed research model in more detail by providing the justification for the selected constructs and moderators.
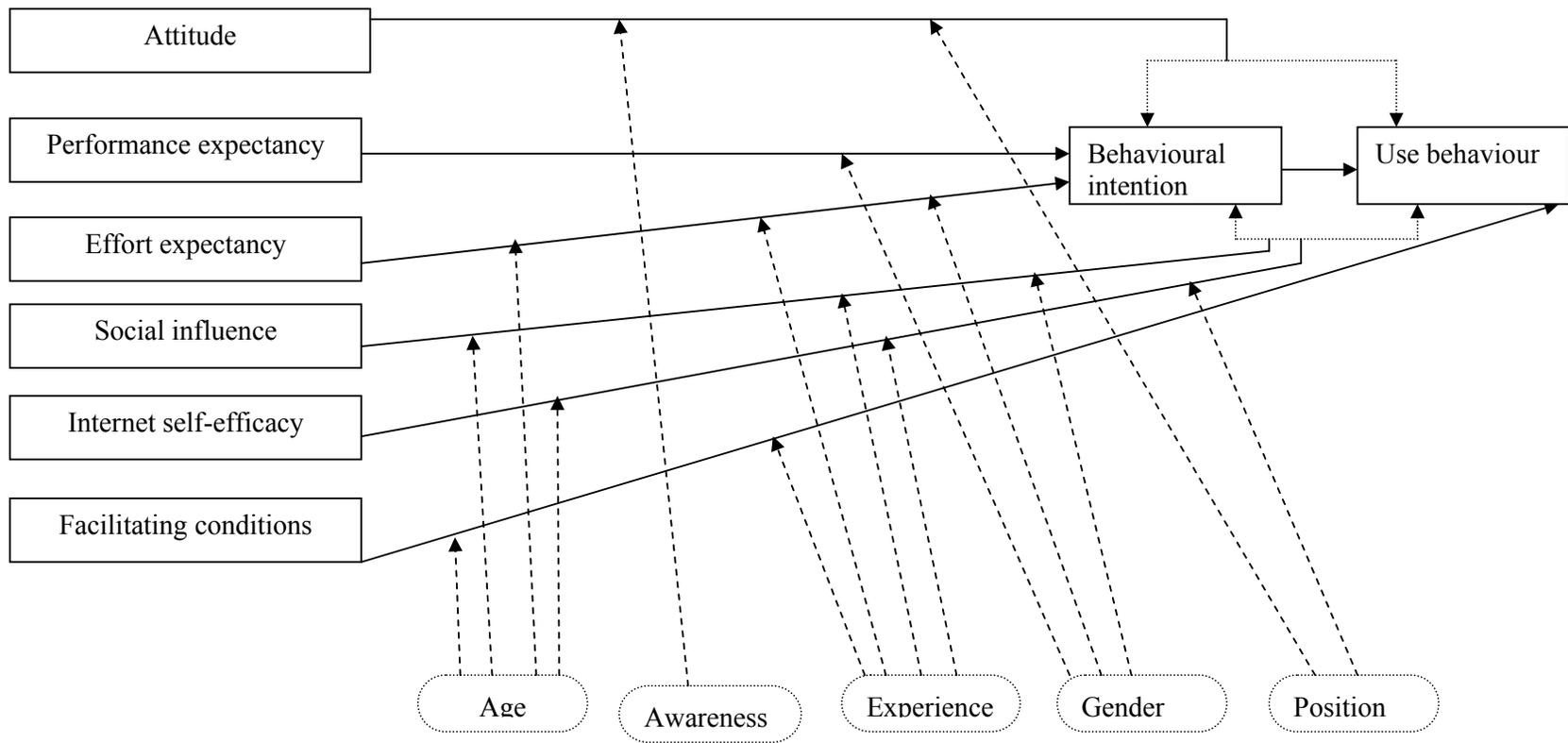
Figure 4: Proposed research model (based on UTAUT)

3.9.1 Conceptualisation on the role of attitude

Attitude is an individual's overall affective reaction to using a system (Venkatesh *et al*, 2003). The UTAUT model does not consider attitude constructs to have a significant influence on behavioural intention of technology usage on the assumption that its effect is probably being captured by the existence of other constructs such as effort expectancy (Venkatesh *et al*, 2003). However, other studies reveal that individuals' attitudes towards technology have a strong effect on use intention (Schaper and Pervan, 2004; Rosen, 2005; Louho, Kallioja and Oittinen, 2006). Schaper and Pervan (2004) for example, cited Hebert (1994) and Chau and Hu (2002) who reported that attitude towards computers were important factors for technology acceptance decisions as well as behavioural intent to physicians and nurses. Supporting such findings, a study by Louho, Kallioja and Oittinen (2006) also revealed that attitude had a strong effect toward technology use intention. In this study, researchers' attitudes towards open access are expected to influence both their intention and usage behaviour of the new mode of scholarly communication.

3.9.2 Conceptualisation on the role of performance expectancy

The performance expectancy construct has been established to be the strongest predictor of intentions and remained significant at all points for all the eight models tested by Venkatesh *et al* (2003). Previous technology acceptance studies have similarly acknowledged the strength of performance expectancy construct in predicting behavioural intention and usage of technology (Venkatesh *et al*, 2003; Schaper and Pervan, 2004; Garfield, 2005; Louho, Kallioja and Oittinen, 2006; Al-Qeisi, 2009; Suhendra, Hermana and Sugiharto, 2009; Zhou, Lu and Wang, 2010). In this study, performance expectancy relates to how well individuals believe that open access will help them in accessing and dissemination of scholarly content. Performance expectancy was therefore assessed to determine whether or not it is among the motivations for the researchers' adoption of open access.

3.9.3 Conceptualisation on the role of effort expectancy

The effort expectancy construct is said be significant in both voluntary and mandatory usage contexts during early stages of technology adoption and becomes non-significant over periods of extended and sustained usage (Venkatesh *et al,* 2003; Louho, Kallioja and Oittinen, 2006; Birth and Irvine, 2009; Helaiel, 2009; Suhendra,

Hermana and Sugiharto, 2009). According to Schaper and Pervan, (2004), effort expectancy has been found by many acceptance studies to have no significant influence on intention behaviour. Open access scholarly communication is a relatively new innovation among researchers in Tanzania (Lwoga *et al*, 2006). This factor is therefore expected to have significant influence on behavioural use intention of open access by researchers in Tanzanian public universities. In this study effort expectancy is the extent with which authors find it easy or difficult to disseminate their scholarly content through open access avenues.

3.9.4 Conceptualisation on the role of social influence

With respect to this study, social influence relates to how an individual is affected by his/her peers or other leading researchers and/or his/her organisation in deciding on open access usage. There are conflicting results reported by several acceptance studies regarding social influence, some indicate that it has a direct influence on behavioural intention while others show no effect (Schaper and Pervan, 2004). According to Venkatesh *et al* (2003: 451), "none of the social influence constructs are significant in voluntary context but becomes significant when use is mandated". A recent study by Al-Qeisi (2009) also demonstrated the lack of social influence on technology usage in voluntary contexts. Contrary to Venkatesh *et al* (2003), even under the involuntary situations, Schaper and Pervan (2007) established that social influence contributed to ICTs usage. Supporting this observation, Suhendra, Hermana and Sugiharto (2009) also established social influence as among the factors that affected the level of use of information technology in small manufacturing enterprises (SMEs) in Indonesia. This study expected to further shed more light on whether or not such a determinant is significant to open access acceptance and use decisions under the research environment. More specifically, the study was set to find out the extent to which researchers are influenced by fellow scholars in their decisions regarding their choice to use open access scholarly communication.

The organisational influence is the extent to which the organisations determine scholars' decisions in making their research output freely available online. For example, employers or research funding agencies may influence scholars to make their research output publicly available by enforcing the necessary policies. There is evidence that employers or funding agencies (organisations) mandating open access

publishing influence scholars' decisions on open access publishing (Pinifield, 2005; Swan and Brown, 2005; Kim, 2006). In this study, employers and research funding agencies form the organisational system and their influence on researchers' behavioural intention or usage of open access in scholarly communication was ascertained.

3.9.5 Conceptualisation on the role of Internet self-efficacy

Internet self-efficacy refers to "what individuals believe they can do with Internet skills they possess" (Hsu, Chiu and Ju, 2004: 768). It should be noted that Internet self-efficacy in this case is about what individuals believe regarding their abilities and may not necessarily be a true indication of what they are actually able to perform. Technology self-efficacy has been demonstrated by several studies to play a key role in the acceptance and usage of technology (Ifinedo, 2006; Pan, Sivo and Brophy, 2003; Hsu, Chiu and Ju, 2004). In this study, Internet self-efficacy is considered an important factor in determining open access adoption. Since exploitation of open access is dependent on Internet usage, unless researchers demonstrate to have specific abilities to use the Internet in accessing and publishing research findings, they may not benefit from open access scholarly communication. It is thus expected that Internet self-efficacy influences individuals' decisions towards open access acceptance and usage behaviours.

3.9.6 Conceptualisation on the role of facilitating conditions

Within the context of this study, facilitating conditions include technical support in terms of infrastructure and skills provided to enable researchers' exploitation of open access. Facilitating conditions include objective factors in implementation contexts such as management support, training and the provision of technological support, all targeting at removing barriers of technology usage (Venkatesh *et al*, 2003; Schaper and Pervan, 2004).

Facilitating conditions have been found to impact on the actual usage but not behavioural intention (Venkatesh *et al*, 2003; Schaper and Pervan, 2004; Garfield, 2005; Helaiel, 2009; Suhendra, Hermana and Sugiharto, 2009; Zhou, Lu and Wang, 2010). An assessment of the availability or absence of the factors facilitating open

access adoption was done in relation to the existing practice of open access usage in the study area.

3.9.7 Conceptualisation on the role of behavioural intention in technology usage

In being consistent with the original UTAUT model and its later modified versions, it was assumed that the behavioural intention has a significant positive influence on usage of open access scholarly communication. However, contrary to the original UTAUT model that had three direct determinants of intention to use (performance expectancy, effort expectancy, and social influence), and two direct determinants of usage behaviour (intention and facilitating conditions), the proposed research model as described above has two additional determinants (attitude and Internet self-efficacy). Also in the proposed research model, attitude, social influence, and Internet self-efficacy are conceived as determinants to both intention and usage behaviour while facilitating conditions are considered to have a direct effect on open access usage only.

It is also important to note that while other UTAUT based studies like Venkatesh *et al* (2003), Schaper and Pervan (2004), and Schaper and Pervan (2007) were longitudinal (the data gathered at two or more points in time) (Kripanont, 2007), this study was a cross-sectional investigation in which the data was gathered just once over a period of time. Contrary to longitudinal studies that determine behavioural intention and usage in different times (behavioural intention - during technology introduction, and usage during technology implementation), in this study both behavioural intention and usage of open access were determined concurrently. This is based on the assumption that since all institutions in the study had Internet connectivity for more than five years, some researchers from such institutions are likely to be already using open access while others are building interest in using such a scholarly communication system.

3.9.8 Conceptualisation on the role of moderators

Moderators are variables that influence the strength or direction of relationships between independent and dependent variables (Serenko, Turel and Yol, 2006). As was noted in Table 3.2 of Section 3.2, moderators can potentially increase the predictive validity of models. Indeed, Serenko, Turel and Yol (2006: 23) cite Zhang who argues

that "low explanatory powers and inconsistencies of (many) models may be explained by exclusion of important moderating variables reflecting individual differences such as age and gender". To suit their specific research contexts, some scholars opted for adding or dropping some of the moderators while others retained the same variables as those in the original UTAUT model. Examples of studies that maintained same moderators from the original UTAUT model include those reported by Rosen (2005), Anderson and Schwager (2004), and Louho, Kallioja and Oittinen (2006), while those by Kripanont (2007) as well as Schaper and Pervan (2004 & 2007) added more moderators to the original four UTAUT moderators. The proposed research model adapts three original UTAUT model moderators and adds two more factors specifically considered important under the current study environment. It should be noted that the voluntariness moderator was not adapted in the current study due to the fact that Internet or open access usage is not mandated in the universities under the study. As a moderator, voluntariness is often used under situations where technology usage is mandatory (Venkatesh *et al*, 2003). The following subsections briefly examine moderators for the proposed research model.

3.9.8.1 Age, gender and experience

Age, gender and experience have been proposed in several UTAUT based models and evidenced to significantly moderate the influence of determinants of behavioural intention and usage. For example, according to the findings of Venkatesh *et al* (2003), it is established that the effect of performance expectancy on behavioural intention was moderated by age and gender. Based on the referred study, the effect of effort expectancy and social influence were moderated by age, gender and experience while the influence of facilitating conditions on usage behaviour was influenced by age. Several other studies (Anderson and Schwager, 2004; Rosen, 2005; Schaper and Pervan, 2004 & 2007; Louho, Kallioja and Oittinen, 2006; and Kripanont, 2007) considered the above moderators to impart various effects on independent variables towards dependent variables. Therefore age, gender, and experience were investigated to find their peculiar effects on various determinants of behavioural intention and usage of open access.

3.9.8.2 Academic position and awareness

Although the two moderators are not included in the original UTAUT model, they were added in this research model as they are considered important in the current research environment. The importance of each of the two moderators is as described in the following paragraphs.

In Tanzanian public universities, the researchers are categorised in terms of their academic position (assistant lecturer, lecturer, senior lecturer, associate professor and professor). Promotion from one rank to another takes into account the teaching and/ or research experience together with assessment of materials which those researchers have produced. A basic requirement for academic promotion based on research output is related to finding information to produce their publications as well as their publishing avenues. It is questionable whether or not researchers from different academic positions will have different perceptions or thoughts regarding open access usage. Although hardly found in the literature, Kripanont (2007) as well as Schaper and Pervan (2007) considered the academic position as an important moderator on the influence of determinants towards technology usage. In this study therefore, the academic position was used as a moderator and it was expected to have an impact on researchers' attitudes towards their intentions and usage behaviour of open access.

Despite the exclusion of "awareness" as a construct or moderator in many technology acceptance studies, it is a key factor in the process of technology usage. According to Dinev and Hu (2005: 41), "awareness raises consciousness and knowledge about a certain technology and its personal and social benefits". This view was supported by their study that established awareness as the central determinant of user attitude and behaviour towards technology. In the open access environment, awareness has also been acknowledged as an important factor determining usage of this mode of scholarly communication (Chan and Costa, 2005; Swan and Brown, 2005, Moller, 2006; Warlick and Voughan, 2006; Fullard, 2007). In this study, it was expected that open access awareness impacts researchers' attitudes towards their intentions and usage of the new mode of scholarly communication. All the moderators were tested against each of the constructs to establish whether they have any moderating effects.

3.10 Chapter summary

This Chapter briefly reviewed technology acceptance theories/models. It was concluded that the UTAUT model that combines constructs and moderators from other prominent technology acceptance models was the most suitable as a basis for development of a research model for this study. Based on the UTAUT model, a research model with six determinants of open access usage was formulated. Among the six determinants, two were expected to be direct determinants of behavioural intention only, one direct determinant of open access usage only and three were postulated to have influence on both behavioural intention and usage of open access. The proposed research model has also five moderators that are considered to influence the independent variables towards behavioural intention and usage of open access. The research model was tested and further verified using empirical data collected from researchers in Tanzanian public universities as presented and discussed in Chapters Four, Five and Six. The following Chapter discuss the research methodology and analytical techniques adopted in the study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.0 Introduction

Research methodology is a systematic way to solve a research problem scientifically and "encompasses research methods as well as the logic behind the chosen methods of the study" (Kothari, 2004: 8). This Chapter first introduces the scientific research process, the purpose of the study and approach that was adopted in conducting the study. This is followed by a discussion of the research design employed in the study. Thereafter, follows a presentation on the selection and justification of various research methods that were employed in executing the study. Ethical issues that were adhered to while conducting the research are highlighted at the end of the Chapter.

4.1 The scientific research process

Scientific research is concerned with knowledge creation and involves a series of processes before we witness the associated end products such as scholarly output. According to Kothari (2004: 12), "research process consists of a series of actions or steps necessary to effectively carry out the research and the desired sequencing of these steps". Steps involved in the research process have been classified differently by several authors but the most important aspect to note is that in practice, such steps overlap each other and as such there is no exact number as well as sequencing of these steps. For example, while Osaze and Izedonmi (2006:24) group the research process into three main stages, Leedy and Ormrod (2005: 7) present the research process circle as comprising of six stages. On the other hand, Ndunguru (2007: 21) and Kothari (2004: 12) divide that process into seven and eleven stages respectively. This research follows a modified version of the research process as presented by Kothari (2004). Figure 5 presents a research process followed in this research. The processes include: research problem definition (Chapter One); literature review (Chapter Two); and research model formulation (Chapter Three). Other processes such as the research design preparation; data collection; and data analysis are dealt with in this Chapter while the interpretation of research results is presented in Chapter Five. Chapter Six

discusses the research findings whereas Chapter Seven addresses the conclusions and recommendations of the study.

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                          │     definition      │
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│   and     │ - - - - - - ▶  │                     │  ◀ - - - - - - │ research  │
│ theories  │                │                     │                │ findings  │
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                          │ Reporting of research│
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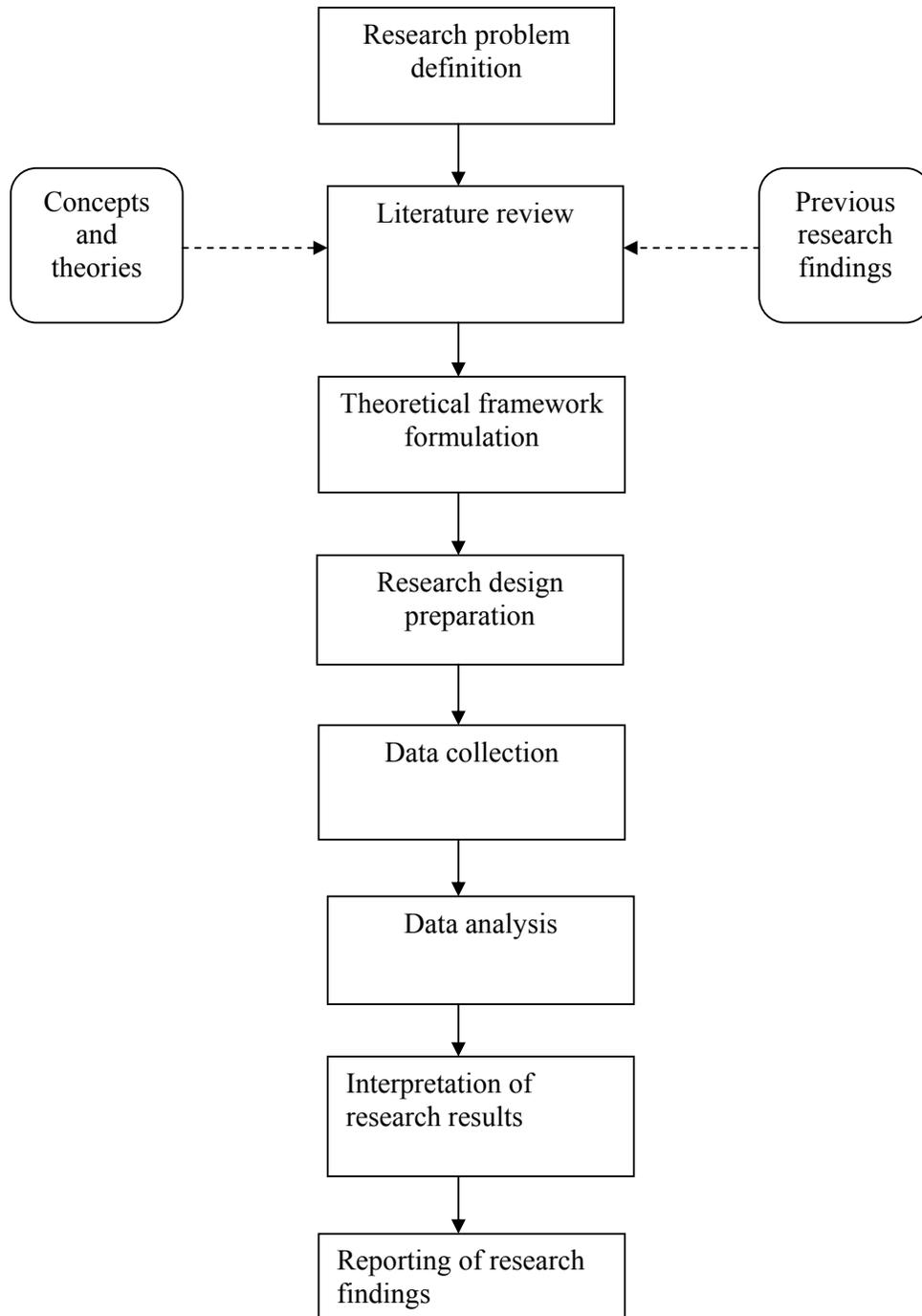
Figure 5: The research process (Kothari, 2004: 11)

4.2 The research purpose

There are three basic purposes of inquiry: exploratory, descriptive and explanatory (Mwanje, 2001; Fakhredaei, 2007). Exploratory research aims at finding out "what is happening, seeking new insights, asking questions and assessing phenomena in a new light" (Fakhredaei, 2007: 48). On the other hand, descriptive studies focus on describing particular characteristics of a specific population of subjects. The major purpose of descriptive research is a description of the state of affairs as it exists at present, while that of explanatory is on studying a situation or a problem in order to explain the relationship between variables (Kothari, 2004; Fakhredaei, 2007; Ndunguru, 2007).

The aim of this study as noted in section 1.5 of Chapter One was to investigate factors affecting the adoption of open access in research activities with the ultimate intention of recommending a model for enhancement of the use of this mode of scholarly communication in the study area. In this case, the study is considered as descriptive in nature. As noted in Chapter Three, a number of constructs and moderators were proposed as key factors affecting the acceptance and usage of open access. The objective was to determine the effect of the constructs and moderators on the intention and use of open access by researchers. This suggests that this study was also explanatory. Based on the above explanation, this research was thus both descriptive and explanatory.

4.3 The research approach

Two choices of research approaches are qualitative and quantitative (Mwanje, 2001; Aina, 2002b; Dixon-Woods *et al*, 2004; Kothari, 2004). Qualitative research involves specialised techniques in obtaining in-depth responses about what people think, do and feel for enabling researchers to gain insights into attitudes, beliefs, motives and behaviours of the target population as well as gaining an overall understanding of the underlying processes (Mwanje, 2001). In other words, qualitative research provides a deeper understanding of the phenomenon under investigation and furnishes a holistic picture of the problem under study.

Quantitative research is based on the measurement of quantity or amount. It is applicable to phenomena that can be expressed in terms of quantity (Kothari, 2004).

This is contrary to the qualitative approach that is concerned with subjective assessment of attitudes, opinions and behaviour. According to Mwanje (2001: 20), "quantitative techniques add precision in measurements; facilitate economy of description, validate statements; and increase accuracy in prediction and objectivity in social research". Quantitative approaches are thus best suited in studies that aim at generating or testing models like the case at hand. Table 4.1 summarises different qualities of qualitative and quantitative approaches to social research.

Table 4. 1: Major characteristics of qualitative and quantitative approaches in social research

QUALITATIVE	QUANTITATIVE
Provide in-depth understanding	Measures level of occurrences
Asks 'Why'?	Asks 'How many'? 'How often'? "How much"?
Studies motivations	Studies actions
Enables discovery	Provides proof
Is personal	Is anonymous
Is exploratory	Is definitive
Allows insights into behaviour trends	Measures levels of actions and trends

Source: Mwanje (2001:22).

Of the two approaches, a researcher can choose either one or a combination of both depending on the nature of the research being done. This depends on the type of questions the researcher intends to answer: "How often, How many?" or "How, Why?" In the case of the first two questions, one would require quantitative approaches while the remaining two questions can be handled better using the qualitative approach. However, in most studies both approaches are used as they employ the two kinds of questions (Mwanje, 2001:22; Dixon-Woods *et al*, 2004). Dixon-Woods *et al* (2004) cites Green *et al*, who outline the rationale for combining qualitative and quantitative methods as being:

> "*to achieve convergence of the results; to identify overlapping facets that emerge on closer inspection using multiple methods; to augment the information gained from an initial approach; to identify and examine contradictions obtained from multiple sources; to add scope and breadth to a study; to guide the use of additional sampling, data collection and analysis techniques*" (*Dixon-Woods et al, 2004: 2*).

The two approaches are also used together in order to "ensure corroboration in which one method is used to verify the findings of the other, facilitation in which one strategy facilitates or assists the other, and complementarity in which two strategies are employed to investigate different aspects of a problem" (Dixon-Woods *et al*, 2004: 2).

This research adopted a triangulation method by involving both qualitative and quantitative approaches. The choice was motivated by the need to attain corroboration, facilitation and complementarity of the two approaches as elaborated above. The other rationale was based on the research purpose as noted in section 4.1.2 above that demand a combination of quantitative and qualitative approaches. Quantitative approaches are best suited for explanatory research while qualitative approaches are more appropriate for descriptive oriented studies (Mwanje, 2001; Kothari, 2004; Fakhredaei, 2007). The quantitative approach was used in order to gather data so as to explain causal relationships, to permit generalisation, and to enable predictions about the use of open access scholarly communication in the universities addressed by the study. The qualitative approach was employed in order to establish a holistic understanding of the general acceptance and usage of open access in the study area.

4.4 The research design

A research design involves a series of decisions regarding the way the research is expected to be conducted. According to Ndunguru (2007: 67), "a research design is an assemblage of conditions for: specifying relationships among variables in a study, operationalising these variables in a study, and controlling effects of extraneous variables, and a plan for selecting the sources and types of information to be used in answering research questions". In other words, a research design is a blue print indicating the way the research is planned to be done in order to achieve its goals. A research design is considered important as it facilitates the smooth conduct of the various research operations through making research as efficient as possible by yielding maximal information with minimal expenditure of effort, time and other resources (Kothari, 2004).

Essentially, the research design should answer such questions as: Where are the data located? How much material or how many cases will be needed? How will the data be collected? How will the data be analysed? The research design in this study involved the researcher's decisions associated with the target population, sample size and sampling procedures, research strategy, data collection methods and instruments, data organisation as well as data analysis procedures. The following sections discuss the main aspects of the research design that were adopted in this study.

4.4.1 Target population

Gray (2004) defines a population as the total number of possible units or elements that are included in the study. The population of the study was the university researchers drawn from six among the eight public universities in Tanzania namely: Ardhi University, Muhimbili University of Health and Allied Sciences, Mzumbe University, Open University of Tanzania, Sokoine University of Agriculture and the University of Dar es Salaam. The six institutions were considered appropriate for this study due to their existence for more than ten years as higher learning institutions; they offered postgraduate training; had Internet access as well as enough full time researchers, all of which were the selected prerequisites for the study. The State University of Zanzibar and Dodoma University having been established in 2002 and 2007 respectively were not included in the study. These institutions were considered less suitable sources of information for the study as they were considered relatively new and did not offer postgraduate training.

The study targeted a population of 1088 university researchers from the ranks of lecturer to professor based at main campuses of the six universities in the study. Researchers were addressed by the study on the understanding that they are the prime determinants of open access development through its usage in accessing and disseminating of scholarly content (Fullard, 2007). The study also targeted 67 policy makers involved in various administrative positions from the referred universities [The deputy-vice chancellors (academic) and deans/directors] for the interview part of this study. The main motivation for involving policy makers in the study is due to the fact that they are responsible with the enforcement of various university policies likely to influence the adoption open access in such institutions (Moller, 2006; Fullard, 2007). For example, policy makers have a major influence in allocating funds

for institutional repository development projects. It should also be noted that only policy makers at higher position in the university who were responsible with academic matters were targeted by this study. This category of policy makers were considered to be more informed on academic matters (especially current issues on scholarly communication) than those who were mostly involved in general administrative matters like vice-chancellors and deputy vice-chancellors (administration and finance). Table 4.2 presents a distribution of researchers targeted for the main survey (questionnaire) of this study. From this Table, it can be noted that lecturers form the dominant group (476) while professors and senior lecturers were 306 for each group respectively. The distribution by gender indicates that there were more male than were female researchers by 856 and 332 respectively.

Junior researchers (tutorial assistants and assistant lecturers) were not included in the study on the assumption that they are not much experienced with research and scholarly communication and therefore their contribution to this kind of study could be minimal. Initially, it was proposed to include assistant lecturers in the study but this idea was dropped after the pilot study. During the pilot study, it was observed that this group of respondents overshadowed senior researchers as they represented close to 70% of all the respondents. It should be noted that the dominance of research assistants may influence the results of the study due to the fact that in the real sense most of such respondents are not much experienced as far as research and publishing are concerned. In most of the public universities in Tanzania like the Sokoine University of Agriculture, one can attain the assistant lecturer position simply by holding a masters degree without any scholarly publishing experience. For the ranks of lecturer, senior lecturer, and professor, it is mandatory for one to have published in recognised journals for almost all public universities in Tanzania. This makes such higher ranks more appropriate for this kind of study.

4.4.2 Sample size

Sample size refers to the number of items to be selected from the universe or population to constitute a sample (Kothari, 2004). Kothari recommends that the sample size should neither be excessively large nor too small but it must be optimum. According to Neuman (2006: 242), a researcher's decision about the best sample size depends on three issues: the degree of accuracy required; the degree of variability or

diversity in the population; and the number of different variables examined simultaneously. In an ideal situation (manageable population, adequate time and financial resources) the researcher is supposed to study the whole population. Sampling was considered necessary in this study due to the fact that the available time and financial resources could not allow the researcher to study the whole population of 1088 respondents. The researcher thus aimed at obtaining a representative sample of the population in order to make generalisations about the whole population. The primary purpose of sampling is to collect specific cases, events, or actions that can clarify and deepen understanding at minimal time and cost as well as high accuracy (Neuman, 2006: 219). According to Neuman, the main goal of sampling is to obtain a representative sample so that the researcher can study a smaller group and produce accurate generalisations about the larger group.

The question of sample size can be addressed in two ways. One is to make assumptions about the population and use statistical equations about random sampling processes, while the second method is a rule of thumb (Neuman, 2006). The former method requires the researcher to make assumptions about the degree of confidence that is acceptable and the degree of variation in the population. The latter method is based on the commonly accepted amount without bothering on the noted assumptions. It should be noted however that, "rules of thumb are not arbitrary but are based on past experience with samples that have met the requirements of the statistical method" (Neuman, 2006: 241). Based on the rule of thumb, for a smaller population (under 1000), a researcher needs a larger sampling ratio (about 30 percent), while for moderate populations (10,000), a smaller sampling ratio (about 10%) is recommended for equal accuracy (Neuman, 2006).

This study adopted the rule of thumb approach. Taking the population size of 1088 (considered small), a sampling factor of 0.5 was used to obtain a sample size of 544 [0.5 * 1088] researchers to be involved in the study. Table 4.3 summarises the distribution of the selected respondents from each university. The selected sample size was considered adequate since most multivariate research such as those adopting logistic regression like the current study would require around 300 responses to support the required statistical analysis (Christensen and Bailey, 2000; Kripanont,

2007). Based on the sample size of the study, the researcher was optimistic of obtaining at least 350 responses.

4.4.3 Sampling procedures

There are two main approaches of sampling i.e. probability and non-probability sampling. According to Neuman (2006: 219), "the non-probability approach is the one in which the sampling elements are selected using something other than a mathematically random process, while the probability sampling approach relies on random processes such that each element has an equal probability of being selected". In general, probability sampling is preferred by quantitative researchers because it produces a sample that represents the population and enables the researcher to use powerful statistical techniques (Neuman, 2006).

The probability sampling approach was adopted in this study in order to enable the researcher to make generalisations of the research findings to the study population using a sample of the respondents. Probability sampling can be achieved either through simple random sampling, systematic random sampling, stratified random sampling or cluster sampling (Kothari, 2004; Neuman, 2006). Stratified random sampling was used in this study in order to ensure that all categories of the respondents were included. In general, stratified sampling produces samples that are more representative of the population than simple sampling if the stratum information is accurate (Neuman, 2006). According to Neuman (2006: 231), using the stratified random sampling, "the researcher first identifies a set of mutually exclusive and exhaustive categories, divides the sampling frame by categories, and then uses random selection to select cases from each category".

Copies of the questionnaire were distributed to researchers selected through stratified random sampling across centres/institutes/directorate/faculties of the six public universities. The researcher established a sampling frame using the current lists of existing academic staff at the respective universities. The population was divided into sub-population (strata) on the basis of research disciplines, rank and gender of the respondents. The population was numbered for enabling the selection of every nth number of the potential respondents based on the sub-populations to ensure

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proportional representation of the respondents. After establishing the sampling frame using the stratified approach, the researcher drew a random sample from each sub-population through systematic random sampling. Replacements were made using the same procedure for the selected individuals who were established to be out of their work stations during the start of the data collection period. The researcher used a sample ratio of 0.5 (as determined on 4.4.2 above) in order to obtain the required number of the respondents from each strata. Table 4.3 summarises the distribution of the respondents from the established sample size (544). From the table it is noted that 27 (5%) of the respondents were drawn from ARU; 84 (15%) from MUHAS; 46 (9%) from MU; 40 (7%) from OUT; 123 (23%) from SUA; and 224 (41%) from UDSM. It is also noted that across the universities, 117 (21.5%) were females and 427 (78.5%) males. The distribution of the respondents by rank was: 152 (27.9%) professors; 153(28.1%) senior lectures; and 239 (43.9%) lecturers. With respect to distribution of researchers by discipline, 291 (54%) and 253 (46%) respondents were drawn from natural sciences and social sciences respectively.

In addition to the sample of researchers selected for the study as noted above, a total of 67 respondents including six deputy vice-chancellors, 29 deans of faculties and 38 directors of institutes/directorates from the six respective public universities were targeted for the interview part of this study.

Table 4. 2: Distribution of senior researchers at six Tanzanian public universities [N= 1088]

University	Distribution of researchers by rank			Distribution of researchers by gender		Total number of researchers
	Professors	*Senior lecturers*	*Lecturers*	*Female*	*Male*	
ARU	6	20	30	9	47	56 **(5.1%)**
MUHAS	40	56	71	32	135	167 **(15.3%)**
MU	14	32	46	22	70	92 **(8.5%)**
OUT	14	20	45	27	52	79 **(7.3%)**
SUA	104	68	74	50	196	246 **(22.3%)**
UDSM	128	110	210	92	356	448 **(41.2%)**
TOTAL	**306 (28.1%)**	**306 (28.1%)**	**476 (43.8%)**	**232 (21.3%)**	**856 (78.7%)**	**1088 (100)**

Source: Academic staff records from Deputy Vice chancellors' offices of respective universities by July 2008.

Key: ARU- Ardhi University; MUHAS – Muhimbili University of Health and Allied Sciences; MU – Mzumbe University; OUT – Open University of Tanzania; SUA – Sokoine University of Agriculture; UDSM – University of Dar es Salaam.

Table 4. 3: Proportional distribution of the respondents of the selected sample [N = 544]

Institution	Professors	Senior lecturers	Lecturers	Females	Males	Natural scientists	Social scientists	Total *(%)*
ARU	2	10	15	5	22	20	7	**27** *(5%)*
MUHAS	20	28	36	16	68	74	10	**84** *(15%)*
MU	7	16	23	11	35	3	43	**46** *(9%)*
OUT	7	10	23	14	26	13	27	**40** *(7%)*
SUA	52	34	37	25	98	102	21	**123** *(23%)*
UDSM	64	55	105	46	178	79	145	**224** *(41%)*
Total *(%)*	**152** *(27.9%)*	**153** *(28.1%)*	**239** *(43.9%)*	**117** *(21.5%)*	**427** *(78.5%)*	**291** *(54%)*	**253** *(46%)*	**544** *(100%)*

4.4.4 Research strategy

There are different research strategies or methods that can be used in conducting research. The researcher can choose a research strategy or method among an experiment, a survey, history, an analysis of archival records and a case study, depending on the nature of the questions to be addressed by the study (Mwanje, 2001; Fakhredaei, 2006; Kripanont, 2007)**.** Table 4.4 summarises different situations that prompt researchers to select appropriate strategies to address their research objectives.

Table 4.4: Relevant situations for different research strategies

Strategy	Form of research question	Required control over behavioural events?	Focuses on contemporary events
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis [content analysis]	Who, what, where, how many, how much	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

Source: Fakhredaei (2006: 50)

A triangulation approach using the survey and archival or content analysis was adopted in the study for data gathering. The survey strategy has been cited as the most reliable way of determining attitudes and knowledge of a particular group through directing interrogation by gathering facts and describing the current situation (Pelizzari, 2003; Allan, 2005). According to Ndunguru (2007: 76), the survey research strategy enables researchers "to develop and test theories, establish cause-effect relationship among a set of phenomena being studied, and assess attributes of a population of subjects under the study". This research strategy was suitable for collecting both quantitative and qualitative data for provision of evidence to support the description. The survey strategy also allows the generalisation of research results. As noted in section 4.1.3, this study adopted the quantitative approach for gathering data so as to explain causal relationships, to permit generalisation, and to enable predictions about the use of open access scholarly communication in Tanzanian public universities. Accordingly, the survey was considered as the most appropriate research strategy for this

study. The survey method also allows for the collection of a significant amount of data from a sizable population more efficiently (Gray, 2004; Ndunguru, 2007). In addition, many open access studies have so far adopted the survey methodology thus justifying further the appropriateness of the methodology to the case at hand (Pelizzari, 2003; Swan and Brown, 2005; Allan, 2005; De Beer, 2005; Kim, 2006; Moller, 2006; Deoghuria and Roy, 2007; Hess *et al*, 2007).

Archival or content analysis supplemented the survey methodology for data gathering. This type of data collection does not involve direct contact of the researcher with the objects of the research as it relies upon the existing documents as source of data (Breakwell, 2003). Data collection through this method is acknowledged to be quick and relatively cheap when compared to other strategies like the questionnaire survey (Ndunguru, 2007; Sridha, 2007). The data from archival analysis is important for cross-checking as well as acting as a benchmark for comparison with primary data. Contrary to some technology acceptance studies that tend to measure the self-reported usage, this study also measured the actual usage of open access through structured records review as elaborated in section 4.4.5.4. Using the two research strategies, the study adopted a number of data collection methods and instruments as detailed in the following sections.

4.4.5 Data collection methods and instruments

Data collection involves gathering of data using defined techniques in order to answer the pre-defined research questions of the study (Onyango, 2002; Kripanont, 2007). The type of data collection method is determined by the chosen research strategies. As noted in section 4.4.4 above, the survey and archival or content analysis were the main research strategies adopted in this study. Survey strategy employs the administration of interview and questionnaire, both of which are about getting answers to a set of questions in the data collection process (Kothari, 2004). In this research, a self-administered questionnaire and personal interviews were used as methods for data collection based on the survey strategy. For the archival or content analysis strategy, a literature review and structured records review were used for data gathering. The four data collection methods used in this study are summarised in Appendix 1 and detailed in the following subsections.

4.4.5.1 Questionnaire

A questionnaire is a research instrument through which people are asked to respond to some questions in predetermined order and it is among the most widely used data collection tools (Gray, 2004). The questionnaire (Appendix 3) was used to collect data in order to address the second to sixth and eighth objectives of the study as indicated in Table 1.1 of Chapter One. The rationale behind the usage of the questionnaire as a survey tool in this research includes:

➢ It is an efficient data collection mechanism when the researcher knows exactly what is required and how to measure the variables of interest (Kripanont, 2007);

➢ The questionnaire is considered advantageous for administration to large numbers of individuals simultaneously to facilitate the collection of data in a relatively short period and thus less expensive and less time consuming than the interview (Onyango, 2002; Gray, 2004; Kripanont, 2007) and;

➢ It is free of bias of the researcher. There is evidence that different researchers obtain different answers because of different ways of asking questions (Kothari, 2004; Gray, 2004).

Other advantages that make the questionnaire method suitable for this study include the fact that the fixed format of the tool eliminates variation in the questioning process, it encourages frank responses, the respondents have adequate time to give well thought out answers, and the tool can be constructed so that quantitative data are relatively easy to collect and analyse (Onyango, 2002; Gray, 2004; Kothari, 2004).

The researcher is also aware of some of the limitations of the questionnaire including low rate of return of the duly filled in questionnaire, the control over the questionnaire may be lost once it is sent, inbuilt inflexibility because of the difficulty of amending the approach once questionnaires have been dispatched, the possibility of ambiguous replies to certain questions, and lastly, it is difficult to know whether the willing respondents are truly representative (Onyango 2002; Gray, 2004; Kothari, 2004). Despite the drawbacks, some corrective measures were adopted to avoid such problems. The measures included the use of several data collection methods (self-administered questionnaire, interview and structured records review); and questionnaire pre-testing through the pilot study before the main survey as well as proper design of the questionnaire. By using both the questionnaire and interview in data collection for this study, some of the weaknesses of questionnaire were expected to be

minimised. According to Kripanont (2006), the two techniques (questionnaire survey and interview) complement one another in that the weaknesses of one approach are complemented by the strengths of the other. The following two subsections highlight on some of the measures that were taken in the questionnaire design to avoid some of the noted weaknesses.

4.4.5.1.1 Questionnaire design

In order to design a suitable and reliable questionnaire for data collection, the researcher paid special attention on four aspects of questionnaire design: the focus, phraseology, sequence and the form of questions as emphasised by Kothari (2004) and Ndunguru (2007). According to Ndunguru (2007: 94), a well focused questionnaire is the one "whose asked questions cover adequately and in sufficient detail all the various aspects of the research problem". Ideally, such questions should be relevant to the research problem. To ensure that a well focused questionnaire was developed, the researcher used the research objectives, research questions (from Chapter One) and the formulated research model (in Chapter Three) as a guide in the questionnaire design. Questions were included in the questionnaire only when they fell within the research objectives, research questions and the research model.

Questionnaire phraseology is about the intelligibility of the questions to the respondents, who characterise the study population (Ndunguru, 2007). It refers to how the questions are phrased to ensure that they are clear, concise and unambiguous so that reliable and accurate information is collected. Questions were formulated to ensure that they are understood to avoid biased responses. Instructions were also provided to the respondents for clear understanding of questions to avoid ambiguity. This was made possible by avoiding jargons. Where necessary, the requisite information was provided to the respondents so that they understood the questions. In short, the researcher ensured that questions were easily understood, simple and conveyed one thought at a time.

In order to make the questionnaire effective and to ensure quality responses, the researcher paid attention to the question sequence in preparing the questionnaire. According to Kothari (2004: 102), "a proper sequence of questions reduces considerably the chances of individual questions being misunderstood". The researcher maintained a proper question sequence to ensure that the relation of one question to another was readily apparent to the respondent.

Questions that were easiest were put at the beginning to encourage the respondents to participate in the survey.

With regard to the general form of the questions, the questionnaire can either be structured or unstructured. Structured questionnaires are those in which there are definite, concrete and pre-determined response options while the unstructured ones are those with no definitive response (Gray, 2004; Kothari, 2004). Structured questionnaires are simple to administer and provide data which are suitable for statistical analysis but they are not appropriate when the researcher is interested to understand a more complete picture of the respondent's feelings and attitudes (Kothari, 2004; Ndunguru, 2007). On the other hand, unstructured questionnaires are highly challenging when it comes to data analysis. In this study, a semi-structured questionnaire was used for data collection in order to balance the advantages and disadvantages of the two main forms of questions. This was also in line with the chosen research approach in section 4.4 (quantitative and qualitative approach) as the semi-structured questions are designed to collect both quantitative and qualitative data.

In order to design a suitable and more reliable questionnaire, where applicable, some relevant questions or items from previous studies were adapted as inputs into the questionnaire design. For example, questions used in the measurement of the research model were based on the developed and validated items as well as scales from other similar studies including Venkatesh *et al* (2003); Anderson and Schwager (2004); Hsu, Chiu and Ju (2004); Cheong and Park (2005); Ifinedo (2006); Hess *et al* (2007); and Kripanont (2007). The questions were phrased so as to suit the current study content. Table 4.5 presents a summary of items that were adapted in this study for the research model formulation.

Table 4.5: Items used in measurement of the research model

Attitude toward using open access
1. Publishing in open access outlets is a good idea
2. Publishing in open access outlets would make my work more interesting
3. Publishing in open access is easy for me
4. Accessing and use of open access materials is a good idea
5. Open access content is beneficial to the scholarly community

Effort expectancy about using open access
1. I believe the interaction with open access publication system to be clear and understandable
2. It would be easy for me to become skilful at publishing my work in open access outlets
3. Learning to publish my work in open access outlets would be easy for me
4. I find it easy to access open access scholarly content from the Internet
5. I clearly understand the implications of publishing in open access outlets

Facilitating conditions
1. I have the knowledge necessary to publish my work in open access outlets
2. I have the necessary resources to publish my work in the open access outlets (e.g. IT infrastructure, Internet access, …)
3. Guidance is available to me to use the Internet effectively for information access
4. Guidance is available to me to use the Internet for publishing my research output through open access outlets
5. My institution recognises open access publications for my carrier development (promotion criteria)

Internet self-efficacy
1. I feel confident searching scholarly information on the Internet
2. I feel confident in publishing my research output on the Internet
3. I feel confident in designing my personal website
4. I feel confident publishing on the internet even when there is no one around to show me how to do it

Performance expectancy about using open access
1. Open access outlets enable scholars to publish more quickly (turn-around time from submission to publishing is short)
2. Publishing in open access outlets increases research impact as such works would be highly used and cited
3. Open access outlets improve accessibility to scholarly literature because it is free and without access limitations
4. Open Access enables researchers in developing countries to access literature more easily
5. Publishing in open access outlets exposes scholarly work to a large potential readership

Social influence
1. Leading researchers in my discipline publish in open access outlets
2. My close colleagues publish in open access outlets
3. My research funding agency that support me would look favourably on me for

> publishing in open access outlets
> 4. My research funding agency require me to publish in open access outlets
> 5. My institution would look favourably on me for publishing in open access outlets
> 6. My institution require me to publish in open access outlets

Scales adapted from: Venkatesh *et al* (2003); Anderson & Schwager (2004); Hsu, *et al* (2004); Cheong & Park (2005); Ifinedo (2006); Hess *et al* (2007); and Kripanont (2007).

4.4.5.1.2 Questionnaire administration and response rate

Questionnaires can be administered personally or by mail. The latter technique is most preferred in situations of wide geographical coverage where it is difficult to administer questionnaires personally. The main drawback of administering mail questionnaires is "the possibility for a very low return in comparison to personally delivered questionnaires" (Kripanont, 2007: 116). In this research, copies of the questionnaire were distributed to the sample population of 544 respondents by hand for self-administration and contracted research assistants in each institution to collect the filled in questionnaires from the respondents. According to Kripanont (2007), personally-administered questionnaires are a good way of collecting data when the survey is confined to a small area. This method of questionnaire distribution was chosen for this research as it is reliable and usually less expensive due to the fact that the study area is not widely dispersed. The number of research assistants engaged per institution varied from one [who had to follow up to 50 respondents] to four [who had to follow up to more than 150 respondents].

Each copy of the questionnaire was accompanied by an introductory letter [Appendix 2] to explain the purpose of the study as well as a guiding definition of open access. The researcher had the opinion that a simple definition of open access was adequate for gathering respondents' views about open access usage since a more technical definition as provided in the Berlin Declaration of Open Access (2003) for example, could rather confuse them leading to less participation of the respondents in the survey. The technical definition of open access and its detailed explanation can properly be provided in other forums intended for advocates of open access to this category of the respondents.

Among the distributed copies of the questionnaire, 405 were returned of which 398 copies were found usable for analysis and seven were discarded as they were incomplete. The overall response rate was thus 73%, Mzumbe University having the lowest return rate (59%)

while the Open University of Tanzania had the highest response (85%). Table 4.6 summarises the questionnaire distribution and the obtained response. The response rate for the main survey was better than the overall return rate of 44% obtained during the pilot study. For the survey questionnaire, a response rate of 73% is very acceptable. The standard acceptable response rate for most surveys is 60% (Malaney, 2002; Evans, Peterson and Demark-Wahnefried, 2004).

Table 4. 6: Questionnaire distribution and response rate [N=544]

Institution	Distributed copies of questionnaires	Returned copies of completed questionnaire	Response rate (%)
ARU	27 (**4.9**)	21	**78**
MUHAS	84 (**15.4**)	57	**68**
MU	46 (**8.5**)	27	**59**
OUT	40 (**7.4**)	34	**85**
SUA	123 (**22.6**)	100	**81**
UDSM	224 (**41.2**)	159	**71**
TOTAL	544 (**100**)	398	**73**

The good response rate for this study was partly attributed to close and frequent follow ups and the fact that the main survey was conducted after rectifying a number of limitations observed during the pilot study. Among the reasons for low response rate during the pilot study was the fact that data collection was done during the vacation period when many researchers were out of station. According to Sellito (2006: 151), "appropriate timing for undertaking surveys is among the critical determinants of the response rate". The main study was done during semester period when majority of the researchers from all the universities were on station.

4.4.5.2 Interview
Conversation between people through face to face or by telephone in which one person has the role of a researcher and the other as a respondent is what is known as interview (Gray, 2004). This study adopted face to face interviews because of limitations such as high costs involved in the telephone interviews (Kothari, 2004). Interviews can either be structured, semi-structured or unstructured. As noted with the case of questionnaire above, there are advantages and disadvantages associated with each of those interview structures. Table 4.7 summarises the characteristics of structured, semi-structured, and unstructured interviews.

Table 4. 7: Structured, semi-structured, and unstructured interviews' characteristics

Structured	Semi-structured	Unstructured
Quick to data capture	Slow and time consuming to data capture and analyse	More slow and time consuming to data capture and analyse
Use of random sampling	The longer the interview the more advisable it is to use random sampling	Opportunity and snowball sampling often used. In organisations targeting of key informants
Interview schedule followed exactly	Interviewer refers to a guide containing mixture of open and closed questions	Interviewer uses aide-memoir of topics for discussion and improvises
Interviewer-led	Sometimes interviewer-led, sometimes informant-led	Non-directive interviewing
Easy to analyse	Quantitative parts easy to analyse	Usually hard to analyse
Tends to positivist view of knowledge	Mixture of positivist and non-positivist	Non-positivist view of knowledge
Respondents' anonymity easily guaranteed	Harder to ensure anonymity	Researcher tends to know the informant

Source: Gray (2004:218).

It can be noted from Table 4.7 that semi-structured interviews borrow characteristics from both structured and unstructured interviews. This research therefore adopted a semi-structured interview schedule (Appendix 4) for data gathering. This choice was an attempt to enable the researcher to reap benefits from both structured and unstructured interviews as well as align the data collection method to the chosen research approach (quantitative and qualitative). The interviews targeted the deputy vice-chancellors dealing with academic and research matters, deans of faculties, directors of centres, institutes and directorates from the selected universities. This group of respondents, apart from playing roles as university administrators, research remain part and parcel of their duties. However, the research role for policy makers occupy less of their time than their administrative duties. Among other factors, the adoption of open access in respective institutions can be facilitated through support of the new scholarly publishing system by this category of respondents as they are the main decision makers of the university in respect to academic and research matters. It was thus considered useful to involve this group of respondents in the study. The interview aimed at establishing the extent to which such respondents were aware of open access as well as

finding out how acceptable is the idea of establishment of open access repositories in the study area. More specifically, interviews were used to address the second research question of the fourth objective to determine how the respondents perceived the establishment of open access repositories at their institutions for dissemination of their scholarly content.

The choice of the interview method was based on the realisation of this data gathering method in complementing the questionnaire survey. Kothari (2004: 98-99) summarises the key merits of the interview method as follows:

> ➢ Suitable for gathering more detailed information ;
> ➢ the interview method can be made to yield an almost perfect sample of the general population;
> ➢ there is greater flexibility under this method as the opportunity to restructure questions is always there especially in the case of unstructured interviews;
> ➢ observation method can as well be applied by recording verbal answers to various questions;
> ➢ personal information can also be obtained easily under this method;
> ➢ samples can be controlled more effectively due to non-missing cases;
> ➢ the researcher may secure the most spontaneous reactions from the respondents than would be the case if a mailed questionnaire is used;
> ➢ misinterpretations concerning questions can be avoided as the researcher may elaborate in cases where the respondents fail to understand questions asked;
> ➢ the researcher can collect supplementary information about the respondent's personal characteristics and the environment which is often of great value in interpreting results and;
> ➢ the interview was also more appropriate to this category of the respondents as it could have been difficult for them to avail time for filling in questionnaires due to their busy schedule since they are involved in various administrative duties apart from other research activities.

Despite its advantages, Gray (2004: 111) considers the interview as probably the most expensive survey method since it requires large amounts of interview time; the possibility of the biasness of the interviewer as well as that of the respondent; certain types of respondents such as important officials or executives or people in high income groups being not easily approachable under this method and lastly, the interview is relatively more time-consuming

when compared to self-administered questionnaire (Onyango, 2002; Gray, 2004; Kothari, 2004).

For successful conduct of the interview, the researcher made every effort to adhere to the pre-requisites and basic tenets of interviewing. For example, the researcher made appointments with the respondents to establish the convenient day and time of the interview for each of them; asked questions properly and recorded the responses accurately and completely; created a friendly atmosphere of trust and confidence by introducing the subject clearly to the respondents so that they feel at ease while talking to and discussing with the interviewer. The researcher also answered legitimate question(s), if any, asked by the respondents. The researcher also cleared any doubt that the respondents had. In short, the researcher's approach to the respondent was friendly, courteous, conversational and unbiased. Furthermore, the researcher avoided to show surprise or disapproval of a respondent's answers but ensured the direction of interview was kept in the right track by discouraging irrelevant conversation.

Among the 67 interviewees who were eligible for the study, 63 participated in the interview. The response rate for the interview survey was thus 94%. Prior appointments with the interviewees as well as the researcher's flexibility to change such appointments to the convenient dates and time of the respondents ensured the notable good response from the university policy makers. Table 4.8 summarises the distribution and response of the interviewees involved in the study. The interview process took between twenty to thirty minutes. The researcher used the interview questionnaire and tape recorder for recording responses from the respondents. At the end of the interview day, the responses obtained in the two recording techniques were summarised and harmonised.

Table 4.8: Distribution of interviewees [N = 63]

Institution	Gender		Total
	Male	Female	
ARU	9	1	10
MUHAS	8	3	11
MU	7	3	10
OUT	4	2	6
SUA	9	2	11
UDSM	9	6	15
Total	**46**	**17**	**63**

4.4.5.3 Literature review

The detailed literature review was dealt with in Chapters Two and Three. In Chapter Two the following themes that were drawn from the research objectives were addressed:

➢ Reviewing developments in scholarly communication and open access adoption at global level;

➢ Investigating the general awareness and usage of open access with a focus on Africa and Tanzanian public universities in particular;

➢ Finding out factors facilitating the adoption of open access in research activities;

➢ Finding out researchers' and policy makers' perceptions on open access scholarly communication and;

➢ Determining factors hindering the adoption of open access in research activities.

The literature review in Chapter Two provided the researcher with a general understanding of the researched problem and was used as a benchmark for comparing and contrasting the research results. The review of literature in Chapter Three was meant to address the objective on formulating a research model of technology acceptance regarding open access usage in research activities in public universities in Tanzania. More specifically, Chapter Three was helpful in focusing the research by identifying dependent and independent variables as well as moderators postulated to shape the acceptance and usage of open access by researchers.

To find relevant literature, the following phrases or key terms were used: open access/open archives, digital/institutional repository and scholarly communication/publishing. Open acces s/views/opinions/ attitudes, authors/academics/scholars/faculty, and technology acceptance/ studies/theoretical frameworks were the other key terms employed in conducting literature

search. The terms were combined and searched in various information sources (such as subscribed databases, specific open access sources, and the general web especially the Google scholar). In addition, 'pearl growing' technique to follow citations between articles were used to find further relevant studies. The researcher continued with the literature review until the conclusion of the study in order to establish new developments in the studied subject.

4.4.5.4 Structured records review

Structured records review refers to "the process in which the researcher uses especially designed forms to guide data collection from documents available in hard copies or electronic formats" (De Beer, 2005: 87). The structured records review was used to partly address the second research objective: to investigate the general awareness and usage of open access with a focus on Africa and Tanzanian public universities in particular.

Structured records review involved studying websites of the six public universities in Tanzania as well as OAIster analysis. To establish the extent of open access publishing in the respective public universities in the study, websites of each university were analysed. A list of all academic departments, institutes, directorates, centres, and faculties were prepared from each of the universities' homepages. Each site was visited to gather information regarding research output which had been made available online and any other relevant information hosted by the website. A form (Appendix 5 part A) was used to capture relevant information regarding any evidence about open access publishing involvement of researchers at respective universities.

The extent to which researchers made available their research output through open access outlets beyond their respective institutions was determined through OAIster analysis. OAIster is a union catalogue of records harvested from open access archives collections worldwide. It provides access to electronic resources by harvesting their descriptive metadata (records) using OAI-PMH (the Open Archives Initiative protocol for Metadata Harvesting). A search combination using names of the respective universities and Tanzania was done to retrieve records from such universities. Where institutions changed names, the old names were also used for alternative searches. The OAIster creates a summary of the retrieved documents by indicating the number of records that are harvested from various contributors

(publishers). The researcher studied the list of contributors/publishers to segregate those which provide unrestricted access to their publications. Upon establishing the list of those publishers making their publications openly accessible, the researcher examined individual publications to establish whether they were available in full-text and verify authors' affiliation to make sure that at least one of the authors belonged to the institution being investigated. A summary (Appendix 5 part B) was used to record the total number of records retrieved from OAIster per institution, the total number of records contributors, documents accessible by subscription only and full-text records available on open access basis.

4.4.6 Pilot study

A pilot study also referred to as a feasibility study, is a small-scale version of the larger survey (Van Teijlingen and Hundley, 2001; Kripanont, 2007). By this definition, it implies that pilot studies draw subjects from the target population and simulate all procedures and protocols that have been designed for data collection in the main study. According to Van Teijlingen and Hundley (2001), the key advantage of a pilot study is that it may give advance warning about where the main research project could fail, where research protocols may not be followed, or whether proposed methods or instruments are inappropriate or too complicated. The following are among the reasons for conducting pilot studies:

- Developing and testing adequacy of research instruments (improve the internal validity of questionnaire);
- Assessing the feasibility of a (full-scale) study/survey;
- Assessing whether the research protocol is realistic and workable;
- Establishing whether the sampling frame and technique are effective;
- Assessing the likely success of proposed recruitment approaches;
- Identifying logistical problems which might occur using proposed methods;
- Estimating variability in outcomes to help determine sample size;
- Collecting preliminary data;
- Determining what resources (finance, staff) are needed for a planned study;
- Assessing the proposed data analysis techniques to uncover potential problems and ;
- Convincing funding bodies and other stakeholders that the main study is worth supporting (Van Teijlingen & Hundley, 2001).

Except the last point, all the above points formed the reasons behind undertaking the pilot study for this research. Pre-testing of the research instruments was ranked high among other

reasons for undertaking the pilot survey of this study. This involves a trial run with a group of respondents for the purpose of detecting problems in the questionnaire instructions or design, whether the respondents had any difficulty in understanding the questionnaire or whether there were any ambiguous or biased questions (Van Teijlingen and Hundley, 2001; Pressor *et al*, 2004; Kripanont, 2007). According to Kripanont (2007), pre-testing should be administered to a sample that is expected to respond similarly to samples on which the scale will eventually be applied.

A pilot study was done by using data collection methods as elaborated in sections 4.4.5.1, 4.4.5.2 and 4.4.5.4 above. The pilot study involved 57 respondents from among the 95 selected researchers in the six public universities under the study. The aim of the pilot study was to test the adequacy of research instruments and to assess the data analysis techniques so as to uncover potential problems if any for the main study. Reliability and validity tests were used as the key determinants for usefulness of the research instruments.

4.4.6.1 Pilot reliability analysis

A reliability test attempts to indicate the extent to which the research tool is without bias (error free) and hence offers consistent measurement across time and across the various items in the instrument (Varma, 2008; Kripanont, 2007). Reliability analysis was conducted using SPSS version 12 for all the questions in the questionnaire with subscales. The overall Cronbach's alpha and Cronbach's alpha if item deleted are the main basis in judging items for deletion or retention in the questionnaire as recommended by several scholars (Santos, 1999; Field, 2006a; Kripanont, 2007). Results of reliability analysis are summarised in Table 4.9.

Table 4. 9: Reliability analysis results for the pilot study

Constructs (Interval scale)	Number of items/sub-scales	Cronbach's alpha	Reliability results	Cronbach's alpha if item deleted
Attitude	8	0.644	Low	0.548-0.686
Effort expectancy	5	0.799	Acceptable	0.748-0.787
Internet efficacy	7	0.825	Good	0.777-0.830
Facilitating conditions	6	0.842	Good	0.793-0.729
Organisational influence	4	0.782	Acceptable	0.686-0.842
Performance expectancy	6	0.675	Acceptable	0.577-0.684
Social influence	3	0.747	Acceptable	0.594-0.738

From Table 4.9 it can be noted that almost all reliability tests were quite high indicating that items in each set were positively correlated except for the attitude construct. The values for Cronbach's alpha of 0.7 to 0.8 are considered as acceptable and good respectively (Santos, 1999; Field, 2006a; Kripanont, 2007; Anez, Reis and Petroski, 2008). The acceptable value for an alpha if item is deleted should not be greater than the overall Cronbach's alpha of the construct in question. For example, if the overall alpha of the construct is 0.841 all values in the column of Alpha if deleted should be around that same level. Items with values greater than the overall alpha mean that the deletion of such items improves reliability (Santos, 1999; Field, 2006a).

The most problematic construct was attitude with the overall Cronbach's alpha value of 0.644 which is less than the recommended 0.7. Re-looking of the whole construct was necessary since even deletion of individual items in the construct seemed not to improve the overall reliability of the construct. Most of the items in other constructs if deleted showed only a marginal improvement in the overall Cronbach's alpha. This suggests the rewording rather than the deletion of individual items in respective constructs was more justifiable in order to improve further the overall reliability of the constructs.

4.4.6.2 Pilot validity test

Validity of the instrument is the extent to which the data collected truly reflect the phenomena being studied (Field, 2005). According to Kripanont (2007), validity tests for assessing the instruments' validity can be done by undertaking content validity, criterion validity or construct validity. This study adopted content validity and construct validity

assessments. Content validity was achieved by borrowing previously validated items for the measurement of the research model as noted in Table 4.5 from section 4.4.5.1.1. The other approach for assessing content validity was to examine responses from the respondents of the pilot study.

Construct validity was determined through assessment of the convergent validity which is synonymous to correlation analysis (Kripanont, 2007). This was done in order to find out the degree to which two measures of the same concept correlated with each other. Correlation analysis was conducted using SPSS version 12. As noted in Table 4.10, except for some items in the attitude construct, the results of correlation analysis for both the inter-item correlation and item-total correlation for many items in other constructs were within the acceptable range implying good validity of the instruments being tested. The acceptable values range from 0.3 to 0.5 for item-total and inter-item correlations respectively (Field, 2006a; Kripanont, 2007).

Table 4. 10: Correlation analysis results for the pilot study

Constructs (Interval scale)	Inter-Item Correlation	Item-Total Correlation
Attitude	-0.007 - 0.838	-0.058 - 0.542
Effort expectancy	0.325 - 0.591	0.522 - 0.621
Internet self-efficacy	0.182 - 0.665	0.357 - 0.708
Facilitating conditions	0.286 - 0.745	0.548 - 0.735
Organisational influence	0.353 - 0.676	0.416 - 0.688
Performance expectancy	0.016 - 0.741	0.311 - 0.590
Social influence	0.422- 0. 586	0.508- 0.635

Following instruments validity tests, the interview schedule and records review forms were found to have no serious omissions as they captured all the required information. Minor corrections including rephrasing of some of the statements from the interview schedule were done. By combining reliability and validity tests results, several deficiencies were noted that prompted a review of the main questionnaire. The review of the questionnaire mainly involved rephrasing and deletion of some of the statements, re-arranging the order of the questions for proper flow of ideas as well as deletion of some of the questions that were not part of the research model in order to reduce the length of the questionnaire. The constructs five and seven were combined to form a single determinant retaining the name of social

influence as adapted in some similar studies (Venkatesh *et al*, 2003; Kripanont, 2007). Despite the fact that many constructs were found to have good overall alpha values as noted in Table 4.10 above, some items with low item-total correlation and those that showed slight improvement of the overall alpha if deleted were considered first for deletion in an attempt to shorten the questionnaire.

4.4.7 Data organisation

Data organisation involves operations that include (but not limited to) editing, coding, data entry, cleaning and data modification (Singleton, Straits and Straits, 1993). After data collection, editing by checking and adjusting errors, omissions, and legibility was done in order to ensure completeness, consistency and readability. Relevant quantitative data from the questionnaire, structured records review and the interview schedule were coded before entering such data in the database. Content analysis was also used to organise the data emerging from open-ended questions into SPSS version 15 for further analysis. During the coding process, the researcher used missing value from the SPSS editor to define missing /non-applicable values so that they were not included in calculations. The data were coded by assigning character symbols (numeric). Each question or item in the above research instruments was assigned a unique variable name for its clear identification. A coding sheet was prepared to record information about how each variable is coded. It comprised a list of all variables, the abbreviated variable names that were used in the SPSS and the way responses were coded. After capturing data by SPSS, further screening and cleaning of the data were done before the data analysis stage was reached as described under the following section.

4.4.8 Data screening

Data management or screening is necessary before proceeding to data analysis in order to avoid incorrect findings and conclusions. This process was important to ensure meaningful solution to the problem being addressed by making the analysed variables more sensible (Field, 2005). According to Odom and Henson (2002), data screening procedures if used properly help the researcher in optimising data so that the analysis produce the most accurate and efficient estimates, more so for regression analyses. In this research, data screening was essentially done to check if data were entered correctly (such as out of range values) and missing values. The two procedures are briefly described under the following subsections.

4.4.8.1 Checking incorrectly entered data

Incorrectly entered data were discovered by looking at the output with respect to frequency distribution and descriptive statistics of the SPSS frequency procedure. The range of values for quantitative variables was examined to make sure that no cases had values outside the range of possible values. An assessment of the means was also done to make sure that all cases had values that corresponded to the coded values. In cases where problems were identified, the researcher re-visited the data entry exercise to find out the root cause of the problem and corrections were made by referring to the hard copies of the data from the questionnaire.

4.4.8.2 Handling of missing data

Although responses from the questionnaire were filtered and only usable questionnaires were retained in the data set, still some missing data values remained in the data set. Missing data is mainly caused by three main factors: i) the respondents refusing to reveal sensitive or personal information; ii) some respondents inadvertently skipping one or more questions; iii) certain questions not being applicable to all the respondents; and iv) in some cases the researcher not providing options such as "no opinion/do not know" and thus forcing the respondents to skip some of the questions (Odom and Henson, 2002). In this study, missing data mostly arose due to reasons number one and two since the other two causes were not applicable in this case as provisions were made for the respondents with no opinion. Similarly, all the questions designed for the multivariate analysis were applicable to all the respondents.

Appropriate data handling is more crucial for multivariate analysis in order to avoid problems associated with the missing responses in the final results. Regardless of the source of the missing data, if not handled appropriately, "it reduces the sample size for analysis as well as resulting into biased or erroneous results in case of non-random missing data" (Kripanont, 2007: 149). It is thus important for researchers to apply appropriate remedies to address missing data before proceeding into data analysis.

There are three main methods of handling missing data (Witta, 2001; Odom and Henson, 2002; Kripanont, 2007; Ludbrook, 2008): listwise or casewise data deletion; pairwise data deletion; and multiple imputations. Listwise or casewise deletion involves elimination of an

entire case where one or more of the variables are missing contrary to the pairwise deletion in which only data that is missing in a particular variable is removed (Witta, 2002; Fox-Wasylyshyn and El-Masri, 2005). Accordingly, listwise deletion wastes more data when compared to pairwise deletion. The multiple imputation technique of missing data handling involves "replacing data with estimates that are based on the values of other variables/items in the data set" (Fox-Wasylyshyn and El-Masri, 2005: 491). According to Fox-Wasylyshyn and El-Masri (2005), this technique does not reduce the sample size due to the fact that it retains all the items in the data set but it is the most complicated method of data handling as compared to the other two above.

The choice of missing data handling methods depends on the type and extent of the missing data. Three main types of missing values include: Missing At Random (MAR); Missing Completely At Random (MCAR); and Not Missing At Random (NMAR) (Croninger and Douglas, 2005). The MCAR data is said to be better than the other two types as it can accommodate any of the missing data remedy while NMAR is considered more problematic since it poses threats to a study's external validity without any clear mechanism for addressing potential bias (Croninger and Douglas, 2005; Kripanont, 2007). On the other hand, if the amount of the missing data is substantial, "the resulting loss of cases may considerably weaken statistical power, increasing the likelihood of accepting the null hypothesis when it is actually false" (Croninger and Douglas, 2005: 4). Taking into account the above observations, it was considered necessary to determine the type and extent of missing data before proceeding into selecting the appropriate remedy strategy.

The Expectation Maximisation (EM) technique was used to judge the type of missing data. The results revealed a Little's MCAR test: Chi-Square = 868.137 = Degree of Freedom (DF) = 884, Sign. = 0.642. These results confirmed that the type of missing data was MCAR since significance value was greater than a threshold value of 0.05 (Croninger and Douglas, 2005; Kripanont, 2007). The extent of missing values were assessed by tabulating the percentage of variables with missing data for each case and the number of missing data for each variable using SPSS missing data analysis. The results of missing value analysis revealed that the missing values of all variables ranged between 0 and 4.3%. As a guide, missing data under 10% for an individual case or observation can generally be ignored except under special circumstances when the researcher expects to use software such as AMOS which in any case does not support missing data for multivariate analysis (Kripanont, 2007). The missing values

being on the lower side and the fact that such values followed the MCAR type of missing data, the researcher could use any of the three data handling methods as discussed on the previous paragraph (Graber, Czellar and Denis, 2002; Bastien and Tenenhaus, 2005; Sun and Zhang, 2006; Kripanont, 2007). In this case, SPSS pair wise default functionality was used for handling missing data in order to avoid the unnecessary reduction of sample size as it could have been the case of using the listwise option. This programme like other multivariate software that support missing values either use casewise or listwise inbuilt functionality to ensure that missing values are excluded in the analysis process so that they do not interfere with the emerging results. The ignorable missing values being of MCAR type as noted above further suggest little impact on results bias.

4.4.9 Reliability analysis

Reliability analysis was conducted using SPSS version 15 for all the six constructs (attitude, Internet self-efficacy, effort expectancy, facilitating conditions, performance expectancy, and social influence) that were used in this study to predict behavioural intention and usage of open access by researchers. The results of reliability analysis are summarised in Table 4.11 where it is noted that almost all reliability tests were either acceptable or good and therefore eligible for inclusion in multivariate analysis. The Internet self-efficacy construct had the lowest but acceptable alpha value while social influence had the highest Cronbach's alpha value. The Cronbach's alpha if item deleted values were of little value in this case since all items showed good internal consistency and none of them was liable for exclusion in the multivariate analysis exercise.

Table 4. 11: Reliability analysis results

Constructs	Number of items/sub-scales	Cronbach's alpha	Reliability results	Cronbach's alpha if item deleted
Attitude	5	0.839	Good	0.402-1.00
Effort expectancy	5	0.836	Good	0.787-0.817
Facilitating conditions	5	0.862	Good	0.823-0.846
Internet self-efficacy	4	0.713	Acceptable	0.584-0.722
Performance expectancy	5	0.896	Good	0.857-0.907
Social influence	6	0.917	Very good	0.539-1.00

After the above steps of screening the data as well as reliability tests, the next step was the real data analysis. The procedures applied in the data analysis process are described under the following sections.

4.4.10 Data analysis procedures

Two main techniques of data analysis namely descriptive and multivariate analysis were employed using SPSS version 15. The choice of this software was based on its high descriptive and multivariate statistical power for quantitative data analysis. The software has been widely applied by many scholars specifically in technology acceptance and user studies (Ammenwerth *et al*, 2002; Pelizzari, 2003; Knutsen, 2005; Ifinedo, 2006; Louho, Kallioja and Oittinen, 2006; Al-Zahrani, 2006) and hence considered suitable to this study as well. The following sub-sections detail the two main analytical procedures that were employed in the study.

4.4.10.1 Descriptive analysis

With regard to this study, descriptive data analysis was done to address the second to fifth objectives of the study (i.e. to investigate the general awareness and usage of open access (second objective), to find out factors that facilitate the adoption of open access in research activities (third objective), to find out researchers' and policy makers' perspectives on open access (fourth objective); and to determine factors that hinder adoption of open access in research activities (fifth objective). According to Kripanont (2007), descriptive statistics have a number of benefits including: describing the characteristics of the sample, checking variables for any violation of the assumptions underlying the statistical techniques used, and addressing specific objectives. A broad descriptive analysis was done across all the available data to establish whether or not some general patterns could emerge using the SPSS. The detailed results from descriptive analysis are presented in Chapter Five sections 5.9 to 5.9.

4.4.10.2 Multivariate analysis

The term multivariate analysis refers to all statistical methods that simultaneously analyse multiple measurements on each individual item or object under investigation (Akinci *et al*, 2007; Hedges, 2009). Such kinds of methods are used for analysing a large amount of information in an integrated manner. According to Harlow (2006), using multivariate statistics allows rich and realistic research designs enabling researchers to understand

complex relations among the variables being studied. The main limitation of multivariate analysis is its requirement for large samples as compared to univariate analysis (Harlow, 2006; Duffy, 2007; Hernandez and Mazzon, 2007).

The multivariate analysis was adopted in this case to address the last objective of the study: to validate the research model that best describes open access behavioural intention and usage by researchers. The choice for adoption of the multivariate statistics in this study was motivated by the nature of the model chosen for guidance in this research. As noted in Figure 4 of Chapter Three, the formulated research model demands simultaneous analysis of variables in order to obtain the desired results. The adequate response as noted in Table 4.6 also makes the multivariate analysis appropriate for this study.

There exist several different multivariate techniques. Some of the multivariate techniques as listed by Akinci *et al* (2007) include the principle component and factor analysis, multiple regression, multiple discriminant analysis, logistic regression, multivariate analysis of variance and covariance, conjoint analysis, canonical correlation, cluster analysis, multidimensional scaling, correspondence analysis, linear probability model, and structural equation modelling. According to Harlow (2006), multivariate methods can also be categorised into either of three groups (examples in brackets): Correlational methods (Structural Equation Modelling (SEM), prediction methods (Logistic Regression (LR), and group difference methods (Multivariate Analysis of Variance (MANOVA). It should be noted however that some of these techniques belong to more than one of the three functional categories. For example, SEM is also among the well known prediction techniques and thus can also fall into the prediction category.

Different multivariate techniques are employed depending on the type of data and the nature of analysis required. In this study, the component factor analysis was used for the measurement model assessment while the binary logistic regression analysis was adopted for the structural model assessment. The measurement model assessment involved isolating important items that should be retained and/or discarded from each of the six constructs as itemised in Table 4.5 of section 4.4.5.1. On the other hand, structural model assessment, the process through which the causal relationships among various factors (main constructs and moderators) was used in relation to the proposed research model in Chapter Three. Logistic regression technique is a type of multivariate analysis that estimates the probability of an

outcome as functions of independent variables (Pohlmann and Leitner, 2003). The following subsections elaborate on how the two multivariate techniques were used in the data analysis of this study.

4.4.10.2.1 Measurement model assessment

The measurement model deals with the relationships between measured items (variables) and latent variables and is assessed in terms of construct validity (Stoelting, 2002). In relation to the research model of the current study, as itemised in Table 4.5, the measured variables (items) were five for performance expectancy and six for social influence constructs. The latent variables or constructs in this case may not be determined directly but through respective items that are directly answered by the respondents. The construct validity refers to the degree to which the obtained results from the use of the measure fit the theories around which the test was designed for the obtained results (Trochim, 2006; Kripanont, 2007). This measurement is normally broken into convergent validity and discriminant validity. The convergent validity is the actual general agreement among ratings, gathered independent of one another, while the discriminant validity refers to the degree to which measures of different constructs are distinct or lack relationship (Cheong and Park, 2005; Trochim, 2006; Colorado State University, 2008).

Construct validity determination is an important step before structural model assessment. The convergent validity is considered to be satisfactory when items loadings are more than 0.70 (Cronbach's alpha values) for each construct (Gefen, Straub and Boudreau, 2000; Cheong & Park, 2005; Saade, Nebebe and Tan, 2007). The primary criterion for discriminant validity is that each indicator must load more highly on its associated construct than on any other construct, and/or the square root of average variance extracted (AVE) for each construct should be higher than 0.50 (Zhang and Li, 2004; Cheong and Park, 2005; Ifinedo, 2006; Sun and Zhang, 2006). As a general guide, correlations between theoretically similar measures should be high while correlations between theoretically dissimilar measures should be low (Trochim, 2006). To ensure the research model has acceptable measurement properties, the measurement model was assessed based on the above criteria.

The construct validity was assessed through exploratory factor analysis conducted using principle component analysis of SPSS by examining convergent validity and discriminant validity. Before proceeding with factor analysis the Kaiser-Meyer-Olkin (KMO) measure and

Bartlett's test were conducted to determine whether or not it was appropriate to conduct factor analysis. For factor analysis to work properly, KMO values should be greater than 0.5 and Bartlett's test should be significant with a value less than 0.05 (Field, 2006b). An eigenvalue of more than 1 was adopted as a determinant criterion for each factor in factor analysis. The varimax rotation was used to obtain factor loading values and cumulative proportions of variance. The detailed results on measurement model assessment are presented in section 5.10.1 of Chapter Five.

4.4.10.2.2 Structural model assessment

While the measurement model deals with both measured (variable that can be observed directly and is measurable) and latent variables (a variable that cannot be observed directly and must be inferred from measured variables), the structural model is concerned with the relationship among latent variables and moderators (where applicable as under the current investigation) (Stoelting, 2002). In this respect as illustrated in Figure 4, the six latent variables namely attitude, effort expectancy, facilitating conditions, Internet self-efficacy, performance expectancy, and social influence were the factors involved in the structural model assessment. Similarly, age, awareness, experience, gender and position were the moderators included in the structural model assessment.

Structural Equation Modelling technique especially using partial least squares is essentially more relevant to enable researchers to model the relationships among multiple independent and dependent constructs simultaneously in a single, systematic and comprehensive analysis (Gefen, Straub and Boudreau, 2000; Kripanont, 2007; Westland, 2007). However, the use of this methodology is not suitable under situations where one of the dependent variables is measured using the binary values. SEM techniques are less desired due to "the complexity associated with incorporating non-latent and ordinal variables such as age, and gender as well as dichotomy variables (such as usage and/or non-usage of technology) (Rosen, 2005; Hernandez and Mazzon, 2006). Kupek (2006) also notes that the treatment of binary and categorical variables as if they were normally distributed as well as the rare use of standard error and confidence limits in some of the SEM applications also contribute to the less preference of such a technique in predicting binary variable outcomes.

In this study, while one of the dependent variable was determined using continuous dependent variable (behavioural intention), the other dependent variable (usage) was binary

in nature. In the former, behavioural intention was assessed by using continuous variable measured from one to four scales while the case of open access usage as a dependent variable was measured using the binary values (one representing usage and zero representing non-usage of open access). While it could have been possible to use SEM technique for handling the first dependent variable and an alternative programme in respect of the second dependent variable, for consistent results, the researcher decided to look for a programme that could be used for both of the dependent variables. This was possible by transforming the continuous variable into binary values with respect to behavioural intention.

Approaches that are often proposed to develop models with outcome variables that are categorical or binary in nature include: logistical regression, ordinary least squares regression, discriminant analysis, and probit analysis (Karp, 1998; Peng *et al*, 2002; Pohlmann and Leitner, 2003; Ackinci *et al*, 2007). Logistic regression analysis, more specifically, binary regression was chosen for this purpose as it is acknowledged to give more accurate predictions of probabilities on dependent outcome when compared to the other three competing techniques (Karp, 1998; Peng *et al*, 2002; Duffy, 2007). This is a form of multiple regression analysis where the outcome variable is binary or dichotomous (1, 0) and the independents are continuous variables, categorical variables, or both (Peng *et al*, 2002; Akinci *et al*, 2007). The popularity of logistic regression analysis in social sciences and other research disciplines such as medicine is due to several advantages of this technique over other multivariate and univariate methods of data analysis. The following are some of the highly cited benefits of using logistic regression analysis (Karp, 1998; Peng *et al*, 2002; Pohlmann and Leitner, 2003; Akinci *et al*, 2007; Duffy, 2007):

> ➢ It is more robust as the independent variables do not have to be normally distributed, or to have equal variance in each group;
> ➢ It does not require the independent variable to be interval and there is no homogeneity of variance assumption;
> ➢ The logistic regression equation limits the generation of the predicted values if the dependent variable lies in the interval between zero and one as comparable to OLS regression where the results in the values of the dependent variable take on values of less than zero or greater than one. In OLS case, the results become substantively irrelevant and with no interpretative value;

➢ It is unlike most of the multivariate analysis techniques that require the basic assumptions of normality and continuous data involving independent and/ or dependent variables and hence it fits in many more situations;

➢ It generates more appropriate and correct findings in terms of model fitness and correctness of analysis comparable to other techniques such as ordinary least squares, two-group discriminant analysis and multiple regression analysis;

➢ Its similarity with linear regression in interpretation and diagnostic results also makes it more favourable to many researchers;

➢ A simple transformation (exponential) of the logistic regression model leads to an easily interpretable and explainable quantity using the odds ratio and;

➢ The model adequacy and fit including measures as well as the generalised test of Hosmer-Lemeshow for lack of model fit in logistic regression models make such a technique preferred by many researchers.

As is the case with other multivariate techniques, logistic regression requires much more data to achieve stable and meaningful results when compared with the standard regression and discriminant analysis. This weakness is however not applicable to this study due to the adequate sample size.

Based on its capability of handling binary outcome variables, binary logistic regression analysis using SPSS was used for the structural model assessment in respect of behavioural intention and usage of open access. To fit into binary regression analysis, measurements in respect of behavioural intention were reduced from four to two: i.e. responses indicated as likely or very likely to publish in open access in future were coded as one, while those indicating unlikely or very unlikely were coded as zero. Binary regression analysis was done in order to validate factors affecting researchers' behavioural intention and open access usage as guided by Figure 4 in Chapter Three. In addition to latent constructs, all the moderators were also employed to assess their direct effect on researchers' behavioural intention and usage of open access.

The Omnibus Test of Model Coefficients, Model Summary, Hosmer and Lemeshow Test, and the classification table outputs were determined for the assessment of the predictive power and the goodness of fit of the model. Causal relationships among independent and

dependent variables were assessed through the unstandardised regression coefficients and odds ratio in accordance to other similar studies that adopted logistic regression technique (Bailey, 2000; Hartmann *et al*, 2002; Bewick, Cheek and Ball, 2005; Hernandez and Mazzon, 2007). The results based on logistic regression analysis are presented in Chapter Five (section 5.10.2.2).

4.5 Ethical considerations

According to Aina (2002b: 193), "ethics are norms that are expected to be followed, and may also be referred to as principles of good behaviour". As far as research is concerned, ethics refer to a code of conduct or expected societal norm of behaviour while conducting research (Kripanont, 2007). Kripanont also points out the need for such ethics to pervade each step of the research process including data collection, data analysis and reporting as well as dissemination of information. Aina (2002b) considers fabrication and falsification of data, copyright violation and plagiarism, and double publishing as among the unethical issues in research that researchers should avoid. According to Mwanje (2001: 65), the following are some of the additional issues to be observed by researchers in designing social sciences research that involves human subjects:

> ➤ Scientific merit - any research must be merited, and the methods must be appropriate to the aims of the investigation;

> ➤ Equitable selection of subjects (though random sampling);

> ➤ Informed consent - study's sample/individuals must understand the nature of the study and possible implications;

> ➤ Confidentiality - responses from the respondents should be used for the research purpose only;

> ➤ Feedback of results - the community must know the findings. This would reinforce future interest in community-based research and;

> ➤ Seeking formal approval of the respondents as well as institutions is important before the onset of data collection.

All the above ethical issues are applicable to this study and the researcher strived to adhere to all of them in each step of the research process from data collection, data analysis and reporting of information. The researcher requested and obtained formal approval from the responsible vice chancellors of the six universities involved in the study before starting data

collection. The objectives and purpose of the study were explained to all the respondents (see introductory letters to the respondents - Appendix 2) so as to get their consent before the commencement of the study. The researcher ensured that no respondent was forced to participate in the study. The respondents were also assured of the confidentiality of the information they provide and that the results of the study were to be used for research purposes only. The research instruments were designed to avoid embarrassing questions through pre-testing of the questionnaire during the pilot study. The data collected were analysed and presented correctly to avoid misinterpretation. All the sources cited in the study were acknowledged to avoid plagiarism.

4.6 Chapter summary

The aim of this Chapter was to present and discuss the research methodology of the study. The Chapter presented the research process followed in conducting the study before addressing the research purpose, approach and design aspects of the study. The purpose of the study was identified as mainly descriptive and explanatory, employing both qualitative and quantitative qualities of research approaches. The research design included discussions regarding target population and sampling procedures, the research strategy, pre-testing of research instruments, pilot study, and data analysis techniques. The survey and archival or content analysis strategies using a triangulation data collection method including the questionnaire, interview and structured records review forms were chosen for data collection. Quantitative data analysis techniques using descriptive and multivariate methods were adopted in the study. Finally, a number of ethical issues adhered by the researcher during the research process were highlighted. The research findings of the study are presented in the following Chapter.

CHAPTER FIVE

PRESENTATION OF FINDINGS

5.0 Introduction

This study aimed at investigating factors affecting the adoption of open access in terms of access and dissemination of scholarly information within Tanzanian public universities in order to recommend means to enhance the usage of this mode of scholarly communication. In the previous Chapter, the research methodology adopted by the study was discussed. Having applied the research methodology, this Chapter presents the results generated from the survey (questionnaire, interviews) and structured records review as discussed in the previous chapter. The reported results are based on the study research questions' themes as listed underneath:

- ➢ To what extent are researchers and policy makers aware of open access and what is the extent of open access adoption in research activities in Tanzanian public universities?

- ➢ What factors facilitate the use of open access outlets by researchers in accessing scholarly literature?

- ➢ What factors facilitate the researchers' use of open access outlets in disseminating research output?

- ➢ What are the researchers' and policy makers' general perceptions on open access publishing?

- ➢ How do the researchers and policy makers perceive the establishment of open access repositories at their institutions for the dissemination of scholarly content?

- ➢ What factors hinder the use of open access scholarly content in research activities?

- ➢ What factors hinder the dissemination of research findings through open access avenues?

- ➢ How useful is the research model in terms of its predictiveness and fitness to the collected data?

> ➤ What are the significant variables that influence researchers' open access usage behaviour and behavioural intention?

The presentation of the findings is guided by research questions as listed above except section 5.1 that presents profile of the respondents. The results of the descriptive statistics address the first seven research questions that appear from sections 5.2 to 5.8. The inferential statistics' results are presented in the last section (5.9) to address the last two research questions. It should also be noted that while the total number of the useful questionnaire was 398 as observed in the previous chapter, in certain circumstances the reported results are based on fewer cases due to the fact that some respondents did not answer all the questions. In other words, the results indicate the percentage of the actual respondents to a particular question rather than the percentage of the total sample.

With respect to the descriptive results, in situations where all or two of the tools were used, the results from the questionnaire are reported first followed by those from the interview. The structured records review results are presented last. In a few cases the results from the main questionnaire and interview are combined for convenience of their presentation.

5.1 Profile of the respondents

The study targeted 67 policy makers and 544 full time researchers from six public universities in Tanzania. Among the 67 policy makers, 63 (94%) were interviewed, 73% of whom were males and 27% females. Distributed by their positions, the interviewees included 4 deputy vice-chancellors (academic); 31 deans of faculties/ schools; and 28 directors of centres/directorates/institutes.

With respect to researchers, the response achieved was 398, which is 73% of the target. The distribution of the researchers by rank and qualification for each institution is summarised in Table 5.1.

Table 5. 1: Distribution of the researchers by rank [N=398]

Rank	Institution						Total (%)
	ARU	MUHAS	MU	OUT	SUA	UDSM	
Lecturer	10	20	17	24	30	83	184 (**46.2**)
Senior lecturer	9	23	8	7	25	27	99 (**24.9**)
Professor	2	14	2	3	45	49	115 (**28.9**)
Total (%)	21(**5.3**)	57 (**14.3**)	27 (**6.9**)	34 (**8.5**)	100 (**25.1**)	159 (**39.9**)	398 (**100**)

Table 5.1 above reveals that close to a half (46.2%) of the respondents were lecturers, followed by professors (28.9%) and senior lecturers (24.9%). In terms of the highest academic qualifications attained by the respondents, 299 (75.1%) were holders of PhD degrees while the remaining 99 (24.9%) had Masters degrees. Among the 398 respondents, 310 (77.9%) were males and 88 (22.1%) females.

The distribution of the respondents by age revealed that 78 (19.6%) were aged between 31-40 years; 157 (39.4%) were between 41-50 years; 145 (36.4%) were between 51-60 years; and 18 (4.5%) were above sixty years. From these findings it can be noted that majority of the respondents were aged between 41-50 years while those beyond sixty years were the minority group. Figure 6 presents a summary of the distribution of the respondents by research discipline.
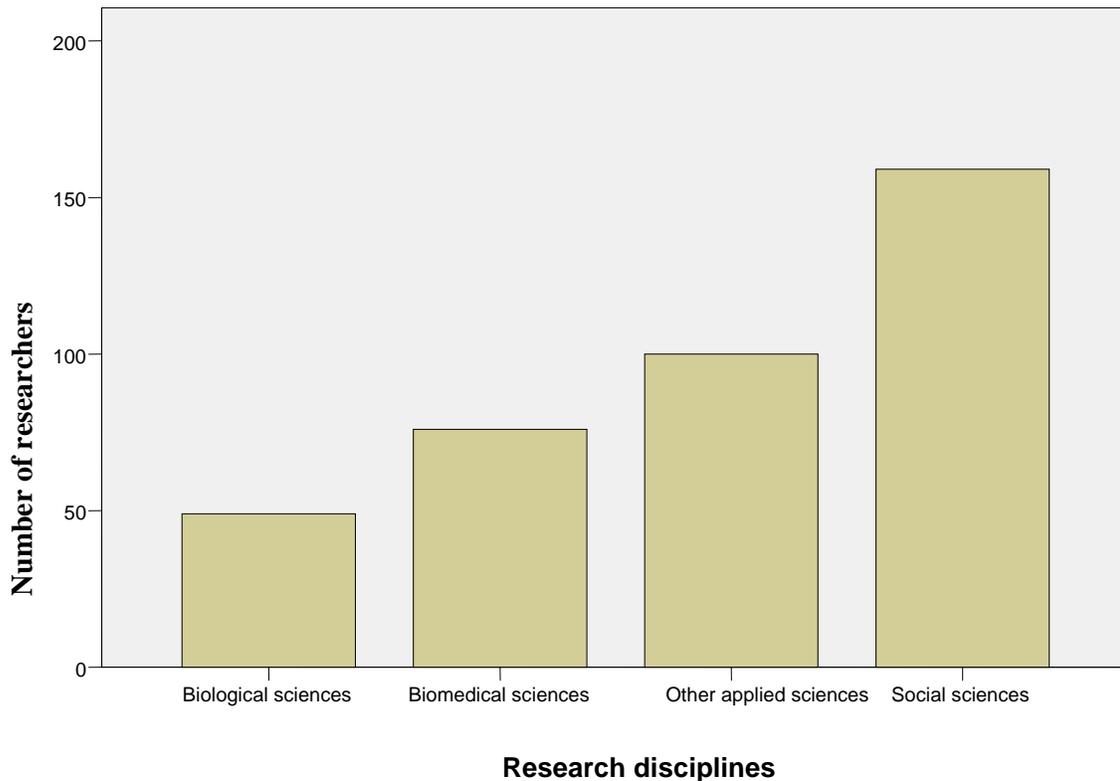
Figure 6: Researchers' distribution by discipline.

Researchers' disciplines were broadly classified into two categories: natural sciences and social sciences. Natural sciences were further subdivided into biomedical sciences (human medicine and veterinary medicine); biological sciences (agricultural sciences, aquatic sciences, animal sciences, biology, forestry science); and other applied sciences (physics, mathematics, engineering, computer science, chemistry, geography and environmental sciences). The sub-disciplines in social sciences included economics, sociology, languages, library and information science, education, management and all other subjects that did not fall under natural sciences as defined above. Based on the above classification, the distribution of researchers by discipline was 159 (41.4%) for social sciences and 225 (58.6%) for natural sciences. The distribution of researchers within the natural sciences was as follows: biomedical sciences (19.8%); other applied sciences (26.1%); and biological sciences (12.8%). Fourteen respondents did not indicate their research disciplines hence they

are not included in the calculation. Figure 7 presents the distribution of researchers by Internet usage experience.
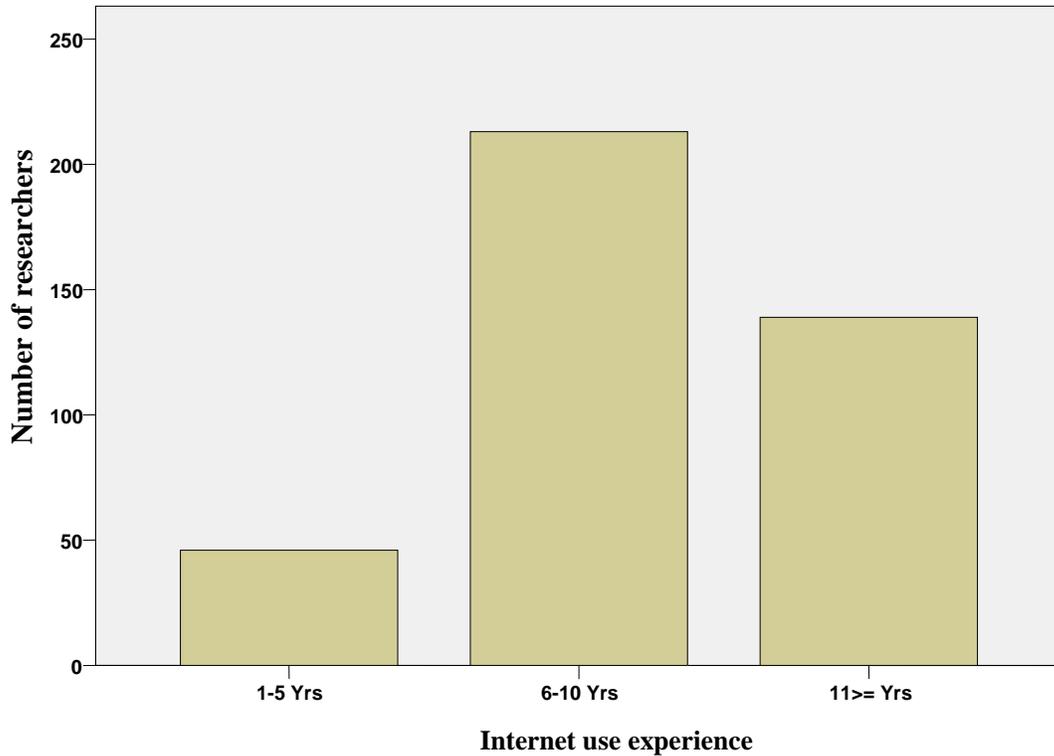
Figure 7: Researchers' Internet use experience in scholarly communication.

It is noted from Figure 7 that among the 398 respondents, slightly above a half (53.5%) of the respondents had experience of 6-10 years; followed by 34.9% who had more than ten years of experience and 11.6% had 1-5 years experience.

5.2 Open access awareness

The study sought to confirm whether or not both researchers and university administrators were aware of the open access concept. The respondents were asked on whether or not they had heard about open access before their participation in this survey and how they were informed about it. Among the 392 researchers who responded to this question, majority (72.1%) of the respondents had heard about open access while 26.4% were not aware of it. With regard to how they became aware of open access, 42% of the researchers claimed to have heard about it from their colleagues, 19.3% learnt of it through publishers' promotion

and 18.8% by following the Internet debate. Other means through which such respondents were informed about open access included: workshops/conferences, library promotion, by chance while surfing the Internet, and some of them learnt about it during their postgraduate training abroad.

With regard to the interview with the university policy makers, among the 63 interviewees, majority (90.5%) of the respondents claimed to be aware of open access. Most (79.4%) of the interviewees in this group, reported to know open access journals but few had heard about other open access initiatives or terms such as open access repositories (25.4%), self-archiving (17.5%), BioMed Central (15.9%), and Budapest open access initiative (3.2%). Thirty three percent of those who were aware of open access had heard from their colleagues, while a quarter (25.4%) knew it by following the Internet debate and the minority (19%) of the respondents were informed through publishers' promotion.

5.3 Open access usage

Actual open access usage was investigated to find out the extent to which researchers accessed and disseminated scholarly content through this mode of scholarly communication. Institutional and OAIster database analysis were also used to complement the responses on the researchers' involvement in publishing using open access outlets within and beyond their universities. Further, the likelihood of researchers' publishing in open access outlets in future was also investigated. The results from such aspects are presented in the following subsections.

5.3.1 Researchers' access to open access content

Tables 5.2 and 5.3 respectively summarise the findings about open access usage by researchers according to their gender and research disciplines. Overall, it was observed that among the 398 respondents, majority (62.3%) of them claimed to have accessed open access materials while the remaining 150 (37.7%) had never accessed such content. Among the 240 respondents who acknowledged having accessed open access content, over three quarters (79.4 %) were males and only one fifth (20.6 %) were females.

Table 5. 2: Open access usage by respondents by gender [N = 398]

Gender	Open access usage (Number & Percentage)			
	Scholarly content access (N=398)		Scholarly content dissemination (N=393)	
	Yes	No	Yes	No
Male	197 (**79.4**)	113 (**75.3**)	61 (**82.4**)	244 (**76.5**)
Female	51 (**20.6**)	37 (**24.7**)	13 (**17.6**)	75 (**23.5**)
Total	248 (**100**)	150 (**100**)	74 (**100**)	319 (**100**)

NB: Percentages based on column totals

Based on Table 5.3, it can be noted that of the 240 respondents who responded to this question, 37% were from the social sciences group as opposed to 63% from the natural sciences group claimed to have used open access sources for accessing information. It should be noted that of the 248 respondents who indicated having accessed open access content in Table 5.2, 3.2% of them did not indicate their research disciplines and were thus not included in the calculation resulting into different totals between Tables 5.2 and 5.3. Usage of open access for scholarly content access was found to vary significantly ($p<0.01$) among different research disciplines.

Table 5. 3: Usage of open access scholarly communication by discipline [N = 384]

Research discipline	Open access usage (Number & Percentage)			
	Scholarly content access (N = 384)		Scholarly content dissemination (N= 379)	
	Yes	No	Yes	No
Biological sciences	33 (**13.8**)	16 (**11.1**)	10 (**13.7**)	37 (**12.1**)
Biomedical sciences	62 (**25.8**)	14 (**9.7**)	36 (**49.3**)	39 (**12.7**)
Other applied sciences	56 (**23.3**)	44 (**30.6**)	12 (**16.4**)	88 (**28.8**)
Social sciences	89 (**37**)	70 (**48.6**)	15 (**20.5**)	142 (**46.4**)
Total	240 (**100**)	144 (**100**)	73 (**100**)	306 (**100**)

NB: Percentages based on column totals

5.3.2 Researchers' dissemination of scholarly content through open access outlets

The dissemination of scholarly content in open access outlets was investigated directly by questioning the researchers and indirectly through institutional and OAIster websites analysis. The results from these investigations are reported in the following subsections.

5.3.2.1 Researchers' self-reported scholarly content dissemination through open access

It can be noted from Table 5.2 that among the 393 respondents only 74 (18.8%) claimed to have disseminated scholarly content using open access outlets. Majority (81.1%) of the respondents acknowledged to have never disseminated their scholarly content through open access mode of scholarly publishing. Among the 74 respondents who claimed to have disseminated their scholarly content in open access, 82.4% were males as compared to 17.6% females. From among those who published in open access outlets, one of them did not indicate his/her research discipline and was thus excluded in the calculation. Thus, based on research discipline, it is observed from Table 5.3 that among the 73 respondents, 20.5% from the social sciences group and 79.4% from the natural sciences claimed to have disseminated their scholarly content using open access outlets. As was the case with access to open access content, the dissemination of scholarly content through open access varied significantly (p<0.001) in different research disciplines.

A total of 167 of journal articles, 40 conference/workshop proceedings, 14 research reports, 9 theses/dissertations, 5 books and 5 book chapters' articles were reported by researchers to have been published in open access outlets. A further analysis revealed that those who published in open access outlets, 67 published in open access journals, 16 and 11 in institutional and disciplinary repositories respectively. Only two respondents claimed that they had published in personal websites.

5.3.2.2 Researchers' dissemination of scholarly content through institutional websites

Institutional websites' analysis was conducted in order to assess the extent to which researchers made freely available their research output through such media. Table 5.4 presents the results based on institutional websites analysis.

Table 5. 4: Institutional website's analysis

University	Is the website accessible	Research information accessible from the university front page?	Research information accessible from the university library web page?	Research information accessible from other university web pages?	Any evidence of local open access journals hosted by the website?	Any evidence of institutional repository from the university website?
ARU	Yes	Yes	Yes	No	No	No
MUHAS	Yes	Yes	No	No	No	No
MU	Yes	Yes	No	No	No	No
OUT	Yes	No	Yes	No	No	No
SUA	Yes	No	Yes	Yes	No	No
UDSM	Yes	No	Yes	Yes	No	Yes

From Table 5.4 it is evident that open access journals and open access repositories were not hosted by any of the university websites except the University of Dar es Salaam front page that had a link to its institutional repository known as "University of Dar es Salaam Research Repository". During the data collection period, this repository had 39 documents mostly university official documents and few research reports that were accessible upon users' registration. The repository in question was established and managed by the Directorate of Research and Publications of the University of Dar es Salaam. It should be noted further that this repository was not registered with any of the global open access registers such as ROAR or DOAR. The above results corroborate the views obtained from the interview with policy makers which revealed that open access publishing has not yet been discussed at strategic or business meetings (68.3% of 63 interviewees), open access has been raised but not yet taken up (23.8% of the respondents), and that the university intends to institute an institutional repository (7.9% of the respondents).

The other observation from institutional websites' analysis was that almost all the websites had links up to faculty/centre/directorate/institute levels and none was linked at departmental level. A further analysis revealed that most of the universities did not pay much attention in promoting their research output through their websites. For example, among the six universities, only two universities (ARU and MU) provided links to journals published by such institutions while the rest did not even show the existence of local journals on their university front pages. A mention of such journals was mostly made in the directorates of research and publications web pages for the remaining universities except MUHAS and OUT where there was no mention at all. By end of May 2009, there were 33 journals published at the six different public universities [distributed as indicated in brackets for each university]: ARU (1); MUHAS (2); MU (3); OUT (3); SUA (7) and UDSM (17). Appendix 6 lists the journals published at the respective six public universities that were involved in this study. Among such journals, 10 were registered with the African Journals Online (AJOL) with number in brackets for each institution [ARU (1); MUHAS (4); OUT (1); SUA (2); UDSM (2).

Contrary to other universities, only MUHAS front page provided a link to medical journals accessible through various initiatives such as HINARI and open access. This kind of information was only made available from the library front pages for the other five public universities under the study.

5.3.2.3 Researchers' scholarly content dissemination in other open access repositories

OAIster website analysis aimed at establishing the extent to which university researchers addressed by this study used open access avenues beyond their universities to publish their research output. Table 5.5 presents the results from the OAIster website analysis.

Table 5. 5: OAIster analysis results: research output

Institution	Total number of retrieved online records	Records from African Journals Online (AJOL)	Records from other online repositories	Total number of records with access restrictions to full-text contributed by at least one author from the investigated institution	Total number of open access records contributed by at least one author from the investigated institution
ARU	4	1	3	0	1
MUHAS	82	63	19	66	16
MU	2	1	1	1	1
OUT	21	16	5	9	1
SUA	117	98	19	93	15
UDSM	430	228	202	152	62
Total	**656**	**407**	**248**	**321**	**96**

The visibility of research output contributed by authors from the six public universities as harvested by OAIster in various open access repositories varied among the respective institutions as follows [number of records in brackets]: ARU (1), MU (1), OUT (1), SUA (15), MUHAS (16), and UDSM (62).

5.3.3 Researchers' future likelihood of publishing in open access outlets

Having obtained the data regarding the extent to which the respondents have been involved in the dissemination of research output using open access outlets, the researcher further investigated on their prospects of publishing in open access outlets in future. Table 5.6 presents the results from this investigation.

Table 5. 6: Researchers' prospects of publishing in open access in future by discipline [N = 384]

Publishing likelihood	Research discipline/number & percentage				Total (%)
	Biological sciences	Biomedical sciences	Other applied sciences	Social sciences	
Very likely	10 (**14.3**)	16 (**22.9**)	15 (**21.5**)	29 (**41.4**)	70 (**18.2**)
Likely	28 (**12.2**)	55 (**24**)	62 (**27**)	84 (**36.7**)	229 (**59.6**)
Unlikely	7 (**10.4**)	3 (**4.5**)	21 (**31.4**)	36 (**53.7**)	67 (**17.4**)
Very unlikely	3 (**18.8**)	2 (**12.5**)	1 (**6.3**)	10 (**62.5**)	16 (**4.2**)
Not sure or undecided	1 (**50**)	0 (**0**)	1 (**50**)	0 (**0**)	2 (**0.5**)
Total	49 (**12.8**)	76 (**19.8**)	100 (**26**)	159 (**41.4**)	384 (**100**)

NB: Percentages for publishing likelihood are based on row totals while percentage totals for the last column and row are based on the overall total of the respondents.

It can be noted from Table 5.6 that majority (77.8% of 384) of the respondents claimed that it was very likely or likely for them to publish in open access outlets in future. The other percentage (21.6%) indicated that they were unlikely or very unlikely to publish using open access outlets in future, while only 0.5% of the respondents were not sure or they were undecided.

5.4 Factors facilitating researchers' use of open access in scholarly communication

This aspect was investigated by asking the researchers about several issues that are considered likely to encourage their use of open access in accessing as well as publishing scholarly content. Such issues included: researchers' Internet usage skills, Internet self-efficacy, facilitating conditions, social influence, performance expectancy, and effort expectancy as described in the following subsections.

5.4.1 Researchers' Internet usage skills

Prior to asking the respondents to rate themselves regarding their Internet usage skills in terms of accessing and publishing research output, they were first requested to indicate how they were trained in such aspects. Table 5.7 present the results on how the respondents learnt to use the Internet.

Table 5. 7: Researchers' training means on Internet usage [N = 394]

Training means	Frequency	Percentage
Self-learning	321	81.5
The university computing centre	118	29.9
The university library	47	11.9

From Table 5.7, it is evident that self-learning followed by the university computing centres and the university libraries were the main training means for many respondents. Others cited training means (number of respondents in brackets): friends (10), short course/seminar/ workshop (8), postgraduate training abroad (6), and private firms (5). It should also be noted that some of the respondents learnt Internet usage through more than one means, hence the number of the respondents and percentage add to more than 398 and 100 respectively.

With regard to Internet usage skills, 23.9% of all 398 respondents claimed to have very good knowledge, 59.8% good, 15.5% fair and only 0.8% of them said to be poor on Internet search skills. On the other hand, among 397 respondents who rated themselves regarding their online information dissemination skills, 12.8% claimed to have very good, 53 % good, 28.4% fair and 5.5% poor skills respectively in terms of information dissemination using the Internet.

5.4.2 Researchers' Internet self-efficacy

Tables 5.8 present results of researchers' Internet self-efficacy deemed necessary for them to use open access.

Table 5. 8: Researchers' Internet self-efficacy ratings [N=384]

Internet-self-efficacy statement	Ratings (number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
I feel confident searching information on the Internet	170 (**44.3**)	170 (**44.3**)	28 (**7.3**)	6 (**1.6**)	10 (**2.6**)
I feel confident publishing research output on the Internet	72 (**18.8**)	176 (**46**)	86 (**22.5**)	22 (**5.7**)	**27(7)**
I feel confident in designing my personal website	34 (**8.9**)	87 (**22.8**)	120 (**31.4**)	77 (**20.2**)	**64 (16.8)**
I feel confident publishing on the Internet even when there is one around to show me how to do it	27 (**7.1**)	111 (**29.1**)	131 (**34.4**)	65 (**17.1**)	47 (**12.3**)

As noted from Table 5.8 above, majority (88.6%) of the respondents strongly agreed or agreed that they feel confident in searching information on the Internet; and publishing research output on the Internet (64%). It should also be observed that a large proportion (68.4%) of the respondents disagreed or strongly disagreed or didn't know/or had no opinion with regard to their ability in designing personal websites. Similarly, 63.8% of the respondents disagreed or strongly disagreed or didn't know/or had no opinion about having confidence in publishing on the Internet without assistance.

5.4.3 Availability of facilitating conditions for open access usage

Table 5.9 presents the results on the availability of facilitating conditions in using open access in publishing and accessing scholarly content.

Table 5.9: Availability of facilitating conditions for open access usage [N=394]

Facilitating condition	Ratings (number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
I have the necessary knowledge to publish my work in open access outlets	47 (**11.9**)	120 (**30.5**)	133 (**33.8**)	55 (**14**)	39 (**9.9**)
I have the necessary resources (e.g. Internet access) to publish on open access outlets	**40(10.2)**	152 (**38.3**)	114 (**28.9**)	50(**12.7**)	38 (**9.6**)
My institution recognises open access publications for my career development	38 (**9.7**)	120 (**30.5**)	79 (**20.1**)	53 (**13.5**)	103 (**26.2**)
Guidance is available for me to use the Internet for publishing my research output	36 (**9.1**)	132 (**33.4**)	93 (**23.5**)	56 (**14.2**)	78 (**19.7**)
Guidance is available for me to use the Internet effectively for information access.	51 (**12.9**)	167 (**42.4**)	87 (**22.1**)	48 (**12.2**)	**41(10.4)**

As noted from Table 5.9, less than half (50%) of all the respondents strongly agreed or agreed that their institutions provide adequate facilitating conditions for them to publish in open access outlets. More than a half (55.3%) of the respondents agreed or strongly agreed with the statement on the presence of guidance for effective usage of the Internet in accessing information.

5.4.4 Effect of social influence on researchers' use of open access

The researchers were provided with a number of statements about social influence and were asked to indicate the extent to which such factors would influence them to publish in open access outlets. Table 5.10 presents the results regarding how researchers' use of open access is influenced by the social factors.

Table 5.10: Role of social influence on researchers' future publishing in open access outlets [N = 394]

Factor	Importance ratings (Number and percentage)				
	Very important	Important	Less important	Least important	Do not know
If close colleagues publish in open access outlets	70 (**17.8**)	165 (**41.9**)	102 (**25.9**)	23 (**5.8**)	34 (**8.6**)
If leading researchers in my discipline publish in open access outlets	128 (**32.4**)	158 (**40**)	66 (**16.7**)	12 (**3**)	31 (**7.8**)
If my research finding agency would look favourably on me	125 (**31.7**)	168 (**42.6**)	56 (**14.2**)	9 (**2.3**)	36 (**9.1**)
If my research finding agency require me to publish in open access outlets	121 (**30.4**)	190 (**48.2**)	41 (**10.4**)	10 (**2.5**)	32 (**8.1**)
If my institution would look favourably on me for publishing in open access outlets	137 (**34.8**)	169 (**42.5**)	42 (**10.7**)	6 (**1.5**)	40 (**10.2**)
If my institution requires me to publish in open access outlets	130 (**33.1**)	179 (**45.5**)	42 (**10.7**)	5 (**1.3**)	37 (**9.4**)

It can be noted from Table 5.10 that almost all factors on social influence were considered by about three quarters of all the respondents as important or very important determinants for their publishing in open access outlets. The research funding agency and employer

requirements for the researchers to publish in open access outlets were the highly ranked factors that could influence the researchers to publish in open access outlets. Accordingly, 78.6% of the respondents indicated these factors as important or very important. Researchers' colleagues publishing in open access was ranked lowest by (59.7%) of the respondents as an influencing factor in publishing in open access.

5.4.5 Open access performance expectations in scholarly communication

An assessment was made to determine how the researchers believed open access facilitates access and dissemination of scholarly content. The results from this investigation are presented in Table 5.11.

Table 5.11: Researchers' ratings on performance expectations of open access [N = 396]

Expectation	Ratings (number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
Open access outlets enable scholars to publish more quickly	109 (**27.7**)	164 (**41.6**)	52 (**13.2**)	6 (**1.5**)	63 (**16**)
Open access outlets increase research impact by researchers' works being highly cited	126 (**32.1**)	157 (**39.9**)	58 (**14.8**)	7 (**1.8**)	45 (**11.5**)
Open access outlets improve accessibility to scholarly literature because it is free	171 (**43.3**)	157 (**39.7**)	29 (**7.3**)	**7 (1.8)**	31 (**7.8**)
Open access enables researchers from developing countries to access literature more easily	179 (**45.2**)	140 (**35.4**)	34 (**8.6**)	8 (**2**)	35 (**8.8**)
Publishing in open access outlets exposes scholarly work to a large potential readership	165 (**41.5**)	160 (**40.5**)	29 (**7.3**)	7 (**1.8**)	34 (**8.6**)

Table 5.11 reveals that majority (83%) of the respondents agreed or strongly agreed with the statement that open access outlets improves accessibility to scholarly literature; 82.3% agreed or strongly agreed with the statement that publishing in open access outlets exposes scholarly works to a large potential readership; 80.6% agreed or strongly agreed with the statement that open access enables researchers from developing countries to access literature more easily; 72% agreed or strongly agreed with the statement that open access outlets increases research impact; and 69.3% agreed or strongly agreed with the statement that open access enables scholars to publish more quickly. Less than half (50%) of all the respondents either disagreed or strongly disagreed with or didn't know/or had no opinion on the five statements about performance expectancy of open access.

5.4.6 Researchers' effort expectancy in open access scholarly communication

Researchers' views about their expected difficulties or ease of open access outlets' usage was examined by providing a number of statements to the respondents for rating themselves against their ability to use open access in scholarly communication. Table 5.12 presents the results from this investigation.

Table 5.12: Researchers' views about their expected difficulties or ease of open access outlets' usage in scholarly communication [N = 394]

Tasks	Ratings (number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
I expect interaction with open access publication system to be clear and understandable	71 (**18.2**)	194 (**49.7**)	44 (**11.3**)	5 (**1.3**)	76 (**19.5**)
It is (will be) easy for me to become skilful at publishing my work in open access	54 (**13.8**)	212 (**54.2**)	58 (**14.8**)	9 (**2.3**)	58 (**14.8**)
Learning to publish my work in open access outlets is (would be) easy for me	58 (**14.7**)	212 (**53.8**)	65 (**16.5**)	10 (**2.5**)	49 (**12.4**)
I clearly understand the implications of publishing in open access outlets	57 (**14.5**)	184 (**46.8**)	71(**18.1**)	11 (**2.8**)	70 (**17.8**)
It is (will find it) easy	89 (**22.4**)	212 (**54.1**)	46 (**11.7**)	8 (**2**)	37 (**9.4**)

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to access open access scholarly content from the Internet					

Table 5.12 reveals that majority of the respondents believed that they were unlikely to face difficulties in using open access outlets to access or publish scholarly output. Finding it easy to access scholarly content was agreed or strongly agreed with by majority of the respondents (76.5%) followed by (61.3%) of the respondents who agreed or strongly agreed with the statement that they understood the implications of publishing in open access outlets.

5.5 Respondents' general perceptions about open access

Researchers' general perspectives about open access were assessed by establishing how they perceived open access publications they accessed, their attitudes towards open access scholarly communication and their general comments about open access. The results from such investigations are reported in the following subsections.

5.5.1 Rankings on open access publications

The respondents were requested to rate the quality of open access publications they accessed. Table 5.13 presents the results of researchers' rankings regarding open access publications.

Table 5.13: Researchers' assessment on open access publications [N = 227]

Open access publications' assessment	Frequency	Percentage
Publications represent adequate standards of quality and have scientific merit	178	82.4
Publications are original and represent high quality research	116	54
Publications are mediocre or of little scientific merit	33	14.5

The results in Table 5.13 indicate that majority of the respondents rated open access publications positively. They considered open access publications they accessed to have had adequate standards of high quality research and scientific merit (82.4%) and that they were original and with high quality research (54%). On the negative side, less than a fifth (14.5%) of the respondents indicated that open access publications were mediocre with little scientific merit.

5.5.2 Researchers' attitudes on open access

The results about researchers' attitudes on open access are presented in Table 5.14.

Table 5.14: Researchers' attitudes towards open access [N=396]

Attitude statement	Ratings (Number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
Publishing in open access is a good idea	166 (**41.9**)	180 (**45.5**)	17 (**4.3**)	7 (**1.8**)	26 (**6.6**)
Publishing in open access outlets would make my work more interesting	70 (**17.9**)	150 (**38.2**)	102 (**26**)	20 (**5.1**)	51 (**13**)
Accessing and use of open access materials is a good idea	116(**29.4**)	203 (**51.4**)	36 (**9.1**)	5 (**1.3**)	49 (**11.9**)
Open access content is beneficial to the scholarly community	147(**47.3**)	168 (**42.6**)	25 (**6.3**)	5 (**1.3**)	49 (**12.4**)
Publishing in open access is easy for me	44 (**11.2**)	119 (**30.4**)	112 (**28.6**)	41 (**10.5**)	76 (**19.4**)

It can be noted from Table 5.14 that majority of the respondents were very positive in almost all the attitude statements provided. With the exception of the last statement where almost more than half (58.5%) of the respondents either disagreed, strongly disagreed or had no opinion, the first four attitude statements were positively rated by more than a half (50%) of the respondents.

Researchers' attitudes about open access were backed up by the university policy makers' views on several open access policy supporting statements. The interviewees were requested to indicate the extent to which they would support or not support a number of policy statements or measures for fostering open access uptake at their respective universities. Table 5.15 presents policy makers' views regarding fostering open access at their respective institutions.

Table 5.15: Policy makers' views in fostering open access development [N= 63]

Statement	Ratings (Number & percentage)			
	Would support	Would likely support	Would need more information	Would not support
Explicit recognition or reward for open access publications	40 (**63.5**)	12 (**19**)	11 (**17.5**)	0
Recommend researchers to retain copyright for publications	45 (**71.4**)	10 (**15.9**)	7 (**11.1**)	1 (**1.6**)
Establish policy to require faculty deposit research output in institutional repository	43 (**68.3**)	15 (**23.8**)	4 (**6.3**)	1 (**1.6**)
Sponsor author charges in open access journals	42 (**66.7**)	12 (**19**)	5 (**7.9**)	4 (**6.3**)
Sponsor publication of institutional journals so that they become openly accessible	41 (**65.1**)	11 (**17.5**)	3 (**4.8**)	8 (**12.7**)

The results in Table 5.15 indicate that majority of the university policy makers would support most of the measures in fostering open access development. Among the 63 respondents, a great majority (92.1%) said they would support or are likely to support the establishment of a policy requiring their faculty to deposit research output in institutional repositories; 87% would support or are likely to support the recommendation for the researchers to retain copyright for their publications; 85.7% would support or are likely to support their institutions to sponsor author charges for their employees to publish in open access journals; 82.5% would support or are likely to support their institutions to sponsor publication of their institutional journals so that they are made openly accessible; and 82.5% would support or are likely to support the explicit recognition or reward for open access publications published by their employees.

5.5.3 Respondents' general comments about open access

The positive attitude about open access by researchers and university policy makers was also noted from individuals who provided the general comments about open access. Table 5.16 lists some of the statements emanating from comments provided by the researchers and policy makers regarding open access.

Table 5.16: Researchers' and Policy makers' general comments on open access

> Open access is good, it should not be limited to universities alone but should be adopted national-wide

> University administrators should be educated on open access benefits and limitations for its adoption at respective institutions.

> University policies should be reviewed to consider open access publications in career development.

> Open access is good for sharing research results as well as increasing researchers' and institutions' recognition internationally.

> Open access increases collaboration of researchers internationally.

> Open access is important but it is new, there is need for more sensitisation and having it supported by university policies.

> Create awareness for positive perceptions on quality and value of open access publications.

> Open access is especially good for countries with limited access and dissemination of research findings.

> There is no reason to hide academic work, so I support open access.

> Open access is good, it will benefit distance learning students

> Good initiative, promote and implement it.

> Open access depends on Internet, so connectivity should be improved for more researchers to benefit.

> Open access is good but the perceived low quality of free journals and poor Internet connectivity especially in Tanzania remain the main challenges.

> Open access is very new to most academicians though it seems to be very good as far as accessibility to information is concerned.

> Open access is something new and interesting - it should be promoted; developing countries should accelerate the pace of establishing open access publishing in order to make their publications widely accessible.

> Open access publications increase the visibility and impact of scientific findings from researchers to a wide audience especially in developing countries.

> Scholars in developing countries should be encouraged to publish in open access outlets so that their findings reach more people.

> Open access is good for information sharing but there is need for a good mechanism to ensure quality control to avoid poor quality materials.

> It is unacceptable/difficult making publications free of charge, hence do not support

open access.

As noted from Table 5.16, most of the general comments about open access were positive. However, some individuals accepted the new scholarly communication with caution especially with regard to quality control. Only the last statement which was provided by one of the interviewees was totally against open access publishing.

5.6 Respondents' perceptions on institutional repositories' establishment

Researchers' perceptions on institutional repositories' establishment at their respective institutions for the dissemination of scholarly output was assessed to determine the acceptability of repositories in question. The importance of institutional repositories at their respective universities, the preferred repository content, acceptable use of repository content, importance of reviewing repository content, and the most appropriate unit to manage the repositories were the key issues investigated. The following subsections present results about these issues.

5.6.1 Importance of institutional repositories

Before seeking their views regarding their acceptance of open access repository establishment at their institutions, the researchers and policy makers were first required to comment on whether or not the dissemination of research output at their respective institutions was a problem. A total of 392 respondents provided answers to this question. Slightly above a half (53.3%) of the respondents agreed and nearly a third (29.8%) strongly agreed with the statement that the dissemination of research output at their respective universities was a problem. These results correspond with those from the interviewees in which close to half of the respondents (46%) agreed and (44.4%) strongly agreed with the statements that such mechanisms of enforcing the dissemination of research findings were not working and that the dissemination of research at their respective universities was a problem.

On the importance they attached to the establishment of institutional repositories as a strategy to improve the dissemination of research output at their universities, among the 394 respondents, 60.4% considered it very important and 36.3% as important. Only 3.3% of the respondents said it was either less important or least important. Similar views were observed

from the interviewees whereby, among 63 respondents, 57.1% considered it very important, 39.7% important, and only 3.2% said it was the least important.

5.6.2 Preferred institutional repository content

The respondents were asked to indicate the most preferred content for their institutional repository if established at their universities. Tables 5.17 and 5.18 respectively presents results on preferred institutional repository content as suggested by the respondents in the main questionnaire and interview. The percentages add to more than 100 due to multiple responses.

Table 5.17: Preferred institutional repository content by researchers [N=398]

Preferred content	Frequency	Percentage
Conference papers	322	80.9
Peer-reviewed articles published in a journal	320	80.4
Theses/dissertations	314	78.9
Teaching materials	244	61.3
Non-peer-reviewed articles published in a journal	122	31
Articles waiting peer review in a journal	75	18.8

Table 5.18: Preferred institutional repository content by policy makers [N = 62]

Preferred content	Frequency	Percent
Conference papers	55	87.3
Peer-reviewed articles published in a journal	54	85.7
Theses/dissertations	50	79.4
Teaching materials	41	65.1
Articles waiting peer review in a journal	18	28.6
Non-peer-reviewed articles published in a journal	17	27

The results from both Tables 5.17 and 5.18 respectively indicate that the most preferred repository content (in that order of priority) were conference papers (80.9%), peer-reviewed articles in a journal (80.4%), theses/dissertations (78.9%) and teaching materials (61.3%). Non-peer-reviewed articles were least preferred (31%) to be included in the repository. Research reports, consultancy reports and annual institutional reports (in that order of priority) were among the additional publications highly ranked by the researchers for inclusion in the institutional repositories.

5.6.3 Allowable use of institutional repository content

The researchers were required to indicate the allowable use of their materials if deposited in the repository. Table 5.19 summarises the results about the acceptable use of the repository materials.

Table 5.19: Allowable use of materials in institutional repository [N=398]

Allowable usage	Frequency	Percent
Any use of deposited works so long as it is properly acknowledged	290	72.9
Individuals should be required to register before using repository content.	207	52
Anybody should be allowed to comment and/ or add notes on deposited works	93	23.4

It can be noted from Table 5.19 that more than three quarters (72.9%) of the respondents would allow any use of their works to be deposited in the institutional repository so long as users provided proper acknowledgement. Slightly above a half (52%) of the respondents would only allow usage of their works upon users' registration. However, about a quarter (23.4%) of the respondents could allow comments or addition of notes by other people in their deposited works.

5.6.4 Review of repository content

To find out how researchers valued the review of publications for the integrity of scholarly communication, the respondents were requested to indicate the importance of reviewing publications that had not undergone the review process before being deposited in the institutional repository. Among the 378 respondents who answered this question, 45% said it was very important, 45.8% said it was important, while the remaining 9.3% considered it as either less important or least important or had no comment. The respondents were also required to propose the review team for repository content. Table 5.20 presents the proposed review team by the researchers.

Table 5.20: Proposed review team for IR content [N = 339]

Source of review team	Frequency	Percentage
Faculty/Institute/ Directorate research committee	125	36.9
Departmental research committee	122	36
University-wide research committee	77	22.7

As to who should compose the review team, it is noted from Table 5.20 that among the 339 respondents who provided answers, 36.9% proposed the departmental research committee, 36% proposed faculty/institute/directorate committee and the other 22.7% respondents recommended the university-wide committee to do the review process. Other respondents also recommended specialists in the field; external experts; selected reviewers; and the university technical team (in that order of priority) as the other alternatives for composition of the review team.

5.6.5 Proposed unit for institutional repository management

The researchers were required to propose the most appropriate unit within their universities they thought should manage the institutional repository once established. These findings are presented in Table 5.21.

Table 5.21: Proposed unit for IR management [N = 374]

Proposed unit	Frequency	Percentage
University library	244	65.2
University-wide unit responsible with research administration	78	20.9
Each faculty/Institute/Directorate	47	12.6

The results in Table 5.21 indicate that nearly two thirds (65.2%) of the respondents preferred the university library as the most appropriate unit for managing institutional repository; a fifth (20.9%) recommended a university-wide research coordination unit while the remaining 12.6% of the respondents chose faculty/institute/directorate as their preference. A similar trend was observed from the university research administrators. Among 63 administrators,

61.9% recommended the university library; 19% the university-wide research coordination unit; 12.7% the computer centre/ICT unit and; 3.2% considered the faculty/institute directorate as the most suitable units for managing institutional repositories. Those who chose the library said their preference was motivated by several reasons including: repository management as being the task of the library in other places; the library being well equipped in terms of ICT facilities and expertise and; the library having a mandate of information management for the university.

The arguments for preference of the university-wide research units included: a university-wide unit controls all research activities at the university hence it is easy to track research output for inclusion in the repository; a university-wide unit is mandated with coordination and dissemination of research findings; the unit is more representative for the whole university; and that the unit is responsible with quality control of publications from the university and hence well positioned to manage the institutional repository. The preference for faculty/institute was also justified as it would make the review process less bureaucratic since people who form the review panel as well as publications for review are located at such units.

5.7 Factors hindering researchers' use of open access content

Factors that hinder researchers' use of open access content were determined by asking the respondents their reasons for not accessing open access content. Among the 45 respondents who provided the reasons for non-usage of open access outlets to access information mostly (44.4%) said it was due to inadequate information search skills on the Internet, close to one third (28.9%) of the respondents said they were unaware about open access, 15.5% of the respondents cited poor Internet service, 6.7% of the respondents said it was due to lack of time, and the remaining proportion (4.4%) indicated that they just never attempted to access free content on the Internet.

Similar factors most likely to contribute to non-usage of open access are deduced from the factors reported by the respondents as affecting their general Internet usage and summarised in Table 5.22.

Table 5.22: Internet use problems faced by researchers in information access [N = 340]

Nature of the problem	Frequency	Percentage
Slow Internet connectivity	202	59.4
Access restrictions by publishers (requiring subscription to access)	181	53.2
Inadequate Internet search skills	52	15.3
Power interruptions	29	8.5
Unreliable Internet connectivity	25	7.3

From Table 5.22 it can be noted that slow Internet connectivity, inadequate Internet search skills and power interruptions as well as the unreliable Internet connectivity are some of the problems reported to have been affecting the researchers in accessing open access content.

5.8 Factors hindering researchers' dissemination of research findings through open access

To determine the factors that hinder researchers in disseminating their research output through open access avenues, the respondents were requested to indicate reasons for not publishing in such outlets. This question was directed to 319 respondents who indicated to have never published in open access outlets. They were provided with a list of pre-conceived reasons so that they indicate the extent of their agreement or disagreement with such reasons. Table 5.23 presents the results regarding the reasons for non-publishing in open access outlets.

Table 5.23: Reasons for not publishing in open access outlets by researchers [N=286]

Reason for not publishing in open access outlets	Ratings (number & percentage)				
	Strongly agree	Agree	Disagree	Strongly disagree	Do not know
Lack of adequate skills to publish in open access outlets	106 (**38.8**)	69 (**24**)	45 (**15.6**)	25 (**8.7**)	43 (**14.9**)
Long-term availability of open access publications is not guaranteed	29 (**10.1**)	73 (**25.3**)	46 (**16**)	22 (**7.6**)	118 (**41**)
Open access publications are of low quality as compared to subscribed ones	39 (**13.6**)	80 (**41.6**)	55 (**19.2**)	31 (**10.8**)	81 (**28.3**)
Open access publications are likely to be misused or plagiarised	53 (**18.5**)	93 (**32.5**)	37 (**12.9**)	21 (**7.3**)	82 (**28.7**)
Open access publishing is not compatible with the existing scholarly communication practice	24 (**8.3**)	57 (**19.7**)	74 (**25.5**)	20 (**6.9**)	114 (**39.4**)

It is revealed from Table 5.23 that about two thirds (60.8%) of the respondents strongly agreed or agreed with the statement regarding lack of adequate skills for open access publishing as a contributing factor for them not to publish in open access outlets. The other reasons which were highly ranked include: open access publications being of low quality as compared to subscribed versions (55.2%); open access publications being likely to be misused or plagiarised (51%); and researchers' worry on long-term availability of open access publications (35.4%). The reason that open access publishing is not compatible with the existing scholarly communication practice was lowly ranked (28%) as the cause for the researchers' non-usage of open access outlets in disseminating research output. Other factors that were cited to affect the ability of the researchers to publish online as noted in Table 5.23 are equally likely to affect researchers wishing to publish in open access avenues.

Table 5.24: Internet use problems faced by researchers in publishing on the Internet [N = 176].

Nature of the problem	Frequency	Percentage
Slow Internet connectivity	64	36.4
Publication charges by some open access publishers	55	31.2
Inadequate online publishing skills	54	30.7
Power interruptions	41	23.3
Unreliable Internet connectivity	30	17

It can be noted from Table 5.24 that slow Internet connectivity (36.4%), publication charges by some publishers (31.2%), lack of skills to publish online (30.7%), power interruptions (23.3%), and unreliable Internet connectivity (17%) are the reported problems that directly or indirectly affect the researchers to publish in open access outlets. Some additional reasons reported by the respondents as contributing to their non-publishing in open access outlets include non- recognizing of open access publications for career development and high costs of publishing in open access outlets.

5.9 Validation of the research model on open access usage in scholarly communication

The results reported in the previous sections (5.2 - 5.8) were based on descriptive statistics. This section reports the inferential statistical results based on the research model (Figure 4) that was developed in Chapter Three. The results presented in this section are meant to validate the research model in question. The following subsections present the measurement model and structural model results.

5.9.1 Measurement model assessment results

The measurement model assessment was done to determine the statements from each construct for retention or elimination in the binary logistical regression analysis. Essentially, the measurement model assessment involved the factor analysis for the determination of the constructs validity. Before proceeding with factor analysis the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test were conducted to determine whether or not it was appropriate to conduct factor analysis. The determined KMO measure of sampling adequacy was 0.879. The Bartlett's test of sphericity was found to be significant [Ch-square = 6638.042 = Degree of freedom (df) = 435 = Significance (sign.) = 001]. The results suggested that the data could support factor analysis. The factor analysis results are presented in Table 5.25.

Table 5.25: Factor analysis results extracted from the rotated component matrix

Survey items	Component					
	1(SI)	2(PE)	3(FC)	4(EE)	5(AT)	6(ISE)
Will publish in open access outlets if your institution would look favourably on you for publishing in such outlets	**0.877**	0.168	0.058	0.086	0.102	0.032
Will publish in open access if your institution requires you to publish in such outlets.	**0.856**	0.138	0.037	0.062	0.113	0.053
Will publish in open access if your research funding urgency requires you to publish in such outlets	**0.845**	0.125	0.103	0.141	0.155	0.036
Will publish in open access if your funding research urgency would look favourably on you for publishing in such outlets	**0.812**	0.082	0.092	0.043	0.170	0.033
Will publish in open access if leading researchers in your discipline publish in such outlets	**0.717**	0.072	0.097	0.062	0.319	0.020
Will publish in open access if your close colleagues publish in such outlets	**0.646**	0.082	0.132	0.039	0.338	0.138
Open access outlets enable researchers in developing countries to access literature more easily	0.167	**0.874**	0.062	0.122	0.052	0.043
Open access outlets improve accessibility to literature because it is free	0.174	**0.861**	0.001	0.175	0.112	-0.007
Open access outlets expose scholarly work to a large potential readership	0.130	**0.843**	0.071	0.147	0.062	-0.060
Open access outlets increase research impact by such works being highly used and cited	0.100	**0.784**	0.130	0.214	0.172	0.061
Open access outlets enable scholars to publish more quickly	0.075	**0.577**	0.250	0.354	0.129	0.121
Guidance is available for me to use the Internet for publishing my research output	0.024	0.039	0.801	0.186	0.085	0.026
I have the necessary resources to publish my work in open access outlets	0.057	0.146	**0.793**	0.092	0.068	0.021
Guidance is available for me to use the Internet effectively for information access	0.123	0.113	**0.782**	0.118	-.008	0.051
I have the necessary knowledge to publish my work in open access outlets	0.069	0.028	**0.757**	0.128	0.043	0.171
My institution recognises open access publications for my career development	0.127	0.047	**0.746**	0.140	0.54	-0.031
Learning to publish my work in open access outlets (is) would be easy for me	0.127	0.157	0.100	**0.816**	0.071	-0.005
It will be easy for me to become skilful at publishing my work in open access	0.108	0.146	0.079	**0.777**	0.183	0.034

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I believe the interaction with open access publication system is clear and understandable	0.007	0.161	0.195	**0.725**	0.140	0.104
I clearly understand the implications of publishing in open access outlets	0.048	0.129	0.235	**0.633**	0.165	0.165
I (will) find it easy to access open access scholarly content from the Internet	0.123	0.337	0.171	**0.624**	0.017	0.097
Publishing in open access is a good idea	0.422	0.167	0.009	0.096	**0.735**	0.028
Accessing and use of open access materials is a good idea	0.368	0.159	-0.076	0.129	**0.715**	-0.009
Publishing in open access outlets would make my work more interesting	0.208	0.014	0.089	0.127	**0.710**	0.091
Open access content is beneficial to the scholarly community	0.377	0.194	0.044	0.130	**0.698**	0.004
Publishing in open access outlets is easy for me	0.003	0.067	0.247	0.222	**0.578**	0.260
I feel confident publishing my research on the Internet	0.023	0.010	0.211	-0.063	0.157	**0.783**
I feel confident in publishing on the Internet without assistance	0.028	0.071	-0.032	0.176	0.016	**0.772**
I feel confident in designing personal websites	0.031	-0.097	0.165	0.019	0.178	**0.693**
I feel confident in searching information on the Internet	0.117	0.089	-0.099	0.146	-0.079	**0.602**

Key: 1 (SI) - Social influence; **2 (PE) –** Performance expectancy; **3 (FC) –** Facilitating conditions; **4 (EE) –** Effort expectancy; **5 (AT) –** Attitude; **6 (ISE) –** Internet self- efficacy.

The above statements were measured on a 5-point scale: 5 = No opinion/do not know, 4 = Strongly disagree, 3 = Disagrees, 2 = Agree, and 1 = Strongly agree, except the social influence statements where: 5 = No opinion/do not know, 4 = Least important, 3 = Less important, 2 = Important, 1 = Very important. Reverse coding whereby 5 represented strongly agree or very important and 1 for no opinion/do not know was done prior to entering the data onto the SPSS database for subsequent analysis.

As noted from Table 5.25, exploratory factor analysis yielded six constructs with a total of 30 items as designed in the survey questionnaire. The factor loadings of the items ranged from 0.5 to 0.9. With regard to the discriminant validity, it was proved that items belonging to same constructs loaded highly in their constructs as compared to the loadings of similar items in different constructs. This is noted in Table 5.25 whereby the loadings from the same constructs as shaded while those from the different constructs are not shaded. All the factors

included in the factor analysis had no cross construct loading exceeding 0.5 while the minimum loadings for factors from the same constructs were above 0.5.

5.9.2 Structural model assessment results

The structural model assessment was conducted using binary logistic regression in two separate analyses. The first part involved determining the factors affecting behavioural intention of open access usage by the researchers. The other part was on determining factors affecting the researchers' actual open access usage. The following subsections report the results from the two investigations.

5.9.2.1 Determinants of researchers' behavioural intention of open access usage

This analysis involved a determination of the causal relationships among various factors shaping the researchers' open access usage behavioural intention. This analysis was done after the determination of the fitness and appropriateness of model to the collected data. Accordingly, the Omnibus Test of Model Coefficients, Model Summary, Hosmer and Lemeshow Test, and the Classification table outputs were examined. The Omnibus Test of Model Coefficient was found to be statically significant, (X^2 = 73.646, N = 379, 11 degree of freedom, p<0.001). The model summary results revealed a -2 Log Likelihood of 339.498 with 0.177 and 0.266 Cox & Snell and Nagelkerke R squares respectively. The Hosmer-Lemeshow test was found insignificant (X^2 = 16.403, 8 degree of freedom, p = 0.03. The model was found to correctly predict 79.7% of the predictions on open access usage as revealed by the classification table. Table 5.26 presents the results of various causal relationships among various factors contributing to open access usage behavioural intention by the researchers.

Table 5.26: Determinants of researchers' behavioural intention of open access usage [N = 379]

Factor	B	SE	Wald	Significance	Exp(B)
Attitude	0.285*	0.135	4.472	0.034	1.330
Effort expectancy	0.457**	0.143	10.263	0.001	1.579
Internet Self-efficacy	-0.090	0.140	0.411	0.521	0.914
Performance expectancy	0.275*	0.135	4.153	0.042	1.317
Social influence	-0.207	0.139	2.202	0.138	0.813
Age	-0.196	0.203	0.929	0.335	0.822
Awareness	-1.076**	0.295	13.325	0.001	0.341
Gender	0.019	0.338	0.003	0.956	1.019
Experience	0.076	0.215	0.126	0.723	1.079
Position (Rank)	-0.091	0.162	0.316	0.574	0.913
ATT X AW	0.132	0.091	2.108	0.147	1.141
SI X AG	-0.029	0.038	0.560	0.454	0.972
PE X GDR	0.190	0.098	3.761	0.052	1.209
EE X AG	0.139**	0.042	10.979	0.001	1.149
SE X AG	-0.028	0.043	0.425	0.515	0.972
ATT X POS	0.065	0.040	2.590	0.108	1.067
SI X EXP	-0.076	0.058	1.724	0.189	0.927
EE X EXP	0.213**	0.065	10.817	0.001	1.237
ISE X EXP	-0.064	.063	1.041	0.308	0.938
SI X GDR	-0.156	0.116	1.816	0.178	0.856
ISE X POS	-0.005	0.048	0.009	0.924	0.995
SI X POS	-0.030	0.044	0.462	0.496	0.970
EE X GDR	0.381**	0.116	10.721	0.001	1.464

Key:

➤ **ATT:** Attitude; **EE:** Effort expectancy; **SI:** Social influence; **ISE:** Internet self-efficacy; **AG:** Age**; AWR:** Awareness; **EXP:** Experience**; GDR**: Gender**; POS:** Position

➤ **B: Unstandardised regression coefficient (Odds ratio)**

➤ **Exp(B) : Exponentiated odds ratio**

➤ **SE: Standard Error**

➤ ***p<.05; **p<.01; ***p<.001**

It is noted from Table 5.26 that the main constructs of Internet self-efficacy and social influence as well as independent factors including age, gender, experience and position did not significantly influence the researchers' behavioural intention of open access usage in scholarly publishing.

Attitude significantly determined the behavioural intention of researchers' open access usage (B = 0.285, p<0.5 with the Exponentiated odds ratio of 1.330). Effort expectancy influence also significantly determined researchers' behavioural intention to use open access (B = 0.457, p<0.01 with the Exponentiated odds ratio of 1.579). Similarly, Performance expectancy significantly determined the behavioural intention of open access usage by researchers (B = 0.275, p<0.05 with the Exponentiated odds ratio of 1.317).

It is further noted that the influence of effort expectancy with respect to the researchers' behavioural intention of open access usage was moderated by age, gender, and experience. Age (B = 0.139, p<0.01; with the Exponential odds ratio of 1.149), gender (B = 0.213, p<0.01; with the Exponential odds ratio of 1.237). Similarly, experience (B = 0.381, p<0.01) significantly moderated the effect of effort expectancy regarding the researchers' behavioural intention of open access usage.

With respect to the independent factors, it is noted that the researchers' awareness had direct influence on their behavioural intention of open access usage. The researchers' awareness of open access (B = -1.076, p<0.001; with the Exponential odds ratio of 0.341) significantly shaped their behavioural intention of open access usage.

5.9.2.2 Determinants of researchers' open access usage behaviour

As was the case in the previous analysis, the Omnibus Test of Model Coefficients, Model Summary, Hosmer and Lemeshow Test, and the Classification table outputs were determined prior to assessing the causal relationships among the various factors shaping researchers' open access usage behaviour. The Omnibus Test of Model Coefficient was found to be statistically significant, (X^2 = 112.58, N = 374, 11 degree of freedom, p<0.001). The model summary results revealed a -2 Log Likelihood of 256.67 with 0.260 and 0.412 Cox & Snell and Nagelkerke R squares respectively. The Hosmer-Lemeshow Test was also found significant (X^2 = 6.593, 8 degree of freedom, p = 0.58. The model was found to correctly predict 83.7% of the predictions on open access usage as revealed by the classification table. Table 5.27 presents the results of the various causal relationships among various the factors contributing to open access usage by the researchers.

Table 5.27: Determinants of researchers' open access usage [N = 374]

Factor	B	SE	Wald	Significance	Exp(B)
Attitude	0.332	0.186	3.190	0.074	1.393
Facilitating conditions	0.409*	0.176	5.365	0.021	1.505
Internet Self-efficacy	-0.138	0.146	.896	0.344	0.871
Social influence	-0.517**	0.177	8.578	0.003	0.596
Behavioural intention	1.759***	0.344	26.186	0.000	5.808
Age	0.512*	0.244	4.424	0.035	1.669
Awareness	-1.887**	0.550	11.751	0.001	0.152
Gender	-0.456	0.419	1.186	0.276	0.634
Experience	-.0467	0.268	3.027	0.082	0.627
Position	-0.104	0.184	0.332	0.571	0.901
FC X AG	0.122*	0.053	5.290	0.021	1.129
FC X EXP	0.150	0.079	3.642	0.056	1.162
ISE X AG	-0.054	0.04	1.647	0.199	0.947
ISE X EXP	-0.086	0.062	1.906	0.167	0.917
ISE X GDR	-0.132	0.107	1.537	0.215	0.876
ISE X POS	-0.064	0.049	1.665	0.197	0.938
SI X AGE	-0.161**	0.053	9.355	0.002	0.851
SI X EXP	-0.180*	0.074	5.948	0.015	0.835
SI X GDR	-0.445**	0.145	9.373	0.002	0.641
SI X POS	-0.194**	0.060	10.303	0.001	0.828

Key: 1. FC: Facilitating conditions; 2. B (Odds ratio); 3. Exp(B) : Exponentiated odds ratio; 4. SE: Standard Error; 6. *p<.05; **p<.01; ***p<.001

It can be noted from Table 5.27 that three factors had significant effects on the researchers' open access usage in scholarly publishing. The first determinant of the researchers' open access usage is facilitating conditions. This factor was found significant (B = 0.409, p<0.5 with the Exponentiated odds ratio of 1.505). This factor was also significantly moderated by age (B = 0.122, p<0.05. Social influence also significantly determined the researchers' usage of open access (B = -0.517, p<0.01 with the Exponentiated odds ratio of 0.596). Age (B = -0.161, p<0.01), experience (B = -0.189, p<0.05) and position (B = -0.194, p<0.01) significantly moderated the effect of social influence on the researchers' usage of open access. Lastly for the main constructs, behavioural intention significantly influenced the researchers' usage of open access (B = 1.759, p<0.001 with the Exponentiated odds ratio of 5.808). It was further established that age and awareness had direct effects on the researchers' usage of open access. Furthermore, awareness significantly determined

researchers' usage of open access at p<0.001 while the effect of age was noted to be significant at p<0.05.

5.10 Chapter summary

This Chapter presented the findings about open access scholarly communication in public universities in Tanzania. The overall results indicate that many researchers were aware of the open access concept. It was also revealed that most of the researchers used open access outlets to access rather than disseminate their scholarly output. From the descriptive statistics it has been established that researchers' Internet usage skills, Internet self-efficacy, facilitating conditions, social influence, performance expectancy, and effort expectancy are among the factors that could facilitate the researchers to use open access in scholarly communication.

With respect to the inferential statistics, effort expectancy, facilitating conditions and Internet self-efficacy on the one hand, and age, awareness, research discipline, behavioural intention, facilitating conditions, and social influence have been established to significantly influence the researchers' behavioural intention and open access publishing behaviour. The slow Internet connectivity, inadequate skills for information search under the digital environment, and power interruptions were identified as the main hindrances for the researchers to access online materials including open access content. On the other hand, the respondents listed the slow Internet connectivity, publication or author charges by some publishers, inadequate online publishing skills, power interruptions, and unreliable Internet connectivity as the main obstacles for them to publish in open access outlets.

The general perceptions of the researchers and university policy makers about open access were very positive. Many respondents highly welcomed the idea of the establishment of institutional repositories as a way of improving the dissemination of research output emanating from their respective universities. The most preferred research content (in the order of priority) for the proposed institutional repositories were: conference papers, peer-reviewed articles from journals, theses/dissertations, research reports, and consultancy reports. Majority of the respondents emphasised the need of reviewing the content before posting it in the institutional repositories. The university libraries were the most preferred units within the university set up for the management of institutional repositories. The following Chapter interprets and discusses the results presented in this Chapter.

CHAPTER SIX

INTERPRETATION AND DISCUSSION OF RESEARCH FINDINGS

6.0 Introduction

Chapter Five presented the research findings of the study. This Chapter interprets and discusses the findings presented in the previous Chapter. As explained in section 1.5 of Chapter One, the overall aim of the study was to investigate factors affecting the adoption of open access in research activities within public universities in Tanzania so as to recommend the means of enhancing the use of this mode of scholarly communication. The specific objectives of the study were to:

i) Review developments in scholarly communication and open access adoption at global level.

ii) Investigate the general awareness and usage of open access with a focus on Africa and Tanzanian public universities in particular.

iii) Find out factors that facilitate the adoption of open access in research activities in Tanzanian public universities.

iv) Find out researchers' and policy makers' perceptions on open access scholarly communication in Tanzanian public universities.

v) Determine factors that hinder the adoption of open access in research activities in Tanzanian public universities.

vi) Suggest strategies to resolve the hindrances to the adoption of open access in research activities in Tanzanian public universities.

vii) Formulate a research model of technology acceptance regarding open access usage in research activities in Tanzanian public universities.

viii) Validate the research model that best describes open access usage behaviour and behavioural intention by Tanzanian public universities' researchers.

In order to address the above objectives, the study sought to answer the following questions:

1. What forces are behind the emergence of open access?

2. To what extent has open access been adopted internationally?

3. To what extent are researchers and policy makers aware of open access and what is the extent of open access adoption in research activities in Tanzanian public universities?

4. How is the open access awareness and usage in Tanzanian public universities rated in comparison to other countries in Africa and elsewhere?

5. What factors facilitate the use of open access outlets by researchers in accessing scholarly literature?

6. What factors facilitate the researchers' use of open access outlets in disseminating research output?

7. What are the researchers' and policy makers' general perceptions on open access publishing?

8. How do the researchers and policy makers perceive the establishment of open access repositories at their institutions for the dissemination of scholarly content?

9. What factors hinder the use of open access scholarly content in research activities?

10. What factors hinder the dissemination of research findings through open access avenues?

11. How can the identified hindrances be resolved for more adoption of open access to improve scholarly communication?

12. What are the important dependent variables expected to influence researchers' open access usage behaviour and behavioural intention?

13. Which moderators are expected to affect the influence of dependent variables towards independent variables?

14. How useful is the research model in terms of its predictiveness and fitness to the collected data?

15. What are the significant variables that influence researchers' open access usage behaviour and behavioural intention?

The presentation in this Chapter follows the order and themes of research questions as listed above. It should also be noted that the findings pertaining to research question number one and two were discussed in Chapter Two. Similarly, the findings for research questions number twelve and thirteen as listed above were discussed in Chapter Three. The information and insights that emerged from the literature provided a basis for comparison with the emerging research findings of this study.

It should also be noted that the research question number eleven is addressed separately in Chapter Seven which among other aspects focuses on recommendations of the study. However, this research question is partly addressed in this Chapter wherever the respondents provide solutions to some of the hindrances to open access usage.

6.1 Respondents' background

Although the research questions were not concerned with the background of the respondents, aspects such as academic qualification, gender, rank, and Internet usage experience were among the important preconceived factors expected to determine open access usage in public universities addressed by this study. These factors are considered important as they were employed as moderators of researchers' open access usage in the research model used to guide this study as explained in Chapter Three. The importance of such factors is also noted in other similar studies that adopted these factors as moderators of technology acceptance (Venkatesh *et al*, 2003; Zhang and Li, 2004; Louho, Kallioja and Oittinen, 2006; Schaper and Pervan, 2007). A brief discussion of researchers' background is thus considered important to establish the suitability of such respondents to the study of this kind. The background of the respondents provide confidence on the part of the researcher regarding the reliability of the responses since under normal circumstances competent respondents are expected to give reliable answers (Lwehabura, 2007).

The profile of the respondents as presented under section 5.1 include age, highest academic qualification, gender, experience in terms of Internet usage, and rank/position of the respondents. The five attributes are considered important in shaping scholarly communication involvement of researchers. The researchers' age (70.4% beyond 40 years), academic qualifications (75.1% PhD holders), Internet use experience (88.4% more than five years) and seniority (53.8% above lecturer position) are all on the higher side. This is not surprising, since under normal circumstances, the older researchers are expected to have attained high qualifications and also accumulated more research experience. The distribution of the respondents by gender as observed in section 5.1 is an indication of a balanced study population based on the existing staffing at the respective universities as noted in Table 4.2 in Chapter Four. The number of female respondents was low as a result of this category of employees having the lower representation than their male counterparts in all the universities under the study. This is due to the fact that fewer females are employed by the universities as none of the universities in the study area had attained a gender balance in their employment.

From the observed researchers' profile, it is evident that such respondents were appropriate for this study as majority are expected to be involved in scholarly communication as well as potential users of Internet technology in exploitation of open access opportunities. This is due to the fact that majority of the respondents were PhD holders and belonged to senior academic ranks which demand of them to be involved in scholarly communication. While it is possible for an individual to be positioned to the rank of lecturer immediately upon the attainment of a PhD, it is impossible for such individual to get further promotion to higher ranks without involving themselves in some form of scholarly communication. Based on the existing promotion criteria, movement from the ranks of lecturer/or senior lecturer to professor for example, requires an individual to have published several articles [number of publications vary from lecturer to professor] in recognised publications for almost all Tanzanian public universities. A typical example is the promotion of a lecturer to the position of senior lecturer at the Sokoine University of Agriculture. This requires one to have accumulated a total of seven units of which at least three units should come from published papers in recognised peer-reviewed journals or books (SUA, 2009). Moreover, since majority of respondents have Internet use experience of more than five years, they are inadvertently potential beneficiaries of open access opportunities in scholarly communication.

6.2 Awareness of the concept of open access

Majority of both the policy makers (90.5%) and researchers (72.1%) were aware of open access before this survey. These findings are contrary to those reported by Greyson *et al* (2009) in which policy makers were found lagging behind with respect to open access awareness. The cited study reveals that only 38% of the 13 research administrators had a clear idea of open access. In the cited study 84% librarians indicated to be clear with the concept of open access. This means that for most of the respondents in the current study, the concept is quite familiar and hence they were in a position to have an opinion about it. Compared to several previous studies done in Tanzania and elsewhere, the findings of this research reveal an improvement in open access awareness over time. For example, studies done prior to 2007 indicated less than 60% of the respondents being aware of open access (De Beer, 2005; Pickton, 2005; Lwoga *et al*, 2006; Macfie, 2006; Moller, 2006; Ouya, 2006). This compares to recent studies that were conducted in the Southern African region by Fullard (2007) and SARUA (2008) which reported the awareness of open access among the respondents to be 61% and 71% for the former and the latter studies respectively. It appears that policy makers, i.e. the interviewees are more familiar with open access journals as

compared to other open access aspects or initiatives. This implies lack of deeper understanding of open access on the part of these respondents and hence the need for more awareness creation so that the concept is well understood.

Colleagues, publishers' promotion and general reading Internet usage were found to be the main means through which the respondents were informed about open access. These findings suggest that despite their potential (Wang and Su, 2006; SARUA, 2008), university libraries did not play a significant role in promotion of open access in the universities involved in this study. Several other studies have acknowledged that colleagues, contacts from institutional repository staff members, publicity through campus newspapers, results of a web search engine/Internet, direct publicity from publishers, word of mouth from associates, and participation in an initial meeting of institutional repository are the ways through which the respondents were exposed to open access (Pelizzari, 2003; Swan and Brown, 2005; Kim, 2006; Moller, 2006; Sanchez-Tarrago and Fernandez-Molina, 2009). The results of this and other studies imply that advocates of open access need to use a combination of those methods in promoting this mode of scholarly publishing so that it is widely known by researchers. It is thus necessary for librarians in collaboration with other stakeholders within the public universities in Tanzania to spearhead campaigns aiming at creating further awareness of open access by the researchers and policy makers using a combination of channels.

6.3 Usage of open access outlets in accessing scholarly content

The study revealed that awareness does not automatically translate to use since access to open access content was relatively low (62.3%) as compared to the high level of open access awareness (72.1%) by such respondents. While also noting that access only does not confirm use, it is however important to note that other similar studies registered higher access to open access content. For example, Gadd, Oppenheim and Probet (2003) and Pelizzari (2003) report 88% (N=530) and 77.4% (N=62) respectively of the respondents in their studies to have accessed open access content. Similarly, De Beer (2005) found out that 88% of the respondents have accessed free content on the Internet. This compares to 80% and 66% of the respondents who were reported to have accessed open access content by Deoghuria and Roy (2007) and Mann *et al* (2008) studies respectively. A study by Utulu and Bolarinwa (2009) reports the low usage of open access content as compared to the current findings and the above studies. Based on the cited study, it is noted that only 46% of the respondents acknowledged to have accessed scholarly content through open access journals.

Respondents from this study who claimed to have never used or accessed (37.7%) open access scholarly content were likely to be the non-users of online information search facilities such as Google scholar which could have availed to them both free and subscribed content. Since open access definition was provided to the respondents before they were asked whether or not they had accessed open access content, the possibility for such respondents to have accessed free content without their prior knowledge of open access mode of scholarly communication is ruled out. Swan and Brown (2005:70) observe that "Google scholar crawl web pages and OAI-compliant open access archives specifically indexing academic material and returns to searchers articles from open access archives that they may not have explored before out of ignorance of their existence". This view has also been corroborated by other scholars pointing out that sometimes, the researchers find themselves benefiting from open access materials through Internet search, without their awareness that they were actually benefiting from open access initiatives (Papin-Ramchan and Dawe, 2006; Fullard, 2007). In order to increase the usage of open access for accessing scholarly content, the promotion of this mode of scholarly communication as well as training on the effective exploitation of the Internet by the research community is considered important.

6.4 Dissemination of scholarly output in open access outlets

Ideally, researchers' access to free scholarly content is expected to be a motivation for them to disseminate their scholarly output using similar outlets. This should be the case for any researcher who wishes to disseminate her/his research findings widely for more impact. In this respect, it is assumed that usage of free content by scholars also makes them more aware of the benefits of open access. However, the findings from this study indicate that fewer researchers disseminated their findings through open access means than they did in accessing open access content. According to results of this study, less than 20% of the respondents published in open access outlets as opposed to 62% of those who accessed free scholarly content from the Internet.

Less publishing in open access outlets by researchers in the public universities addressed by this study is also noted from the low visibility of their research output in the OAIster database. It should also be noted that the total number of publications reported by researchers to have been made openly accessible did not tally with those visible in the OAIster database. It is possible that some of the respondents' publications claimed to have been made openly accessible appeared in other online sources that were not registered in the OAI database. For

a repository to be considered open access, it must use suitable technical standards so that it is easily harvested by other search engines so that its content is also easily accessible by users who are not aware of the existence of such a repository (Berlin Declaration, 2003). A typical example is the case of the University of Dar es Salaam repository that is not harvested or registered with open access registers and where such respondents' publications might have been deposited. Another example is the Economic and Social Research Foundation also based in Dar es Salaam. The latter hosts an online repository with full-text articles on Tanzania developmental issues contributed by researchers from within and outside the country. This repository is accessible at htt://www.tzonline.org but is also not registered with open access registers and not harvested by the OAIster database.

The situation whereby researchers publish less than they access content in open access outlets is not peculiar to public universities in Tanzania. Similar findings were reported by other open access studies done elsewhere (Gadd, Oppenheim and Probet, 2003; Schroter and Tite, 2006). A notable example is the study done by Gadd, Oppenheim and Probet (2003) whereby while 57.8% of 456 respondents were reported to have submitted papers to open access journals as opposed to 88% of the respondents who acknowledged of having accessed free content made available by other scholars. A survey by Deoghuria and Roy (2007) also established that out of 125 respondents, 80% of them used open access to access literature and 20% used open access outlets for publishing their research output. Similar findings which were reported by Mann *et al* (2008) indicate that 66% of the respondents claimed to have been using open access publication media at least once in their academic career. Based on the referred study, only 28% of the respondents had actually published using the same media. A study by Utulu and Bolarinwa (2009) further support the above observations. Based on the cited study, while 40% of the respondents claimed to have accessed scholarly content in open access journals, 35% reported to have previously published in such outlets. The observed results of less publishing in open access outlets by scientific authors conform to the global level of open access publications' output. It is estimated that only 15% of the current annual research output is immediately made freely available through open access (Brody *et al*, 2007; Bjork, Roos and Lauri, 2009).

The disparity regarding researchers' usage of open access in terms of accessing and/ or publishing can be attributed to the fact that publishing is more involving than accessing scholarly content on the Internet. While it is possible for one to access free materials by

chance through a simple search on the Internet, publishing on the same media is more involving as one must have, firstly something to publish, and then additionally, adequate online publishing skills as well as sufficient familiarity with the potential sites to publish. This scenario of more usage of open access materials than publishing using a similar outlet despite high appreciation of this publishing mode by academic authors is also attributed to the wait and see syndrome (see Mann *et al,* 2008). According to the referred authors, it will take a considerable time for majority of the scholarly community to widely disseminate their research findings using open access media. Rogers (2003) also considers time as an important factor in the innovation-decision process for the adoption of new technologies. Based on Rogers (2003:37), considerable time is involved for individuals to seek "information at various stages in the innovation-decision process in order to decrease uncertainty on the innovation's expected consequences". Thus, being new, many scholars still hesitate to publish in open access until it becomes a common practice by majority of the scholarly community to disseminate their findings. However, it is likely that as more researchers get exposed to this mode of scholarly communication and the more they benefit through accessing scholarly content from open access outlets, the more likely they are to publish in such outlets in future. By accessing open access materials, such researchers become not only aware of open access avenues for scholarly dissemination but are also more motivated to learn how to disseminate their findings using similar outlets. Through usage of open access content, such researchers may also be easily convinced to make their research findings openly accessible than would have otherwise been the case had they not been benefiting from open access.

Despite less publishing in open access by many researchers in the public universities in Tanzania, the fact that majority of the respondents were optimistic of publishing in such outlet in future implies good prospects for future development of open access in such universities. This study revealed that more than three quarters (78% of 384) of the respondents were likely or very likely to publish in open access outlets had they had something to publish. This is compared to studies by Deoghuria and Roy (2007) and Hess *et al* (2007) in which less than 50% of their respondents were reported to be in a position to publish in open access outlets in future. Contrary to the referred two studies in which the respondents were asked about their likelihood of publishing in open access media within a limited timeframe, in the current study the aspect of timeframe was excluded. The respondents were just asked about their future likelihood of disseminating their research

findings using open access outlets. This is the possible reason for majority of the respondents in the current study to indicate their high likelihood to publish in open access outlets in future. It is possible that the respondents who did not expect to publish in open access outlets as reported in other studies did not expect to have anything to publish within the indicated timeframe. Observations from this study suggest that the researchers in institutions addressed by this study are highly motivated to use open access outlets to disseminate their research findings. It is thus important to address other hurdles that are likely to slow down the already indicated high motivation for open access uptake at the respective universities.

6.5 Disciplinary differences in open access usage

A notable observation from this study was the disciplinary differences in open access usage by respondents in terms of both accessing and dissemination of scholarly content. It has been established that the researchers from the natural sciences group were more involved in both accessing and dissemination of scholarly content through open access outlets as opposed to those from social sciences. These findings were however, contrary to a study by De Beer (2005) who revealed the reality that the academic departments in the humanities and social sciences as being very prominent in either engaging in self-archiving or hosting or promoting open access journals. Open access usage has also been reported by other previous studies to have been varied in different research disciplines (Lawal, 2002; Swan and Brown, 2005; Macfie, 2006; Zuber, 2008; Melero *et al*, 2009). Swan and Brown (2005) found computer science and medical disciplines to have been highly involved in open access publishing with respect to self-archiving than other research areas. On the other hand, among nine different research disciplines (chemistry, biological sciences, engineering, cognitive science and psychology, mathematics and computer science, physics and astronomy), the researchers from the chemistry discipline least used open access in scholarly communication (Lawal, 2002). A study by Melero *et al* (2009) further reveal that institutional repositories in Spain were dominated by deposits from researchers in thematic areas of humanities and social sciences followed by those in engineering, life sciences, natural sciences and finally, fine arts and performing arts.

According to Lawal (2002), most of the chemists are involved in research with the potential of patenting specific research findings. As a result of this, such researchers consider putting their findings in public domain before the patent is applied for and awarded would deter their patent ownership rights. It is not surprising for other research disciplines such as physics [the first discipline to establish a pre-print archive (the ArXiv)] and computer science to be leading in open access usage as these disciplines have a long culture of knowledge sharing even before the emergence of open access movement (Lawal, 2002; Swan and Brown, 2005). As open access publishing potential in improving access and dissemination of scholarly content becomes widespread, other research disciplines will increasingly be involved in this mode of scholarly communication than it used to be the case a few years ago. It is thus important for open access advocates to pay a special attention to those research disciplines which are slow in the uptake of this mode of scholarly communication so as to enhance its adoption.

6.6 Enablers of open access usage in scholarly communication

The different pattern of open access usage by researchers was discussed in the previous two sections. This section discusses various factors (presented in section 5.4 of Chapter Five) which are likely to contribute to researchers' usage of open access in respect to access and dissemination of scholarly content. These factors are therefore considered to be the enablers of open access usage. The following enablers emerged from the study.

6.6.1 Researchers' Internet usage skills and self-efficacy

For researchers to access or publish scholarly content on the Internet and open access outlets in particular, it is important that they have the necessary skills. This view is also supported by Wang and Su (2006) who asserted that in order to benefit from open access initiatives readers should improve their information and computer literacy skills. Equally important is for the researchers to become Internet literate in order to use the electronic media environment more effectively for accessing and disseminating scholarly content. The respondents in this study rated themselves as having very good or good skills in terms of accessing online information (83.7%) as compared to 65% who claimed to have very good or good skills with respect to publishing online. The claim by many researchers that they were confident in disseminating their research output via the Internet but at the same time were uncomfortable in using the same media in publishing online without assistance is contradictory. Ideally, those respondents claiming confidence in using the Internet to disseminate scholarly content are

expected to do so without assistance. It is possible that by submitting their research papers through electronic communication and by publishers making such documents available on the Internet, then such authors considered being confident in disseminating their findings online. This view can be supported by a response from one of the respondents who claimed that "I do disseminate research findings online indirectly through publishers". In this case, by publishers making such publications available online, the author did not require additional knowledge apart from submitting their works electronically. The observed contradiction may also imply that the reported Internet usage skills by the respondents did not necessarily reflect the true picture regarding their skills as further explained in the next paragraph.

The respondents also revealed their weakness in terms of their Internet self-efficacy in dissemination rather than accessing information using online sources. While more than 80% of the respondents confirmed of being confident with accessing information, 30% were able to publish their research output online and other 31% were unable to design their personal websites. The latter observation reflects why even those respondents who claimed to have provided their publications freely available online, few of such publications were made available through personal websites. It should be noted, however, that the reported Internet usage skills and self-efficacy are solely based on respondents' own perceptions and that they were not tested or measured by any other means. This means that the reported self-assessment results by researchers may be considered as indicative rather than the actual reflection of their skills and self-efficacy with respect to Internet usage. However, based on the researchers' actual usage of open access, it can safely be argued that low Internet self-efficacy as reported by many respondents, in a way, explains why many researchers accessed rather than disseminated scholarly content using open access outlets. It should also be noted that other factors that inhibit online publishing as will be observed later in the course of this discussion might have also contributed to the above observation. Both the Internet usage skills and self-efficacy have been acknowledged as the key determinants of effective exploitation of information under the digital environment (Waldman, 2003; White and Gendall, 2005). It is thus necessary for the universities in the study to take deliberate measures to improve the Internet usage skills and self-efficacy of their researchers so that they can fully benefit from open access opportunities in improving both access to and dissemination of scholarly output.

6.6.2 Infrastructural and technical support

The existence or non-existence of factors related to infrastructure and technical support within the working environment may stimulate or deter researchers' use of open access outlets in accessing and disseminating scholarly content. Five factors relating to infrastructure and technical support as presented in section 5.5.3 were assessed based on the respondents' perceptions to determine their possible influence on scholars' usage of open access.

More than 50% of the respondents in this study complained about the lack of the necessary resources such as Internet access for them to publish on open access outlets. Since during the time of data collection all the six institutions that were involved in the study had Internet connection, the inadequacy of infrastructural support indicated by the respondents is likely to be related to problems associated with low speed as well as unreliability of the Internet accessibility. These factors were reported in section 5.7 of Chapter Five as the main general hindrances faced by the researchers while using the Internet.

With respect to availability of technical support, while slightly above 50% of the respondents acknowledged adequacy of guidance for effective usage of the Internet to access scholarly content, the overall results imply that most of the facilitating conditions for researchers to publish online were non-existent. For example, while only 42.4% of the respondents either agreed or strongly agreed on having the necessary knowledge to publish in open access outlets, 57.7% of the respondents either disagreed or strongly disagreed on or they were not sure of having such knowledge. A similar study by Deoghuria and Roy (2007), also revealed that 45% of scientists claimed that they had knowledge in publishing in open access outlets while 10% said they would need specific assistance (from a computer or library personnel) in order to publish their works in such outlets. The findings revealing that most researchers were uncomfortable to publish on the Internet as noted above imply the need for support to enable such researchers to publish online. Without provision of this support, chances for those respondents to disseminate their findings through open access could be minimal. Therefore, these results suggest that less publishing in open access outlets by researchers in this study was partly contributed by lack of facilitating conditions as well as Internet self-efficacy of the respondents as noted in the previous section. The limited availability of facilitating conditions in terms of both infrastructure as well as technical know-how have also been cited as among the reasons for low uptake of open access in most developing countries (Muthayan, 2003; Hirwade and Rajyalakshmi, 2006; McCulloch, 2006; Christian, 2008). It is thus necessary to

improve both technological and human factors in the universities addressed by this study in order to improve the adoption of open access.

6.6.3 Organisational and other scholars' influence

Organisational or research funding as well as peers and colleagues are the social influence factors acknowledged to motivate authors to publish in open access outlets (Deoghuria and Roy, 2007; Hess *et al*, 2007; Suber, 2008). Researchers' employers or research funding agencies may mandate or put in place policies that encourage researchers to publish in open access outlets for wider dissemination of research outputs. By publishing in open access outlets, researchers' peers and/or leading researchers in specific research disciplines may also influence decisions of their colleagues in terms of using similar outlets to disseminate their research findings.

The findings of this study revealed that the researchers in public universities involved in this study rated social influence factors as strong determinants of their decisions to publish in open access outlets. However, researchers' peers and colleagues influence were found less important when compared to other social influence factors related to organisational or research funding bodies with respect to respondents' usage of open access. These results imply that employers and/or research funding bodies in the study area stand a better chance of accelerating the adoption of open access in the respective universities than fellow researchers' influence. Similar findings were reported by other previous studies. A study by Deoghuria and Roy (2007) for example, reveals that out of 125 scientists, 64% and 20% considered funding agencies and employers respectively do influence scholars in publishing in open access outlets. Peers' influence was negated by majority of the respondents as a motivation for their publishing in open access outlets in studies reported by Deoghuria and Roy (2007) as well as Hess *et al* (2007). However, the referred two studies also revealed that publishing in open access outlets by leading scientists' in the respondents' disciplines or other disciplines could influence the scholars in the referred study to also consider disseminating their research output in similar outlets. This gives a support to the importance of the social influence factor.

The above observations suggest that putting in place policies that enforce recognition of open access publications in tenure awards to their employees as well as funding researchers' publications costs in open access outlets should be considered as among the measures that

could be employed by the universities and other research funding agencies to boost the adoption of open access in the country and elsewhere. This view has also been supported by many scholars such as Prosser (2005); Warlick and Voughan (2006); Deoghuria and Roy (2007); and Hess *et al* (2007).

6.6.4 Motivators for open access scholarly communication

Researchers' expectations of open access publishing have also been acknowledged by many studies as among the important motivators for them to consider accessing or disseminating scholarly content using open access outlets. For example, free or unrestricted access to open access content has been reported as the main motivation for many researchers to access open access scholarly content (Hajjem, Harnad and Gingras, 2005, Kennan and Wilson, 2006; Schroter, Tite and Smith, 2005; Warlick and Voughan, 2006; Bernius *et al*, 2009; Frandsen, 2009). Similarly, it has been observed that increased research impact (Chan, 2004; Swan and Brown, 2005; Brody, 2006; Joint, 2009; Gargouri *et al*, 2010); increased speed of publication or dissemination of research output (Prosser, 2005; Carr *et al*, 2006); and a wider dissemination of research output (Schroter, Tite and Smith, 2005; Swan and Brown, 2005; Sanchez-Tarrago and Fernandez-Molina, 2009) as among the other factors influencing researchers in considering making their publications openly accessible.

The findings of this study also revealed that most of the respondents had a lot of expectations regarding open access publishing in improving both accessibility as well as dissemination of scholarly output. Over 60% of the respondents either agreed or strongly agreed on the view that open access publishing is superior to the conventional subscription based scholarly publishing in many respects. These findings support the previous observation that despite that many researchers have not previously published in open access outlets, majority of the respondents had expectations of future publishing in open access outlets [see last paragraph of section 6.4]. The results suggest that a belief by majority of the scholars that open access improves scholarly communication as compared to the conventional business based publishing may be used as a strong selling point of open access to the scholarly community.

6.6.5 Capabilities of using open access outlets

The researchers' expected difficulty or ease of using open access outlets to access or disseminate scholarly content, may either facilitate or deter researchers from adopting open access. According to Hess *et al* (2007), a belief that publishing in open access is easy to learn is considered as among open access supporting factors. Despite the findings that over 60% of the respondents in this study believe that they were unlikely to face difficulties in using open access outlets to publish their research findings, to a large extent, most of these researchers would find it easy to use open access outlets in accessing rather than disseminating information through open access. These results further support the previous noted low self-efficacy as acknowledged by researchers especially with respect to dissemination of scholarly content using the Internet. A similar study by Deoghuria and Roy (2007) established that among 125 scientists 21% believed that the interaction with open access publication systems were clear and understandable; 18% thought that it was easy for them to become skilful at publishing their work in open access outlets. The findings by the latter study were contrary to the current findings and other studies including Kohne *et al* (2005); Louho, Kallioja and Oittinen, (2006); and Butler and Richardson (2008) which report high proportion of the respondents as having significantly expressed less effort expectancy towards the use of the new technologies.

Based on these results, apart from imparting skills to the researchers regarding usage of the open access environment and the Internet in general in scholarly communication as suggested earlier in section 6.6.1, it is also necessary to design more user friendly open access platforms for researchers' ease in accessing and publishing research output. To take advantage of these findings, platforms for open access publishing as well as information search facilities should be easier for users to learn (Wang and Su, 2006). This is particularly important taking into account that a transition from print to electronic information environment in certain cases has resulted into researchers spending much of their time in trying to accomplish their scholarly communication tasks. For example, Eger (2008) established that the estimated time spent on browse/scan and search by various online information users from Austria, Germany and Switzerland increased by 27% between October 2006 and October 2007 due to an increase of users who were less trained in online searching. If this is the case for developed countries' researchers, then more capacity building is required among scholars in developing countries. This is due to the fact that in most cases, technology development originates from the former and diffuses slowly to the latter countries. Therefore, for scholars in the developing countries

to be at par with their counterparts in the developed world in terms of usage of such technology, more efforts needs to be directed to scholars from the former countries to build their capabilities for effective exploitation of new opportunities brought by technological development.

6.6.6 Attitudes and general views on open access

The way researchers perceive open access have significant influence towards their adoption of this mode of scholarly communication. This view is in accordance with Rogers' (2003:223) assertion that "subjective evaluation of an innovation, derived from personal experiences and perceptions … drives the diffusion process and thus determines an innovations' rate of adoption". Scholars' general attitudes and views towards open access are thus fundamental to their decisions on whether or not to use open access publications or whether or not contribute to open access publishing. It is scholars' understanding and positive views of open access that may determine the destiny of open access movement. According to Wang and Su (2006), without authors' support and submission, the open access movement cannot be meaningful and successful. While their positive views could promote open access development, opposite views could undermine its progress. The general researchers' perspectives [reflecting attitudes and views] about open access were presented in section 5.6.

In this study, majority of the researchers had very positive attitudes towards open access publishing. Over 80% of the respondents considered open access as beneficial to the scholarly community and that access and use of open access as well as publishing in open access were good ideas. The low score by many respondents on the statement that "publishing in open access is easy for me" as noted in Table 5.14 supports the findings on effort expectancy as discussed in section 6.6.5 where it was noted that the respondents were less confident in using open access outlets to disseminate their research findings. A number of similar studies have also revealed that majority of the authors as well as non-authors had positive attitudes towards open access (Swan and Brown, 2004; Schroter, Tite and Smith, 2005; Hess *et al*, 2007). Hess *et al* (2007), for example, established that within information systems, medical science and others, over 90% of the respondents reported to have positive or very positive attitude towards open access.

The general comments on open access by researchers and policy makers as well as the latter's views regarding fostering open access development in the public universities also provide insights in the acceptability of open access by such respondents. As noted in Tables 5.15 and 5.16, policy makers' views regarding fostering open access development in their respective universities as well as the overall comments on open access were very positive. Such observations suggest that those stakeholders may not oppose the introduction of scholarly publishing at their respective institutions. The support of open access by majority of the respondents as observed from these findings corroborated with those reported by SARUA (2008). The referred study revealed that 77% of the respondents had expressed support with regard to the introduction of open access publishing at their respective institutions. However, the fact that open access development in the country is still at its infant stage, more advocacy for this mode of scholarly communication to all stakeholders is required before its full development is realised.

Although the idea of introducing open access may be easily accepted by the researchers, the actual financing of open access projects requires a clear statement on its benefits before the project is approved by the university management. This is due to the costs involved in implementing open access projects. The cost for establishing an open access institutional repository for example, is estimated at US$ 56753 for a developing country (Van der Merwe and Kroeze, 2008). This amount may be inhibitive for most universities in developing countries taking into account the competing projects from the already limited financial resources.

6.6.7 Perceptions on open access publications' quality

Publications' quality has been cited as among the important aspects considered by scholars in making decisions of using scholarly content (Pickton, 2005; Warlick and Voughan, 2006; Utulu and Bolarinwa, 2009). Fang and Zhu (2006) findings also reveal that some authors claim not to publish in open access outlets due to the fear of lack of integrity for their publications due to the perceived low quality of such documents. Several other studies have further reported that some scholars did not use open access materials because of considering them as lacking quality control (Swan and Brown, 2005; Xu, 2005; Deoghuria and Roy, 2007).

The findings from this study show that the quality of open access publications was perceived positively by many respondents. Among the researchers who acknowledged to have accessed open access publications, very few (14.5%) said that such publications were mediocre or of little scientific merit against majority (82.4%) of the respondents who perceived open access publications to have good quality with acceptable scientific merit. Such findings suggest that quality control of open access publications is not foregone as perceived by some non-authors and users of open access publications. Although it is possible to find some of the non-peer-reviewed open access publications, the certification process for open access publications is said not to differ from the traditional publications (Budapest Open Access Initiative, 2002; Prosser, 2005). Furthermore, most of the open access materials found in institutional repositories such as post-prints, theses and dissertations have undergone rigorous review before they are deposited in such repositories. It is thus not surprising for most of the respondents in this study to highly rank open access publications in terms of their quality. It is the view of this researcher that the perception of few individuals of considering open access materials as being of low quality was due to the belief that anything free of charge is less valued. In practice, open access publications are not free as such since someone somewhere must meet the costs associated with the creation, preservation and distribution of such materials. This is the reason why some publishers charge authors some fees to cover publication costs so that such content is accessible freely to users. More efforts are thus important in educating researchers that what they think is free have been paid for by others. This will help change the mindsets of researchers regarding the low value they attach to open access publications.

From the foregoing discussion with respect to respondents' attitudes, general views and their perceptions of open access publications, there is evidence for general support of open access scholarly communication in public universities addressed by this study. Although dissemination of research output using open access outlets was found to be low as compared to accessing scholarly content using similar means, the overwhelming expectation of future publishing in open access by majority of the researchers as noted in section 5.3.3 of Chapter Five further supports their positive attitudes, views and perceptions of this mode of scholarly communication. It can therefore be argued that less usage of open access outlets in the dissemination of scholarly output by researchers in the study area is contributed by other factors than their acceptance of open access mode of scholarly communication. This argument is further supported by the supportive views of researchers' and policy makers'

with respect to the need for the establishment of institutional repository in order to improve the dissemination of local research output at the respective universities as discussed in the following sections.

6.7 The need for institutional repositories' establishment

The views of the researchers and policy makers regarding the establishment of open access repositories at their respective universities are important in order to shed light on the acceptability and management of such repositories. Based on the results presented in section 5.7 of Chapter Five, the following subsections discuss the acceptability and possible management aspects of institutional repositories in public universities in the country by taking into account the views of researchers and policy makers.

6.7.1 Acceptability of institutional repositories' establishment

As noted in section 5.7.1, majority of the respondents (researchers and policy makers) considered the establishment of institutional repositories at their respective universities as very important or important. It is the view of this researcher that the need for institutional repository establishment by many respondents was attributed to the inherent problems of research output dissemination at the respective institutions as acknowledged by majority of the respondents.

Establishing institutional repositories is the best option for improving the dissemination of research information from the universities and other research institutions in Tanzania. This is due to the fact that most of the research output from these institutions is documented in the form of grey literature that has posed problems for wider dissemination as acknowledged by the respondents. The use of open access journals for research dissemination is another important option but its impact in terms of the volume of the content disseminated could be less than is the case with institutional repositories. This is due to the fact that institutional repositories or open access repositories in general may accommodate both grey and published research content while open access journals may take peer-reviewed content only. This view has also been supported by several scholars (Harnad, 2006; Regazzi and Caliguiri, 2006; Bjork, Roos and Lauri, 2009). In a recent study by Bjork, Roos and Lauri (2009) for example, it is noted that out of the 1,350,000 estimated articles published in 2006, the contribution of open access repositories content was 11.3% as compared to 8.1% from open access journals.

Based on the support by the university stakeholders, it is important for public universities and other research institutions in the country to consider IR establishment in their strategies of research output dissemination.

6.7.2 Endorsed institutional repository content

The content of institutional repositories may differ from institution to institution depending on institutional preference. This is the probable reason for Van der Merwe and Kroeze (2008) to emphasise the need for defining the repository content when planning for an institutional repository. Majority of the respondents in this study preferred conference papers, peer-reviewed articles published in journals, theses and dissertations as well as teaching materials in that order of preference. It is important to note that few respondents were in favour of depositing non-peer-reviewed materials in the institutional repositories. Lwoga (2006) established a similar wide range of materials preferred by agricultural researchers in Tanzania. The recommended materials for institutional repositories included conference papers, technical reports, pre-prints, working papers, scientific journal articles, newsletter articles, theses and dissertations. Several other previous studies done elsewhere had also suggested a wide range of materials preferred as repository content (Pickton, 2005; Swan and Brown, 2005; Lwoga, 2006; Van der Merwe and Kroeze, 2008; Jean *et al*, 2009). Despite the wide range of the proposed repository content, the most commonly suggested materials by majority of the studies are research based.

The suggested repository content forms the grey literature that remains invisible in most of the Tanzanian research institutions and elsewhere in developing countries (Matovelo and Chailla, 1999; Mook, Munyua and Nampala, 2005; SARUA, 2008). This implies that the establishment of institutional repositories could greatly improve the dissemination of research output from these institutions. The proposed repository content may be used as an input in institutional policy proposals with respect to what materials should be included in their institutional repositories. Such policies should also take into account which among the proposed contents should be made available for public access and which ones should have some kind of restrictions.

6.7.3 Recommended use of institutional repository content

Ideally, according to open access principle, attribution to the author of a particular work is the main condition required to be adhered to by users of open access content. However, depending on policies guiding usage of repository content, some institutions consider it important to include the usage control such as authorising individual rights to add or edit items (Van der Merwe and Kroeze, 2008).

Majority of the respondents (79.7%) in this study would allow any use of their works deposited in the institutional repository so long as users provided proper acknowledgement. A small percentage (25.5%) would allow comments or addition of notes in their deposited works by other people. These findings are comparable to those reported by Gadd, Oppenheim and Probet (2003) and Pelizzari (2003). The cited studies also reveal the possibilities to view/display, print, save, copy and quote as the acceptable use of repository content by many respondents. The acceptance of any use of deposited materials with acknowledgement condition implies that many researchers were in agreement with the main principle of open access - removal of barriers to scholarly content dissemination. This is the acceptable use allowed by many open access repositories although in certain instances users are required to register before usage, this is probably so for statistical purposes.

6.7.4 The importance of peer review for repository content

The value of scholarly content is in most cases attached to the review process it has undergone. This aspect was also observed in sub-section 6.6.7 whereby usage or non-usage of open access by scholars was said to be influenced by their notion of open access publications in terms of their quality. The findings of this study imply that the researchers attached a great importance to the review process of the materials before being deposited in the institutional repositories. The results from this study resemble with observations made by Pelizzari (2003); Wang and Su (2006); Fullard (2007) as well as Van der Merwe and Kroeze, 2008). In all the referred studies the peer review process is considered important so that open sources cannot be judged as holders of inferior content.

Based on the findings of this study, the following were the respondents' preferred review team for institutional repositories: departmental committees (36.9%), faculty/institute/directorate level research committees (36%), and university-wide committee (22.7%). Among the proposed three options, it is the view of this researcher that the appropriate choice

for the review team may depend on how large the universities or these units are. While for large universities it may not be practical to use university-wide review committees, it is equally difficult to compose review teams for departments with very few researchers. The ideal review team could be composed by members at faculty level. To involve external reviewers could be more difficult especially in universities with high research output. In certain instances, reviewers especially from outside universities may demand payment for the review process and adding further costs to maintaining the repositories.

6.7.5 Preference for the institutional repositories' management units

Different arguments have been raised regarding the most appropriate unit for managing institutional repositories within the university setup. University libraries, university-wide research coordination units, faculties/institutes and in certain instances individual departments have been proposed for hosting and management of institutional repositories (Pelizzari, 2003; De Beer, 2005; Kaur and Ping, 2009). Majority of the respondents in this study recommended university libraries as the most appropriate units for hosting and managing institutional repositories in the public universities in Tanzania.

Studies by Pelizzari (2003), De Beer (2005), and Kaur and Ping (2009) also acknowledged libraries as the most appropriate units for the management of institutional repositories. The respondents' choice for libraries is based on the traditional roles of libraries including that of being custodians as well as managers of information as an institutional asset. The expertise of librarians in information handling was another motivation for choosing libraries. Wang and Su, (2006) support the findings from this study by suggesting the transformation of librarians into knowledge managers from their traditional role of managers of collections in order to fulfil their mandate well in an open access environment. Based on these findings, it is important for librarians and other information workers from such institutions to promote open access within their institutions and take a leading role in formulating convincing project proposals with respect to institutional repositories establishment for consideration by the university policy makers.

6.8 Obstacles to open access usage

In the course of the previous discussion some of the factors including Internet usage skills and Internet self-efficacy as well as facilitating conditions were identified as partly contributing to less usage of open access by researchers. The discussion in this section now turns to the directly perceived reasons by the respondents regarding their less usage of open access outlets in terms of accessing or disseminating scholarly content.

6.8.1 Accessing open access content

Although a significant percentage of the respondents claimed to have accessed open access materials, inadequate information search skills, lack of awareness, and poor Internet services were cited as the main causes affecting the effective usage of open access content. Similar reasons that were provided by the respondents based on general Internet usage problems [except the problem of access restrictions] as indicated in Table 5.22 [section 5.8] are applicable to open access as well. This is due to the fact that problems related to Internet usage may not be segregated on whether one is looking for open access materials or subscription based content. These results resemble those reported in respect of Internet self-efficacy and facilitating conditions as discussed in subsections 6.6.1 and 6.6.2.

Slow Internet speed was cited as the main hindrance affecting researchers in information access. This is due to the fact that none of the universities in the study had adequate bandwidth to meet the actual demand of its user population as a result of high connectivity costs. Through consultations with officials of the university computer services, it was revealed that the University of Dar es Salaam had the Internet speed of 12.5 mega bits per second (mbps) downlink and 1.5 mbps uplink; Muhimbili University of Health and Allied Sciences, 1.024 mbps downlink and 0.512 uplink; Sokoine University of Agriculture, 2.048 mbps downlink [shared 1:8] and 0.256 uplink; Ardhi University, 1.2 mbps downlink and 0.2 mbps uplink; Mzumbe University, 1.0 mbps downlink and 1.0 mbps uplink; and the Open University of Tanzania, 0.512 mbps downlink/uplink. Although among the six public universities UDSM seems to have the highest speed, its highest number of user population as compared to other users makes this inadequate. A minimum 3 Kilo bits per second (Kbps) [One mega bit = 1000 kilo bits] bandwidth is generally considered sufficient per active user during peak periods for universities in developing countries (INASP, 2003). Universities should therefore determine adequate bandwidth based on their expected user population during peak periods. This should take into account the number of computers expected to have

Internet connection (through the Local Area Network (LAN) and Wireless connections) at such universities during peak periods. For example, a university with 1000 active Internet users during peak time would require a bandwidth of 3000 Kbps (0.3 Mbps). It is thus necessary for all the universities in the study area to further improve their connectivity for their researchers to benefit from open access opportunities. Proper bandwidth management is equally important in order to optimise the already limited connectivity due to expensive bandwidth in developing countries as compared to developed countries (INASP, 2003; CIPESA, 2006).

Despite the fact that majority of the respondents rated themselves as having very good or good skills with respect to online information searching and few citing inadequate Internet search skills as a hindrance to usage of open access materials, in the real sense the problem is likely to be much worse than what was reported. Experience with information literacy training conducted at the Sokoine National Agricultural Library of the Sokoine University of Agriculture reveal that most researchers lack adequate skills in terms of information search techniques under the electronic environment. Upon attendance of such trainings, most of the researchers do acknowledge that they really lacked the necessary techniques on information search. It was not until after the training sessions in question that the researchers realised the problem. This supports the conclusion made by White and Gendall (2005) that it is incorrect to assume that information skills training is not needed by academic staff. This calls for the need for libraries and university computing centres to actively involve themselves in upgrading information and Internet literacy of the researchers from the respective universities as emphasised previously. Unfortunately, based on Table 5.7, it seems most libraries and computing centres in the study area have not yet played this role effectively as few researchers acknowledged to have been trained on Internet usage by their universities. Libraries as traditional managers of information are considered to be better positioned to provide advanced search techniques as well as to promote open access to the public (Wang and Su, 2006).

6.8.2 Dissemination of scholarly content in open access outlets

Factors affecting researchers' dissemination of scholarly output through open access were presented in Chapter Five section 5.9. It was noted that inadequate skills to publish in open access was one of the main cause for researchers' non-publishing in open access. As is the case with the cited problems affecting the researchers in accessing information online, similar

problems reappear when it comes to disseminating research output through the Internet. The observation that researchers did not publish in open access due to their belief that open access publications were considered to have low quality is contradictory to the findings regarding the general open access perspectives of such respondents as discussed in section 6.6.6. However, the high optimism of such respondents to publish in open access in future, positive evaluation of open access scholarly materials as well as the general positive views about open access by such researchers overshadow their current claim.

Concerns about long-term availability of open access publication, open access publishing costs and copyright issues as noted in this study have also been observed in several studies from both developed and developing countries (Foster and Gibbons, 2005; Rowlands and Nicholas, 2005; Kim, 2006; Warlick and Voughan, 2006; Hess *et al*, 2007; Sanchez-Tarrago and Fernandez-Molina, 2009). The problem of long-term availability for open access publications is applicable to electronic versions of subscription-based publications as well. This challenge will probably be addressed as technology advances.

With respect to open access publishing costs, this problem is partly addressed by research funding bodies and other organisations that subsidise publishers and/or fund researchers to pay for such costs where applicable (Rowlands and Nicholas, 2005). As far as copyright issues are concerned, more awareness creation is required on the part of authors as open access publications also abide by authors' rights. In this mode of publishing, authors' attribution is mandatory for users of other scholars' works. This is the most important issue for most scholars since in the real sense they do not benefit from the other barriers imposed by commercial publishers with respect to accessibility to authors' works.

The other obstacle is the less visibility of research output in open access outlets especially in public universities in Tanzania due to the non-availability of open access journals and repositories in the country where the researchers could deposit their works. As noted from section 6.4, it was clear that the university websites of the six universities as well the digital environment in general had not been used very effectively in disseminating institutional research output emanating from the universities in the study. This study revealed that no university in the country had either an open access journal or a typical open access repository for the researchers to make their research output openly accessible. This suggests that the

researchers had no opportunities of publishing their research output in open access outlets within the country.

Furthermore, the absence of open access supporting policies to motivate the researchers to make their publications openly accessible is also another constraint contributing to less motivation for such scholars to make their scholarly content openly accessible. Interviews with policy makers revealed this lack of open access supportive policies. Such policies are considered important in motivating researchers into publishing in open access (Swan and Brown, 2005; Kim, 2006; Suber, 2008; Grundmann, 2009; Sanchez-Tarrago and Fernandez-Molina, 2009).

6.9 The emerging research model on open access scholarly communication

Sections 6.2 to 6.8 discussed research results based on the descriptive statistics in order to establish the general picture of factors likely to affect the adoption of open access in public universities in Tanzania. In this section, results from the inferential statistics are discussed to isolate significant factors for open access adoption in the study area. The main objective of this section is to validate the research model that was proposed in Chapter Three. To fulfil this objective, both measurement model and structural model assessments were conducted [as presented in sections 5.10.1 and 5.10.2 of Chapter Five]. The following sections interpret and discuss the findings from the two analyses.

6.9.1 Factor loadings for the measurement model assessment

The results for the measurement model assessment were presented under section 5.10.1 in Chapter Five. These results imply that factor analysis was appropriate for the measurement model assessment due to the significant tests based on KMO and Bartlett's test. For the factor analysis to work properly, KMO values should be greater than 0.5 and Bartlett's test should be significant with a value less than 0.05 (Field, 2006b). Values of 0.879 and 0.001 for KMO and Bartlett's test respectively as established by this study strongly supported the factor analysis.

The measurement model assessment considered both the convergent and discriminant validity as recommended by several studies (Zhang and Li, 2004; Cheong and Park, 2005; Trochim, 2006; Kripanont, 2007; Saade, Nebebe and Tan, 2007). The factor analysis results as noted in Table 5.25 reveal that loadings of the items ranged from 0.5 to 0.9 for all constructs.

Therefore, all the constructs attained the acceptable convergent validity since item loadings from each construct were higher than the minimum recommended values. For an item to be retained in a particular construct its loading should not be less than 0.5 (Zhang and Li, 2004; Field, 2006a; Marshall and Marshall, 2007; Horne, 2008). With regard to the discriminant validity, it was proven that items belonging to the same construct loaded highly in their construct as compared to their loadings in different constructs. This is noted in Table 5.25 (loadings from same the construct in shading while those from different constructs are not shaded). As a guide, for the acceptable discriminant validity, factors must load more highly on its associated construct than on any other construct (Zhang and Li, 2004; Cheong and Park, 2005; Ifinedo, 2006; Sun and Zhang, 2006; Trochim, 2006). All factors had no cross construct loading exceeding 0.5 while the minimum loadings for factors from the same constructs were above 0.5.

Based on the above observations, it is concluded that the instrument validity was acceptable as it satisfied both convergent validity and discriminant validity suggesting the usefulness of the collected data for multivariate analysis. The acceptable validity of the instruments was partly attributed to the adaptation of validated scales used in similar studies as noted in Table 4.5 [section 4.4.5.1.1] as well as pre-testing of the research instruments.

6.9.2 Structural model assessment for factor causal relationship determination

As noted in section 5.10.2, structural model assessment was done in order to establish the suitability of the model for determination of researchers' behavioural intention and usage of open access. The predictive power and fitness of the model to data with respect to behavioural intention and open access usage by researchers is drawn from the Omnibus Test of Model Coefficients, Model summary, and classification table as presented under section 5.10.2.1. A model that fits the data well is expected to have Omnibus Tests of Model Coefficients significance of less than 0.001 (Christensen and Bailey, 2000). The significant Omnibus Test of Model Coefficients [p<0.001] in this study therefore imply the statistical evidence of the presence of a relationship between the dependent and the combination of independent variables in respect of behavioural intention and open access usage. Based on these tests, the model fitness to the collected data was confirmed.

With respect to the predictive ability, the model correctly predicted 79.7% of the observations with Nagelkerke R^2 of 0.27 in respect of behavioural intention dependent variable.

Nagelkerke R^2, similar to the coefficient of determination (R^2) in linear regression is an adjusted version of the Cox & Snell R^2. It measures how useful the explanatory variables are in predicting the response variables. The larger the R^2 statistics indicate the more of the variation is explained by the model, to a maximum of 1 (Christensen and Bailey, 2000; Bewick, Cheek and Ball, 2005). The model also correctly predicted 83.7% of the observations with Nagelkerke R^2 of 0.41 for the usage dependent variable. Based on R^2 values, the overall explanatory ability of the model in terms of behavioural intention and usage of open access was thus 68%.

The overall predictions accuracy of the model and the explanatory ability of the model as noted above suggest that the formulated model was useful for guidance in this study. According to Christensen and Bailey (2000), the model is considered useful if it results into at least 25% improvement over the rate of accuracy. It should be noted however that based on these results, the regression model was more powerful and useful in the determination of factors for open access usage than behavioural intention. The following subsections discuss the causal relationships among various factors affecting researchers' behavioural intention and usage of open access.

6.9.3 Key determinants of researchers' open access usage behavioural intention

The causal relationships among various factors contributing to open access usage behavioural intention by researchers were presented in Table 5.26. Internet self-efficacy and social influence are the main two constructs that were found to be insignificant factors for researchers' behavioural intention of open access usage. Contrary to these findings however, Schaper and Pervan (2007) established that technology self-efficacy exhibited a higher significance on intension to use ICTs than effort expectancy and social influence.

These findings however confirm those from the UTAUT model developers with respect to Internet self-efficacy (Venkatesh *et al*, 2003). According to the cited authors, Internet self-efficacy is expected to have no direct significance with respect to technology usage intention due to its effect being captured by the existence of effort expectancy. The non-significance of the Internet self-efficacy determinant in this case is thus attributed to significance of effort expectancy towards researchers' behavioural intention of open access usage. In other words,

the effect of Internet self-efficacy towards researchers' behavioural intention is taken over by their effort expectancy.

Conflicting results have been reported by several acceptance studies regarding social influence. According to Schaper and Pervan (2004), some studies report social influence to have a direct influence on behavioural intention while others reported to the contrary. The findings of this study were therefore contrary to those reporting the significance of social influence in determining behavioural intention of technology use (Venkatesh *et al*, 2003; Wu, Tao and Yang, 2007; Schaper and Pervan, 2007; Al-Shafi and Weerakkody, 2009). However, observations from the current study corroborate those reported by the Hutchison and Bekkering (2009) study in which social influence had no significant impact in determining behavioural intention of technology usage. The noted conflicting results from different studies suggest the need for further testing of the above two constructs regarding their role in shaping behavioural intention technology usage. Important determinants of researchers' behavioural intention of open access usage for this study are discussed under the following subsections.

For correct interpretation of the following logistic regression based results, the Odds ratio (Exp (B) for factors with significant unstandardised regression coefficients (B) have been adopted. The two measures are commonly acceptable and have also been used by several other similar studies (Christensen and Bailey, 2000; Hartmann *et al*, 2002; Bewick, Cheek and Ball, 2005; Hernandez and Mazzon, 2007). Taking into account the nature of analysis in this part of the study, Exp(B) >1 against a specific factor implies that the modelled event occurrence increases; Exp(B) <1 implies decreasing chances of the modelled event occurrence; and Exp(B) of zero means that there are no chances for the modelled event to occur. For example, using Table 5.26, the Exp(B) [1.330] against the attitude factor means higher chances of open access usage by individuals who had positive attitudes towards open access than those with negative attitudes. Similarly, the Exp(B) [0.596] against the social influence factor in Table 5.27 implies that the respondents who considered social influence as less important in their decisions to use open access were less likely to use this mode of scholarly communication than those who considered this factor as important. The reported percentages are calculated by subtracting 1.0 from the Exp (B) value multiplied by 100. Using the attitude factor as an example, this implies 1.330-1 = 0.33*100 = 33%.

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6.9.3.1 Significance of attitude on behavioural intention

The researchers' attitude to open access was found to significantly influence their behavioural intention towards open access usage. Based on Exp(B), these results suggest that the respondents with positive attitudes towards open access scholarly communication were 33% more likely to use open access scholarly communication than those with negative attitudes. The respondents' positive attitudes as noted under section 6.6.6 therefore imply good prospects for future uptake of open access in the respective public universities in this study. Even though the results from this study are contrary to Venkatesh *et al* (2003) belief that attitude construct could have no significant influence on behavioural intention of technology usage, other studies reveal that individuals' attitudes towards technology have strong influence on technology use intention, supporting the findings from this study (see Schaper and Pervan, 2004; Rosen, 2005; and Louho, Kallioja and Oittinen, 2006). It is therefore important for open access proponents to strengthen campaigns in promoting this mode of scholarly communication to ensure its support by majority of the scholarly community. This is especially critical in order to change the mindsets of individuals with negative attitudes towards open access.

6.9.3.2 Significance of effort expectancy on behavioural intention

This factor was also found to be among the determinants for researchers' behavioural intention of open access usage. With the Exponentiated odds ratio of 1.579, it implies that individuals who strongly believed that it would be easier for them to use open access outlets in scholarly communication were 57.9% more likely to adopt this mode than those who felt the opposite. Although Schaper and Pervan (2004) report that effort expectancy has been found by many acceptance studies to have no significant influence on intention behaviour, other scholars suggest this construct to play significant roles during early stages of adoption and becomes non-significant over periods of extended and sustained usage (Venkatesh *et al* 2003; Louho, Kallioja and Oittinen, 2006). The significance of this factor as a determinant to researchers' behavioural intention of open access usage in the study area is more likely to have been contributed by the fact that this type of scholarly communication was relatively new to the respondents in this study. Moreover, publishing in open access outlets requires, as in certain cases self-depositing of publications by researchers contrary to the conventional publishing whereby authors just send their papers to the editors for subsequent publishing. Similarly, accessing information under the online environment also requires additional user skills that are quite different from those used in the conventional media (Harle, 2009). It

should be expected therefore that as more and more researchers get used to publishing or accessing information using open access, effort expectancy construct importance would decrease.

The effect of effort expectancy was significantly moderated by age, experience and gender. According to the findings of this study, it was revealed that older and more experienced respondents in terms of Internet usage, which were 14.9% and 23.7% respectively, were more likely to publish in open access outlets in future than younger and inexperienced respondents. These results are contrary to the popular belief that the younger generation's technology uptake is always higher than that of their older counterparts. For example, the moderating effect of age was reported by Venkatesh *et al* (2003) to have indicated the effect of effort expectancy being stronger for older workers. In other words, it was expected that older workers could have been expected to be less likely to publish in open access outlets in future due to their belief of the associated difficulties.

The results from this study suggest that the probable reasons for the likelihood of less effort expectancy by older workers could be attributed to their experience in both using the Internet as well as scholarly publishing. It is expected that the most experienced researchers have also been using the Internet for a longer period in the dissemination of scholarly content and thus are believed to face less difficulties using the same media to publish in open access outlets than the young and junior researchers. According to Venkatesh *et al* (2003), the effect of effort expectancy diminishes as experience in usage of technology increases. It can be argued that in the current technology context, publishing experience is more important in determining effort expectancy with respect to dissemination of scholarly content using open access outlets. In this respect, the older generation having more publishing experience than the younger generation is expected to be more prolific in writing than the latter. Due to the fact that open access publishing especially in open access journals may not necessarily demand a lot of technological efforts suggest that the availability of content to publish in such an outlet is what matters most. For example, in most cases, one only requires to submit an electronic version of the paper to the journal editors through e-mail for her/his paper to be published. There is no doubt that regardless of age, every researcher in public universities in Tanzania has an e-mail access and regardless of whether one submits a paper to a subscribed or open access paper, electronic versions of papers are currently a common practice.

It is also noted from these results that male respondents were 46.4% more likely to publish in open access outlets in future than their female counterparts. Moderating effects of gender and experience towards effort expectancy with respect to behavioural intention of technology usage conform to the results reported by Venkatesh *et al* (2003). Several other studies have acknowledged less technology usage decisions by women than men (Ilie *et al*, 2005; Steinerova and Susol, 2007; Ramaya and Jaafar, 2008). A different set of characteristics between women and men can be explained as among the reasons that shape effort expectancy towards technology usage with respect to gender. It has been argued that men's technology usage decisions are more strongly influenced by their perceptions of its usefulness while those of women are more determined by perceptions of ease of use (Ilie *et al*, 2005). This implies that so long as the technology is perceived useful, intentions of technology usage is expected to be higher for men and lower for women especially under situations of high effort expectancy towards technology usage. This view is further supported by the findings indicating less confidence and assistance reliance for usage of new technology by women as compared to men (Ilie *et al*, 2005; Steinerova and Susol, 2007). The implication of these findings is that the introduction of new technology should consider gender aspects in the provision of user support for its effective application.

6.9.3.3 Significance of performance expectancy on behavioural intention

This construct has been demonstrated by UTAUT developers to be a consistent determinant of individuals' intentions of technology usage (Venkatesh *et al*, 2003). The findings from this study also reveal that individuals who agreed or strongly agreed with the expectation of open access ability to improve scholarly communication were 31.7% more likely to adopt open access than those who disagreed or strongly disagreed with such expectations. These findings further confirm previous results on technology acceptance studies regarding the strength of performance expectancy construct in predicting behavioural intention (Schaper and Pervan, 2004; Garfield, 2005; Louho, Kallioja and Oittinen, 2006; Al-Shafi and Weerakkody, 2009). However, the current findings are contrary to those reported by the Hutchison and Bekkering (2009) study revealing the insignificance of performance expectancy on behavioural intention of technology adoption.

The respondents' high expectations with respect to open access as discussed in section 6.6.4 and the significance of this factor on behavioural intention of open access usage provide another basis for public universities in Tanzania to consider the enhancement of scholarly communication in these institutions through the adoption of open access.

6.9.3.4 Direct effect of moderators on behaviour intention of open access usage

Most technology acceptance and usage studies considered factors such as age, gender, and experience as moderators of latent factors in determining behavioural intention of open access without taking into account the direct effect of such moderators to the dependent variables (Zhang and Li, 2004; Louho, Kallioja and Oittinen, 2006; Serenko, Turel and Yol, 2006; Schaper and Pervan, 2007). This study went one step further by testing the direct effect of moderators to behavioural intention of researchers' usage of open access. For this purpose, age, awareness, gender, experience and position (rank) were investigated to determine whether or not they had any direct significance to researchers' behavioural intention of open access usage.

Among the five moderators, researchers' awareness was the only factor that significantly had a direct influence with respect to respondents' behavioural intention of open access usage. As far as open access awareness is concerned, these results imply that the respondents who were not aware of open access were 57.9% less likely to publish in open access outlets in future than those who were aware of this mode of scholarly communication. These findings suggest the importance of creating open access awareness among the scholarly community for its wider uptake.

6.9.4 Key determinants of researchers' open access usage behaviour

With respect to the determinants of open access usage, attitude and Internet self-efficacy were found to have no significant effect. Exclusion of the attitude construct by several technology acceptance studies as determinants for individuals' usage of technology (Venkatesh *et al*, 2003; Louho, Kallioja and Oittinen 2006; Schaper and Pervan, 2007) is thus supported by findings of this study. These findings were, however, contrary to the findings from other studies demonstrating technology self-efficacy as playing a key role in the acceptance and usage of technology (Ifinedo, 2006; Hsu, Chiu and Ju, 2004). This suggests the need for further investigation of the technology self-efficacy influence on the adoption of innovations

in different research environments. Significant determinants of researchers' usage of open access as established by this study are discussed under the following subsections.

6.9.4.1 Significance of facilitating conditions on open access usage behaviour

Facilitating conditions with and without age moderation significantly determined open access usage by researchers. As noted from Table 5.26, these results imply that the respondents who agreed or strongly agreed with adequacy of facilitating conditions for open access usages were 50.5% more likely to publish using open access outlets than those who indicated to the contrary.

With respect to the moderating effect of age, it is noted that facilitating conditions on open access usage was stronger for older workers. This suggests that such researchers would need more assistance in using open access outlets to publish or access scholarly content. User training in terms of accessing and depositing scholarly content should thus take into account the age groups of the researchers. According to Venkatesh *et al* (2003), it is expected that older workers would attach more importance to receiving help and assistance on the job with respect to usage of new technology than would be the case for the young workers. The findings from this study support those reported by Venkatesh *et al* (2003), Schaper and Pervan (2004), Helaiel (2009), Suhendra, Hermana and Sugiharto (2009) as well as Zhou, Lu and Wang (2010) studies whereby facilitating conditions were established as important determinants of technology usage.

The overall implication of the above observations is the need for improvement of facilitating conditions in the study area for effective exploitation of open access scholarly communication in such institutions. This is particularly important due to the fact that the respondents' assessment implied inadequacy of facilitating conditions to support open access scholarly communication at their institutions as noted in sections 5.5 and 6.6.2.

6.9.4.2 Significance of social influence on open access usage behaviour

Like facilitating conditions, social influence was found to be a determinant of open access usage both independently and under moderation effect. An interpretation from such findings is that the respondents who considered social influence as less important or least important a factor to influence their usage of open access, their chances of disseminating research findings through this mode of scholarly communication were 40.4% less likely than those

who indicated the contrary. Age, experience, gender and position moderated the effect of social influence towards researchers' usage of open access.

Based on the findings of this study, the effect of social influence is expected to be stronger for older workers, those from higher positions, women and those with limited experience than might be the case with other categories of the respondents. The assumption is that the oldest respondents also belonged to higher ranks or positions. According to Venkatesh *et al* (2003), older workers are more likely to place increased salience in social influence, with the effect declining as experience in terms of technology usage increases. With regard to moderating effect of gender on social influence, it is acknowledged that the use of technology by women depend more on social collaboration while for men it is determined by their individual work preferences and competition (Steinerova and Susol, 2007). Thus, based on the social construction theory, women tend to be more influenced by opinions of others before deciding to use a new technology than men (Venkatesh *et al*, 2003; Ilie *et al*, 2005; Steinerova and Susol, 2007).

The findings of this study are contrary to other technology acceptance and usage studies that established social influence as a determinant of usage intention rather than usage behaviour (Venkatesh *et al*, 2003; Schaper and Pervan, 2007). This could be partly attributed to the wider context with regard to social influence as used in this study. While in most of the previous studies social influence encompassed peers, colleagues or other people with influence to the respondents, in the current study, organisational influence including employers and research funding bodies were considered to be part of social influence construct as well. Interventions by organisations [such as mandating open access publishing] that influence researchers have been acknowledged to dramatically increase open access adoption in many countries (Pinifield, 2005; Swan and Brown, 2005; Kim, 2006; Sale, 2006). The findings of this study therefore suggest the need for the universities in the study area to consider developing policies that are likely to improve the adoption of open access at the respective universities. Such policies may include mandates for their employees to deposit research output in institutional repositories and open access publications' rewards for career development of their employees.

6.9.4.3 Behavioural intention as a determinant of open access usage behaviour

Among the assessed five main constructs, researchers' behavioural intention was the strongest determinant of open access usage. The findings from this study therefore corroborate previous findings revealing such a construct to be consistent with the determinant of the actual usage of technology by the respondents (Venkatesh *et al*, 2003; Louho, Kallioja and Oittinen, 2006; Schaper and Pervan, 2007).

According to the findings from this study, it is predicted that the respondents who indicated to publish in open access in future were 480.8% more likely to do so than those who said were unlikely to disseminate their scholarly content through such outlets in future. The implication of these results is that majority of the scholars in public universities involved in the study generally supported open access publishing. Although such results look very impressive, the translation into real practice is something that may not be guaranteed unless proper measures are taken to address some of the problems already noted to have been affecting the development of open access scholarly communication at the respective universities. Taking appropriate measures including improvement of facilitating conditions as emphasised under section 6.9.4.1 above is among the actions that would make this to happen. Equally important could be the establishment of open access repositories that are enforced with appropriate policies to encourage researchers to deposit their research output. Open access proponents in Tanzanian public universities and other research institutions should utilise the findings from this study as the main basis in proposing and selling the introduction of open access at their respective institutions.

6.9.4.4 Direct effect of moderators on open access usage

As was the case with respect to behavioural intention, the five moderators were tested to find out whether or not they had any direct significance to researchers' open access usage. This time age and awareness were isolated to significantly determine researchers' open access usage behaviour. With respect to age, the findings imply that older respondents were 66.9% more likely to publish in open access outlets than the young ones. The reason of publishing experience as explained previously in section 6.9.3.2 also applies to the current scenario of the effect of age difference in technology usage.

It is the view of this researcher that the other contributing reason is the promotion criteria used at the respective universities that remain silent about open access publications'

consideration in career development. Among the reasons expressed by some respondents for their non-publishing in open access was lack of recognition of open access publications in career development. For older researchers, especially professors who publish for recognition rather than career development as they have reached the top positions, the choice of where to publish is not pre-determined as is the case with the young ones. The young researchers are more likely to publish in the conventional journals that have been pre-determined as recognised journals which are used in assessing staff for consideration in their career development.

The impact of awareness on researchers' usage of open access is low when compared to their behavioural intention of open access usage as noted previously. In the current findings it is observed that the respondents who were not aware of open access were 84.8% less likely to have published in open access outlets. This however, does not rule out the need for further promotion of open access so as to enhance its adoption by the research community.

Based on the discussion from sections 6.9.3 to 6.9.4, it is evident that the validated open access scholarly communication model has five key constructs [attitude, effort expectancy, facilitating conditions, performance expectancy, and social influence] as well as four moderators [age, experience, gender, and position] that determine the behavioural intention and usage of open access by researchers. It should be noted that the proposed research model in Figure 4 of Chapter Three had six constructs and five moderators. Of the six constructs therefore, only the Internet self-efficacy has been established to have no significant influence for both the intention and usage of open access by researchers. It should also be noted that awareness has also been ruled out not to play the moderating role of any of the constructs towards the intention and usage of open access by the researchers.

Furthermore, it should be noted that despite awareness and the other four factors being conceptualised as playing the role of moderators as observed in Figure 4 of Chapter Three, this researcher further investigated their direct effects in shaping the behavioural and usage of open access by scholars. Based on this analysis, it has also been established that age and awareness, apart from playing the role of moderators, the two factors have also been established of having the direct effect in shaping behavioural and usage of open access. Figure 8 presents the validated research model of open access scholarly communication.
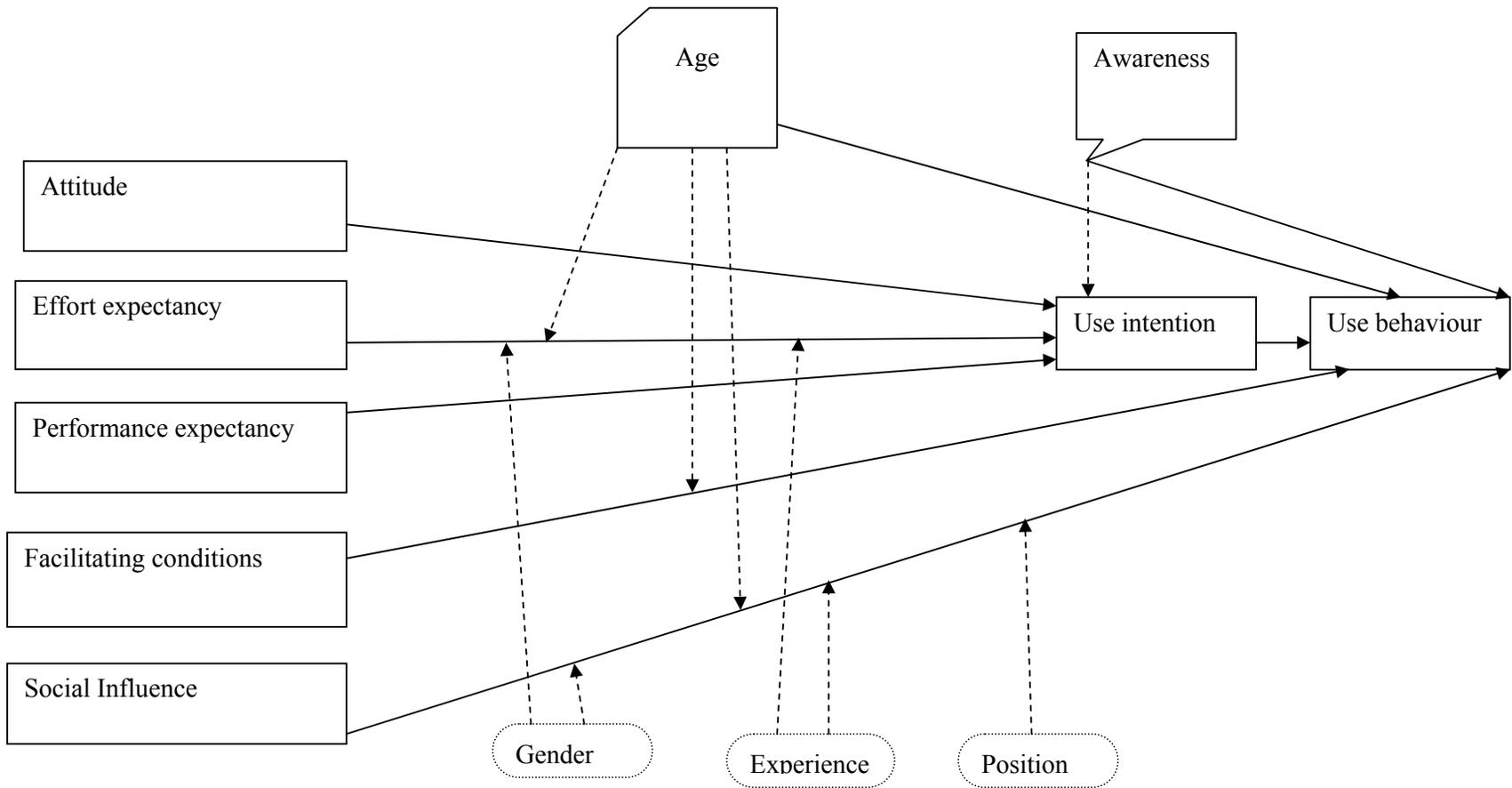
Figure 8: Open access scholarly communication research model

6.10 Chapter summary

This Chapter interpreted and discussed the key findings of the study. The following subsections provide key observations from the interpretation and discussion of the research findings regarding open access scholarly communication in Tanzanian public universities.

6.10.1 Awareness and usage of open access

The study established that 72.1 % of the researchers and 90.5% of policy makers were aware of the concept of open access. The researchers were found to be using open access outlets in accessing rather than disseminating scholarly content. Despite low usage of open access outlets in dissemination of scholarly content, 78% of the 384 researchers were optimistic to use the new scholarly communication model for future publishing of their research findings. Compared to studies done in Africa and elsewhere, the study established that the awareness and usage of open access in the study area followed a similar trend.

6.10.2 Factors affecting open access usage in scholarly communication

Researchers' Internet usage skills and self-efficacy, facilitating conditions, social influence, performance expectancy, effort expectancy, and the respondents' general perceptions about open access were identified as the possible factors likely to facilitate open access adoption in public universities involved in the study. Based on the respondents' feedback, except the facilitating conditions, Internet usage skills and self-efficacy, the rest of the above factors were considered to favour open access development in public universities in Tanzania. Majority of the respondents considered inadequacy of facilitating conditions at their respective universities for their effective exploitation of open access opportunities in enhancing accessing and dissemination of scholarly content. They also ranked themselves as having low Internet usage skills and low Internet self-efficacy with respect to dissemination of their research output online.

6.10.3 Establishment of institutional repositories for dissemination of scholarly content

Over 90% of the respondents from both categories of the researchers and policy makers acknowledged that dissemination of scholarly content at their respective universities was a problem as most research output was documented as grey literature in print formats. They also overwhelmingly accepted the idea of establishing institutional repositories as the best way of improving the dissemination of research findings emanating from their respective institutions. Conference papers, peer-reviewed articles published in journals, theses and

dissertations as well as teaching materials were the most preferred content for the institutional repositories. Majority of the respondents considered prior review of materials before depositing in institutional repository as important. Over 60% of both researchers and policy makers preferred university libraries for the management of institutional repositories as compared to 20% of the respondents who preferred a university-wide research coordination unit for shouldering this responsibility.

6.10.4 Hindrances to open access usage

Inadequate information search skills, lack of awareness and poor Internet services [mainly due to low connectivity] were cited as the main hindrances to researchers in using open access outlets to access scholarly content. Similarly, in addition to slow Internet connectivity, majority of the researchers cited inadequacy of online publishing skills, publication charges by some open access publishers, uncertainties on long preservation of open access materials as well as fear of plagiarism as the main issues that deterred the researchers from disseminating their research findings through open access outlets.

6.10.5 Usefulness of the research model

The measurement model assessment proved a good convergent and discriminant validity for supporting the multivariate analysis. This judgement was based on the fact that all items loadings from all constructs ranged from 0.5 to 0.9 meeting the minimum recommended threshold for the convergent validity. Similarly, no cross construct loading exceeded 0.5 while the minimum loadings for factors from the same constructs were above 0.5, supporting the requirement for the acceptable discriminant validity.

The Omnibus Test of Model coefficients was found significant [p<0.001] for both behavioural intention and usage behaviour of open access by the researchers. These results implied the statistical evidence of the model fitness to the collected data. With respect to the predictive ability, the model was found to correctly predict 79.7% of the observations with Nagelkerke R^2 of 0.27 in respect of behavioural intention dependent variable and 83.7% of the observations with Nagelkerke R^2 of 0.41 for the usage dependent variable. The overall explanatory ability of the model for behavioural intention and usage of open access was thus 68%. Therefore, the overall predictions accuracy and explanatory ability of the model makes it useful for guidance of studying the acceptance and usage of open access scholarly communication by the researchers in public universities that were involved in the study.

6.10.6 Behavioural intention and open access usage determinants

Based on the inferential statistics, attitude, effort expectancy, performance expectancy and awareness were established as the key determinants for researchers' behavioural intention of open access usage. The effect of effort expectancy was found to be moderated by age, experience and gender of the respondents. On the other hand, age, awareness, behavioural intention, facilitating conditions and social influence were established as the key determinants of researchers' behavioural usage of open access. The effect of social influence was found to be moderated by age, experience, gender and position of the respondents. The following Chapter presents the overall summary, conclusions and recommendations of the study.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.0 Introduction

This thesis presented and discussed the findings of an investigation on factors affecting the adoption of open access scholarly communication specifically in Tanzanian public universities. The background to the study providing the general introduction and definition of the research problem was presented in Chapter One. Chapters Two and Three reviewed and discussed literature focusing on this investigation. The research methodology detailing sampling procedures, data collection methods and statistical procedures employed by the study was presented in Chapter Four of the thesis. Chapter Five focused on the presentation of research findings while Chapter Six addressed the interpretation and discussion of the emerging study findings. The purpose of this Chapter is to summarise the study as well as present the conclusions and recommendations of the study. Suggestions for further research are also presented at the end of this Chapter.

7.1 Overall summary of the study

The purpose of this study was to investigate factors affecting the adoption of open access in research activities within public universities in Tanzania so as to recommend strategies for the enhancement of usage of this mode of scholarly communication. The study was motivated by the notable problems associated with access and dissemination of scholarly content in most developing countries including Tanzanian. To achieve the aim of the study, eight objectives and fifteen research questions as outlined in section 1.5 of Chapter One were formulated to focus the scope of this investigation. The UTAUT model was adopted in formulating the research model for the study. According to the UTAUT model, there are three indirect determinants of new technology usage (performance expectancy, effort expectancy, and social influence) and two direct determinants of usage behaviour (intention and facilitating conditions) (Venkatesh *et al*, 2003). In addition to the core constructs, the model developers also identified four moderators [gender, age, voluntariness, and experience] as having specific moderating roles to indirectly and directly determine technology use behaviour. The choice of the UTAUT model was motivated by its comprehensiveness as well as the high explanatory power of this model in comparison to other technology acceptance and use models/theories.

Based on the UTAUT model, the researcher formulated an open access research model [theoretical framework] comprised of six key constructs and five moderators for guidance of the study. Accordingly, the researcher conceptualised attitude, effort expectancy, facilitating conditions, Internet self-efficacy, performance expectancy, and social influence as key determinants of researchers' behavioural intention and usage of open access in Tanzanian public universities. Individual researchers' differences including age, awareness, Internet usage experience, gender and position were also considered as factors moderating the influence of independent variables on the dependent variables (behavioural intention and usage of open access). Apart from determining their moderating effects, the six moderators were also investigated to determine their direct influence on researchers' behavioural intention and usage of open access.

The study adopted the survey and content analysis as the main methods for data gathering. The survey questionnaire targeted 544 respondents selected through stratified random sampling from a population of 1088 university researchers from main campuses of the six public universities in Tanzania. The interview which targeted 67 university policy makers from the six institutions complemented the questionnaire survey. Among the distributed copies of questionnaire, 398 (73%) were returned duly completed by researchers. Similarly, 63 (94%) of the policy makers participated in the interview. Of the 398 respondents, 310 (77.9%) were males and 88 (22.1%) females.

The distribution of respondents by positions revealed that majority were lecturers (46.2%), followed by professors (28.9%) and senior lecturers (24.9%). In terms of the highest academic qualifications attained by the respondents, 299 (75.1%) were holders of PhD degrees while the remaining 99 (24.9%) had Masters Degrees. With respect to age, 78 (19.6%) were aged between 31-40 years; 157 (39.4%) between 41-50 years; 145 (36.4%) between 51-60 years; and 18 (4.5%) were above sixty years. According to distribution by research disciplines, 159 (41.4%) of the respondents represented social sciences and 225 (58.6%) natural sciences. In terms of Internet usage experience, majority of the respondents (53.5%) had experience of 6-10 years; followed by 34.9% who had more than ten years of experience and lastly; 11.6% who had 1-5 years experience. Apart from the 398 researchers who responded to the main questionnaire, 63 university administrators were interviewed, 73% of whom were males and 27% females. Among the interviewees, there were 4 deputy

vice-chancellors (academic), 31 deans of faculties/schools, and 28 directors of centres/directorates/institutes.

The study also carried out content analysis which involved a literature review and structured records review. The literature review provided the researcher with a general understanding of the research problem and was used as a benchmark for comparing and contrasting the research results. The structured records review involved studying websites of the six public universities involved in the study as well as OAIster analysis. This exercise was important in order to determine the actual involvement of the researchers in the study area in disseminating their research output through open access outlets within and beyond their institutions. Data emerging from the survey and structured records review were analysed using the descriptive and binary logistic regression statistics of SPSS. In summary, the following are the key results on the basis of themes from the seven among eight of the research objectives of this study. It should be noted that the remaining research objective about suggesting strategies to resolve the hindrances to the adoption of open access is addressed under the recommendations section.

7.1.1 Review of the developments in scholarly communication and open access adoption at global level

7.1.1.1 Through the literature review it has been demonstrated that the current business mode of scholarly communication is characterised by copyright and price restrictions to scholarly content accessibility. This has resulted into limited accessibility to such content by scholars especially from developing countries. This is due to low affordability of the material resulting from exorbitant prices charged for the accessibility of such publications.

7.1.1.2 Open access has been noted as emerging from the existing business model of scholarly publishing in an attempt to improve dissemination of information through the removal of access restrictions to scholarly output. The enabling online digital information environment has been established as among the facilitating factors for the scholarly community to introduce open access as a potential solution for the widest dissemination of scholarly content.

7.1.1.3 Different levels of open access adoption have been noted at international level with those continents having more developed countries leading in the uptake of open access scholarly communication as compared to those continents dominated by least developed countries. Overall, 15 % of the global scholarly content has been established as being published in open access outlets while the remaining 85% is disseminated using the traditional mode of scholarly communication.

7.1.2 Investigation of the general awareness and usage of open access

7.1.2.1 The study has established that 72.1% of researchers as compared to 90.5% policy makers in Tanzanian public universities were aware of open access.

7.1.2.2 Low involvement of researchers to disseminate their research findings through open access outlets was also verified through OAIster website analysis revealing a total of 167 journal articles, 40 conference/workshop proceedings, 14 research reports, 9 theses/dissertations, 5 books and 5 book chapters' articles to have emanated from researchers in the universities involved in the study.

7.1.2.3 Less involvement of open access publishing by researchers was also evident from the respective university websites due to lack of local open access journals and institutional repositories.

7.1.2.4 Overall, majority of the respondents (77.8% of 384 respondents) expected that it was very likely or likely for them to publish in open access outlets in future.

7.1.2.5 As compared to studies done in other African countries and elsewhere, the findings from this study suggests a similar trend with respect to the awareness and open access usage by scholars. This is true for the adoption of open access in general as well. However, the results from this study reveal an improvement with respect to open access awareness when compared to studies done a few years ago.

7.1.2.6 The study revealed further that in all cases open access usage in terms of dissemination of scholarly content was on the lower side in comparison to scholars'

similar usage of open access outlets in accessing openly accessible scholarly content. This trend is observed from studies done in both developed and developing countries.

7.1.3 Determination of factors facilitating researchers' adoption of open access

7.1.3.1 Researchers' Internet usage skills and self-efficacy, facilitating conditions, effort expectancy, performance expectancy and social influence were identified as the possible factors likely to enhance open access adoption in Tanzanian public universities.

7.1.3.2 With respect to Internet usage skills, 83.7% and 65.8% of the respondents rated themselves as having very good or good online skills in accessing and disseminating scholarly content respectively.

7.1.3.3 As far as Internet self-efficacy is concerned, while majority of the respondents strongly agreed or agreed that they felt confident in searching information on the Internet (88.6%) and publishing research output on the Internet (64%), less than 40% of the respondents were confident in designing personal websites.

7.1.3.4 The findings also revealed that apart from having Internet connectivity, less than 50% of the respondents agreed or strongly agreed that their institutions provided adequate facilitating conditions for them to use open access outlets effectively in scholarly communication.

7.1.3.5 With respect to effort expectancy, majority of the respondents (76.5%) agreed or strongly agreed with the statement that it was easy for them to access online scholarly content while 61.3% of the respondents agreed or strongly agreed that they understood the implications of publishing in open access outlets.

7.1.3.6 Regarding the assessments of researchers' performance expectancy, over 60% of the respondents either agreed or strongly agreed that open access publishing was superior to the conventional subscription-based scholarly publishing in many aspects related to access and dissemination of scholarly content.

7.1.3.7 Compared to the rest of social influence related factors that were considered as important or very important by more than 50% of the respondents, the research funding agency and employer requirements for researchers to publish in open access outlets were the highly ranked factors (by 78.6% of the respondents) that could influence researchers to disseminate their scholarly content using open access means.

7.1.4 Determination of researchers' perceptions on open access

7.1.4.1 The respondents' general perceptions were very positive on the new scholarly publishing as reflected from their views and ratings of open access publications.

7.1.4.2 Over 80% of the respondents considered open access as beneficial to the scholarly community, access and use of open access as a good idea, and that publishing in open access was a good idea.

7.1.4.3 Apart from positive general comments on open access by the researchers and policy makers, among the researchers who acknowledged to have accessed open access publications, very few (14.5%) said that such publications were mediocre or of little scientific merit against majority (82.4%) of the respondents who perceived those publications as having good quality and with acceptable scientific merit.

7.1.4.4 Over 90% of the respondents from both categories of researchers and policy makers acknowledged that dissemination of scholarly content at their respective universities was a problem. They also overwhelmingly accepted the idea of establishing institutional repositories as the best way to improve dissemination of research findings emanating from their respective institutions.

7.1.4.5 Conference papers, peer-reviewed articles published in journals, theses and dissertations as well as teaching materials (in that order of priority) were the most preferred content for the institutional repositories.

7.1.4.6 Respondents attached a great importance on the review of institutional repository content. They preferred review teams for repository contents as follows: departmental

committees (36.9%), faculty/institute/ directorate level research committees (36%), and university-wide committee (22.7%).

7.1.4.7 With respect to usage of institutional repositories' content, majority of the respondents (79.7%) in this study would allow any use of their works so long as users provided proper acknowledgement. A small percentage (25.5%) would allow comments or addition of notes in their deposited works by other people.

7.1.4.8 Majority (over 60%) of both the researchers and policy makers preferred university libraries for the management of institutional repositories as compared to 20% of those who preferred the university-wide research coordination unit.

7.1.5 Determination of factors hindering researchers' adoption of open access

7.1.5.1 With respect to hindrances to open access adoption in Tanzanian public universities, the respondents cited poor Internet services - mainly due to low connectivity (74.4%), inadequate information search skills (44.4%), and lack of awareness (28.9%) as the main obstacles for them to use open access outlets to access scholarly content.

7.1.5.2 Similarly, in addition to slow Internet connectivity, majority of researchers cited inadequacy of online publishing skills (60.8%), perceived low quality of open access publications (55.2%), fear of plagiarism (51%), uncertainties on long preservation of open access materials (35.4%), publication charges by some open access publishers (31.2%), and power interruptions (23.3%) as the main deterrents to researchers' dissemination of research findings through open access outlets.

7.1.6 Formulation of a research model on acceptance and usage of open access by researchers

7.1.6.1 Based on the UTAUT model, a research model with six core constructs as determinants of the intention and usage behaviour of open access was formulated.

7.1.6.2 Among the open access usage determinants, performance expectancy and effort expectancy were postulated to directly influence behavioural intention only. Behavioural intention and facilitating conditions were considered as direct determinants of open access usage only while attitude, Internet self-efficacy and social influence were postulated to influence both behavioural intention and usage of open access.

7.1.6.3 The formulated research model had also five moderators [age, awareness, experience, gender and position/rank] postulated to have influence on the independent variables towards behavioural intention and usage of open access.

7.1.7 Validation of the research model on open access usage and behavioural intention by researchers

7.1.7.1 The UTAUT based open access research model was validated and found useful for guidance of the study. The determined KMO measure of sampling adequacy was 0.879 and the Bartlett's test of sphericity was found significant [Ch-square = 6638.042 = Degree of freedom (DF) = 435 = Significance = 001]. These results signified the data support for factor analysis.

7.1.7.2 Factor analysis revealed loadings of the items [30 items forming six constructs] from each construct ranged from 0.5 to 0.9 for all constructs and items belonging to the same construct to load highly in their respective constructs as compared to their loadings in different constructs, thus meeting both the convergent and discriminant validities.

7.1.7.3 The Omnibus Test of Model coefficients was found significant [$p<0.001$] for both behavioural intention and usage behaviour of open access by researchers. These results implied the statistical evidence of the model fitness to the collected data.

7.1.7.4 With respect to the predictive ability, the model was found to correctly predict 79.7% of the observations with Nagelkerke R^2 of 0.27 in respect of behavioural intention dependent variable, and 83.7% of the observations with Nagelkerke R^2 of 0.41 for the usage dependent variable. Based on R^2 values, the overall explanatory ability of the model in terms of behavioural intention and usage of open access was thus 68%.

7.1.7.5 The study revealed [p-values in brackets] the attitude ($p < 0.05$), effort expectancy ($p < 0.01$), performance expectancy ($p < 0.05$) and awareness ($p < 0.01$) as the key determinants for researchers' behavioural intention of open access usage.

7.1.7.6 The effect of effort expectancy was found to be moderated by age ($p < 0.01$), experience ($p < 0.01$) and gender ($p < 0.01$) of the respondents.

7.1.7.7 On the other hand, age ($p < 0.05$), awareness ($p < 0.01$), behavioural intention ($p < 0.001$), facilitating conditions ($p < 0.05$) and social influence ($p < 0.01$) were established as the key determinants of researchers' behavioural usage of open access.

7.1.7.8 While the effect of facilitating conditions was modified by age ($p < 0.05$), that of social influence was found to be moderated by age ($p < 0.05$), experience ($p < 0.05$), gender ($p < 0.01$) and position ($p < 0.01$).

7.2 Conclusions

The above section summarised key findings from this study. This section provides key conclusions as guided by the themes drawn from the research questions of the study.

7.2.1 Forces behind the emergence of open access

Access restriction to information through copyright and licensing as practiced by the business mode of scholarly publishing is the main force behind the emergence of open access. Developments in ICTs that have made it possible to digitise information to common standards have further motivated open access proponents to consider the new mode of scholarly communication as a practical solution in widening accessibility to scholarly content.

7.2.2 Open access adoption at global level

Despite its emergence in the early 1990s, open access adoption is still at its infancy to date. This mode of scholarly communication is more widespread in developed countries as compared to the developing world due to the existence of various movements and initiatives for fostering the development of open access in the former countries. It is generally concluded that continents or countries with pronounced research output and well developed ICTs infrastructure are the ones that are also ahead in open access adoption. It is thus

emphasised that high level policy making bodies at regional and individual countries' level in continents such as Africa should advocate for open access in order to improve its adoption.

7.2.3 The extent of researchers' awareness and open access usage

Despite the high awareness of open access by researchers and policy makers, there is evidence of less usage of open access outlets in the dissemination of research findings in these institutions. There is an indication of there being little or no formal advocacy initiatives for open access scholarly publishing within the study area. This is due to the fact that majority of the respondents were informed about open access informally through colleagues rather than institutionalised organs such as libraries. This scenario might have contributed to low usage of this mode of scholarly publishing in dissemination of research findings in the study area. As far as the awareness and usage of open access is concerned, it is concluded that researchers and policy makers in the study area do not differ from those in other countries with respect to the two aspects. It is necessary for librarians in collaboration with other stakeholders within the public universities in Tanzania and elsewhere to spearhead campaigns aiming at creating further awareness of open access to researchers and policy makers in order to enhance its adoption.

7.2.4 Factors facilitating researchers' usage of open access in accessing and disseminating scholarly information

Attitude, awareness, effort expectancy, facilitating conditions, performance expectancy and social influence are the important factors that determine the usage of open access in Tanzanian public universities. It is important to alleviate the deficiencies and capitalise on strengths noted in these factors in order to improve the adoption of open access. For example, while it is necessary to improve both technological and human factors, it is equally important to develop policies for the enhancement of open access adoption in the study area.

7.2.5 Hindrances to researchers' usage of open access in terms of accessing and disseminating scholarly content

Although the absence of factors noted in section 7.2.4 above automatically translates into obstacles with respect to access and dissemination of open access content, the conclusion from this study is that inadequate institutional facilitating conditions form the key obstacles of open access adoption in all the public universities that were involved in the study. The

improvement of Internet connectivity coupled with user community training in terms of online access and dissemination of scholarly content is thus crucial in order to enhance adoption of open access at respective universities. The establishment and institutionalisation of open access policies that recognise research output from open access channels for career development of researchers will further foster the adoption of this mode of scholarly communication.

7.2.6 Acceptability of open access publishing in Tanzanian public universities

Based on the findings of this study, it is concluded that both researchers and policy makers in the study area highly support the idea of open access publishing. This conclusion is drawn from the respondents' general views and perceptions about open access. This aspect is also notable in the willingness of the respondents with respect to open access publishing and support of institutional repositories' establishment at the respective institutions. These findings form a basis for the proponents of open access in the country to have justification for the introduction of this mode of scholarly publishing in public universities and other research institutions in the country. During the time of conducting this study, none of the public universities involved in the study had formally introduced and/ or practiced open access publishing.

7.2.7 Usefulness of the UTAUT model in open access behavioural intention and usage studies

The UTAUT model is increasingly being adopted to guide technology acceptance and usage studies. However, very few studies on the acceptance and usage of open access have employed UTAUT based research models in their investigations. The current study has demonstrated the usefulness of the model in question in an attempt to understand the contributing factors with respect to open access adoption. The findings from this study established conflicting results compared to several other studies in respect to some constructs such as attitude, Internet self-efficacy, and social influence. The need for further testing and validation of the UTAUT model in different environments and technology settings as recommended by several other scholars is thus pertinent (Venkatesh *et al*, 2003; Kripanont, 2007; Marchewka, Chan and Kostiwa, 2007; Wu, Tao and Yang, 2007).

7.2.8 The overall contribution of the research findings

The key findings from this study as well as the developed and validated open access research model provide valuable information to understanding the adoption of open access scholarly communication in public universities and other research institutions in Tanzania. The findings from this study may also be valuable to similar institutions from other countries with similar research environments to Tanzania.

7.3 Recommendations

The previous section presented conclusions of the study findings. This section addresses the sixth research objective: suggest strategies to resolve the hindrances to the adoption of open access. As Fullard (2007) puts it, both indirect and direct interventions are necessary routes for fostering the progress of open access. According to the referred author, the following are some of the indirect measures that are likely to foster open access development at local levels:

➢ Indirect interventions such as the mainstreaming of author options or convention of traditional journals into open access by some publishers;

➢ Authors' benefits from open access materials accessed by chance through search engines such as Google scholar and;

➢ The ongoing international open access initiatives are some of the indirect measures likely to foster open access developments at local levels.

Recommendations made in this section have been derived from the conclusions about the study findings as presented in the previous section and focus on the direct interventions. It is the view of this researcher that the recommended solutions could foster the uptake of open access scholarly communication in the universities that were involved in the study as well as in other research institutions in the country and elsewhere.

7.3.1 Advocacy for open Access

Among other factors, the awareness and clear understanding of open access benefits is critical for its wide adoption by the scholarly community and other stakeholders. According to Suber (2004), for example, the reason for some scholars not publishing in open access may not be their opposition to open access, but because they are unfamiliar with that mode of scholarly communication. Chan and Costa (2005) also point out that the new form of scholarly

communication can flourish only if faculty and university administrators are made aware of the benefits of open access. This calls for the need for advocacy campaigns directed to various stakeholders including policy makers, authors and readers of scholarly content as well as information managers. In view of the fact that some researchers and policy makers in the study area were found to be unaware of open access, it is important to further advocate for this mode of scholarly communication.

The need for further advocating of open access in such institutions is further motivated by low publishing involvement of researchers in open access outlets as revealed by this study. For a wider impact, the open access advocacy campaigns should be done at all levels from institutional to national level. At the national level, open access advocates should be led by the Tanzania Library and Information Association (TLA). Apart from sensitizing information professionals, TLA should also lay strategies for organised advocacy to key leaders of strategic ministries responsible with education, research and communication, universities as well as other research institutions in the country. To achieve this mission, the TLA should consider preparing strategic position paper explaining the benefits and opportunities offered by open access in stimulating the economic development of the country. The Consortium of Tanzania Universities and Research Libraries (COTUL) under the current formation is also another potential organisation to work with TLA in advocating for open access development in the country.

Librarians and other information professionals should be used as change agents at institutional level. This group of professionals should lobby with the university administrators on the establishment of institutional repositories as supported by majority of the respondents in this study. Among other mechanisms, the following means may be employed:

> ➢ Organising workshops and seminars specifically designed for creating awareness and deeper understanding of open access;

> ➢ Including specific training sessions to researchers for demonstration of access and publishing in open access outlets;

> ➢ Linking open access information sources to library websites for users to access and;

➢ Preparing and dissemination of open access promotion materials as well as advising authors on possible open access outlets for the dissemination of their scholarly output.

7.3.2 Internet speed improvement

Slow Internet connectivity was the main concern raised by majority of the respondents in this study. Without adequate bandwidth accompanied by its proper management, scholars from these universities will not effectively utilise open access potentials and the online electronic environment in general. This implies that researchers from these institutions are compelled to spend a lot of their time trying to access information online. At the same time information hosted at their universities, even if available online, may not be easily accessed by other scholars from outside researchers' institutions due to the existing low uplink and downlink connectivity in all the public universities in Tanzania as noted in section 6.8 of Chapter Six.

Based on the above observations, it is highly recommended for the universities in the study to improve their Internet speed through subscription to more bandwidth so as to meet the demand from the scholarly community at the respective institutions. The submarine fibre optic cable connection that was launched in June 2009 (by President Jakaya Kikwete of the United Republic of Tanzania) offers a great opportunity for such universities to improve their connectivity. During the launching ceremony, the President promised the laying of the National Optic Fibre Cable (OFC) that is expected to be connected to the Submarine cable for the improvement of Internet connectivity throughout the country (Shame, 2009). The expectation is that once the universities and other research institutions are connected to the submarine fibre optic cable, the Internet speed will greatly improve and reduce connectivity costs as compared to the currently satellite based connections in use throughout the country (CIPESA, 2006).

7.3.3 Researchers' training on effective exploitation of the Internet in scholarly communication

Despite majority of the respondents rating themselves high regarding their abilities of Internet usage in terms of accessing and disseminating scholarly content, it is the view of this researcher that such results may not necessarily reflect the reality on the ground since no actual skills assessment was done. Moreover, training on effective usage of the Internet is

important taking into account the fast changing of the digital environment making it difficult for most scholars to easily access and disseminate scholarly output. As a result, it is not strange to find the researchers spending much of their valuable time in searching for information due to the challenging online environment (Eger, 2008). It is also true that apart from online publications being made available through publishers' initiatives, own online publishing is new to most of the researchers involved in the study. Therefore, it is important to device mechanisms of imparting such skills to scholars. This reality made Harle (2009:15) to argue that " With more sophisticated ICTs now being used in HE [Higher Education], and with developing web technologies relating to information access and publishing becoming more sophisticated, libraries need to continually upgrade the technical skills of the existing staff and to enable and encourage them to develop new expertise".

As the institutions establish institutional repositories, online publishing skills on the part of the researchers become very important for the self-deposit of their research findings. It is thus highly recommended for information professionals from both libraries and university computing centres to proactively device attractive training modules for upgrading the information search and publishing techniques in the online environment. Both on site for hands-on training and online (by depositing instructional materials on university websites for researchers' self-learning at their own pace) should be considered.

7.3.4 Formal introduction of institutional open access publishing

The study findings revealed that none of the public universities involved in the study have put in place operational strategies to encourage open access development at the respective institutions. The willingness of researchers from these institutions to publish in open access outlets in future was however found to be very high. Apart from encouraging scholars to disseminate their research findings in open access outlets such as open access journals and other repositories elsewhere, among the viable strategies for taping the observed researchers' willingness to publish in such media is for the universities to establish open access publishing outlets within their premises. The establishment of institutional open access repositories for fostering the widespread of open access in all public universities and other research institutions in the country is highly recommended. This takes into account the overwhelming support of this idea by both researchers and policy makers as a way to improve dissemination of research findings from public universities that participated in this study.

The above recommendation is also motivated by the fact that the future development of open access seems to be more promising for open access repositories than open access journals (Harnad, 2006; Bjork, Roos and Lauri, 2009). It should be noted that most of the research output that is documented as grey literature at the respective universities can be highly visible if deposited in the institutional repositories. The recommended institutional repositories may also be used for deposition of articles from local journals published at respective universities. Most of the local journals at such universities have limited circulation as a result of being published in print format.

There are many benefits for institutional repositories to make it justifiable for public universities and other research institutions in Tanzania to seriously consider investing in such ventures. Chan, Kirsop and Arunachalam (2005) best summarised some of the benefits of institutional repositories as follows:-

➢ *International access to research generated in developing countries*- papers published by developing countries' researchers in foreign journals which are not accessible to other scholars in their home countries may be easily accessible if universities and researchers in these countries set up institutional repositories to be deposited with a great number of papers published by their researchers;

➢ *Improved citation and research impact*- this is considered as the most persuasive reason for institutions to set up interoperable open access archives, both in developed and developing countries. There is evidence that citation and the impact of papers that are openly accessible are far greater than non-open access publications (Antelman, 2004; Hajjem, Harnad and Gingras, 2005; Brody, 2006) and;

➢ *Open access repositories allow improved access to subsidiary data*- repositories provide access to materials such as theses and dissertations, technical reports and other forms of publications that do not have regular publishing outlets but are important for research and teaching purposes (Chan, Kirsop and Arunachalam, 2005).

From the above observations, it is evident that universities and other research institutions in the country can greatly improve dissemination of their research findings by establishing institutional repositories for archiving and dissemination of research output emanating from such institutions. This option will improve dissemination of institutional research output within and beyond country borders and probably minimise a great deal the problems of scholarly content dissemination that have existed for a long time.

The recommended institutional repositories should be established using standard software and platforms fulfilling minimum and acceptable requirements so that they are harvested and optimally used. Among other aspects, the recommended institutional repositories should adopt OAI-PMH compatible software to be interoperable with other repositories (Berlin Declaration of Open Access, 2003; Alemu, 2009). Some of the recommended software meeting the above criteria include: DSpace, Eprints, CDSware, Fedora, and Greenstone (Open Source Institute (OSI), 2004; Afroz, 2008; Perera, 2008; Salanje, 2008). The choice of the appropriate software should however depend on the specific and additional requirement of individual institutions.

7.3.5 Review of institutional policies for enhancement of open access publishing

The existing policies that encourage researchers to "publish or perish" also contribute to the development of scholarly communication in public universities in Tanzania but have not adequately addressed the problem of dissemination of research output from these institutions. Review of institutional policies targeting the adoption of open access is a crucial determinant for open access development to widen the dissemination of scholarly content. This is true of public universities and other institutions in Tanzania and elsewhere. This view has also received support from several other scholars (Swan and Brown, 2005; Carr *et al*, 2006; Warlick and Voughan, 2006; Deoghuria and Roy, 2007). It is thus necessary for universities and other institutions in Tanzania to consider preparing appropriate policies to support the development of open access. This recommendation is supported by the fact that the findings from this study revealed majority support from the policy makers on various policy statements that can be included in the proposed policies on institutional open access.

Policies that support recognition of open access publications in career development, for example, can play a major role in encouraging researchers to disseminate their research findings in such outlets. Instead of using the pre-determined lists of journals [predominantly

traditional journals and in most cases less frequently updated] for staff assessment, it is more practical to use the established journal assessment criteria to evaluate staff performance from whichever journal the evaluated staff has published. This approach would give more room or freedom for researchers to choose journals in which to publish their works but taking into account the journal quality aspects regardless of whether it is open access or subscription-based. Ideally, a researcher who publishes an article in an open access journal which is at par with the subscription-based in terms of the established assessment criteria should deserve more points. This is due to the fact that a researcher disseminating scholarly content in open access outlets is likely to make more research impact due to the potential for wider readership of the work in question as a result of unlimited accessibility.

Policies that guide the build up of institutional repositories are also crucial for growth and sustainability of the repositories in question. Universities should consider the possibility of mandating their researchers to deposit their scholarly output in the institutional repositories once established. This recommendation is based on previous research findings reported by several scholars that mandating institutional repository depositing by faculty greatly contributes to the growth of such repositories (Carr *et al*, 2006; Kim, 2006; Sale, 2006). Fortunately, under many circumstances researchers have shown willingness to abide by these conditions as put forward by their employers and other research funding bodies (Swan and Brown, 2005; Kim, 2006; Sale, 2006). Majority support by the respondents in this study with respect to the importance of social influence as a determinant of their publishing in open access outlets also suggest that researchers in the study area could comply with institutional repositories' deposit mandates.

The other possibility is for the universities and other research funding agencies to require researchers to disseminate their research findings in open access outlets as a way of accounting for the award for their research grants. According to Kim (2006), grant-awarding bodies and university or department actions influence scholars' decisions to make or not to make their materials publicly accessible. Some research funding bodies like the Max Plank Society in Germany and the Wellcome Trust in UK have made it mandatory for their grant recipients to publish in open access outlets scholarly content emanating from the research funded by such organisations (Chan 2004). It is thus important for the public universities in Tanzania and other research institutions to adopt similar strategies in order to enhance dissemination of research information in the country.

7.3.6 Suggestions for further research

The scope and limitations of this study as noted in Chapter One of this study provides several opportunities for further research using the open access research model as well as the research tools in a wider scope. The wider scope for further research may include: private universities, other higher learning and research institutions, and national research managing bodies beyond the universities such as the Tanzania Commission for Science and Technology (COSTEC). Based on the wide scope for further research, this researcher highly recommends the following six areas as follow ups to the current study.

7.3.6.1 Validation of the open access research model

Similar studies within the higher learning institutions including private universities and other public tertiary learning institutes within Tanzania and beyond are recommended for comparative results. Such studies should further validate the developed UTAUT based open access research model. Those studies should concentrate more on the validation of the research instruments and constructs as well as moderators that have resulted into conflicting research findings by several studies including this one.

7.3.6.2 Assessment of libraries' capacities in fostering open access development

The study on the assessment of library capacities in fostering open access is recommended to be conducted in all public universities and other research institutions in Tanzania. This recommendation is a result of the findings from this study in which majority of the respondents considered libraries as the most appropriate units for the establishment and management of institutional repositories. Among other issues, a study of this kind could investigate library capacities in terms of technological and staff skills in handling user training for effective exploitation of open access publishing opportunities. Libraries' abilities to establish and manage institutional repositories should also be ascertained by this kind of a study.

7.3.6.3 Determination of most appropriate repository platforms and software

The fact that there are several suitable platforms and software for the establishment of institutional repositories as noted in section 7.3.4 prompts the need for a study to establish the most suitable software for adoption by the respective universities and other research institutions in the country, taking into account the local environment. According to OSI (2004:16), "the local requirements of each repository implementation will dictate which

system will best serve institution's needs". A study is thus recommended to evaluate the suitability of the existing repository platforms and software in order to identify the most suitable ones for adoption by Tanzanian public universities and other research institutions in the country.

7.3.6.4 Establish local journal editors' views on opening access to their publications

Among other findings, this study established the willingness for majority of the respondents to publish in open access outlets in future. It can be of great value to establish the local journal editors' positions with respect to converting their journals into open access [delayed or immediate open access]. The recommended study may consider assessing the circulation of local journals, economic aspects [revenue generated from journals], funding sources for such publications, and the willingness of journal owners in making their publications openly accessible.

7.3.6.5 Researchers' training needs' assessment

Specific case studies are recommended for institutional establishment of training needs of the researchers in order to develop tailor made trainings to this group for their effective usage of the digital information environment to access and disseminate scholarly content. This kind of study should establish researchers' training needs with respect to online publishing in both open access and conventional publishing outlets. This is important so that the new skills on effective usage of the digital information environment are imparted to researchers.

7.3.6.6 Assessment of policy makers' views regarding open access at Government level

The support for open access model at country level depends very much on the awareness and support by political and other national leaders. It is thus recommended that a study be conducted to target this group of the respondents [ministers, members of parliament, ministerial principal secretaries] in order to establish their views about the new mode of scholarly communication with respect to fostering the economic development of the country. Based on interviews, this kind of a study may also be used as one of the strategies of selling open access to this group of respondents.

7.4 Chapter summary

This Chapter summarised the key research findings of the study as guided by the themes drawn from the research questions. Conclusions of the study as well as recommendations and suggestions for further research were also addressed in this Chapter.

The study findings revealed that majority of the policy makers and researchers in the public universities involved in the study were aware of the open access concept. However, with respect to usage of open access in scholarly communication it was found that majority of the respondents accessed rather than disseminated scholarly content using open access outlets. A research model based on the UTAUT model was developed and validated. The validated research model had the overall explanatory ability of 68% of the variance in terms of behavioural intention and usage of open access by researchers. Based on this research model, the study established that attitude, awareness, effort expectancy and performance expectancy have been the key determinants for researchers' behavioural intention of open access usage. Similarly, age, awareness, behavioural intention, facilitating conditions and social influence were established as the key factors in influencing the researchers' actual usage of open access. The study further demonstrated that age, experience, gender and position had moderating effects to independent variables towards behavioural intention and usage of open access by the researchers.

Based on the conclusions drawn from the study findings, the researcher advanced a number of recommendations. The following are some of the measures recommended to enhance the adoption of open access so as to improve the dissemination of research findings from the public universities in Tanzania and other research institutions:

- ➢ More advocacy for open access;

- ➢ Upgrading of the Internet speed;

- ➢ Upgrading of researchers' Internet usage skills in scholarly communication;

- ➢ Formal introduction of institutional open access publishing and;

- ➢ Review of institutional policies to enhance open access publishing.

The Chapter concludes by suggesting the following six areas for further research as a follow up to the current study:

- ➢ Validation of the open access research model;

- ➢ Assessment of libraries' capacities in fostering open access development;

- ➢ Determination of most appropriate repository platforms and software;

- ➢ Establish local journal editors' views for opening access to their publications;

- ➢ Researchers' training needs' assessment and;

- ➢ Assessment of policy makers' views regarding open access at Government level.

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APPENDICES

Appendix 1: Summary of data collection tools

Research question	Data collection tool/information source
1. What forces are behind the emergence of open access?	Literature review (Chapter 2)
2. To what extent has open access been adopted internationally?	Literature review (Chapter 2)
3. To what extent are researchers and policy makers aware of open access and what is the extent of open access adoption in research activities in Tanzanian public universities?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q11, 15, 16,17,19) ➢ Interview schedule (Appendix 4: Q3-5) ➢ Structured record review [Appendix 5]
4. How is the open access awareness and usage in Tanzanian public universities rated in comparison to other countries in Africa and elsewhere?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q11, 15, 16,17,19) ➢ Interview schedule (Appendix 4: Q3-5) ➢ Structured record review (Appendix 5)
5. What factors facilitate the use of open access outlets by researchers in accessing scholarly literature?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q9, 10, 18, 21, 22, 23, 24, 25, 28, 26) ➢ Interview schedule (Appendix 4: Q11)
6. What factors facilitate the researchers' use of open access outlets in disseminating research output?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q9, 10, 18, 21, 22, 23, 24, 25, 28, 26) ➢ Interview schedule (Appendix 4: Q11)
7. What are the researchers' and policy makers' general perceptions on open access publishing?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q17,22, 36)
8. How do researchers and policy makers perceive the establishment of open access repositories at their institutions for the dissemination of scholarly content?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q29-34) ➢ Interview schedule (Appendix 4: Q7-12)
9. What factors hinder the use of open access scholarly content in research activities?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q9, 10, 18, 21, 22, 23, 24, 25, 28, 26) ➢ Interview (Appendix 4.4, Q11]

10. What factors hinder the dissemination of research findings through open access avenues?	➢ Literature review (Chapter 2) ➢ Questionnaire (Appendix 3: Q9, 10, 18, 21, 22, 23, 24, 25, 28, 26) ➢ Interview schedule (Appendix 4: Q11]
11. How can the identified hindrances be resolved for more adoption of open access to improve scholarly communication?	➢ Literature review (Chapter 2) ➢ Respondents' suggestions
12. What are the important dependent variables expected to influence researchers' open access usage behaviour and behavioural intention?	➢ Literature review (Chapter 3)
13. Which moderators are expected to affect the influence of dependent variables towards independent variables?	➢ Literature review (Chapter 3)
14. How useful is the research model in terms of its predictiveness and fitness to the collected data?	➢ Structural model assessment
15. What are the significant variables that influence researchers' open access usage behaviour and behavioural intention?	➢ Structural model assessment

Appendix 2: Introductory letter for a survey on open access scholarly communication in Tanzanian public universities

Dear respondent,

I kindly request you to participate in this survey that aims at assessing the acceptance and usage of open access scholarly communication among scientists in Tanzanian public universities. **The main principle of open access is the accessibility to scientific knowledge free of cost and access restrictions for everybody over the Internet.** Open access publications are a form of electronic publications, but not all electronic publications are freely available to users. Other electronic publications that are offered by traditional journals often have access restrictions and are only available to subscribers.

This survey focuses on ascertaining your awareness of this development within scholarly communication and seeks your views on several aspects of open access. Your views are highly valuable regardless of whether you already have experience with open access or not, as it is your personal opinion that matters since there are no right or wrong answers. Results from this survey form a crucial component of my PhD thesis and will provide an important input in recommending a most suitable model for dissemination of scholarly output by capitalising on the current Information and Communication Technologies (ICTs) developments in the country. Your answers will be treated with high confidentiality and at no time will your data be given to a third party. Survey results will only be used for scientific purposes.

I appreciate the value of your views. Please do not hesitate to contact me for clarification on any aspect in this questionnaire.

F.W. Dulle
PhD student (University of South Africa)
E-mail: fwdulle@suanet.ac.tz
Phone.: +255787423399

Appendix 3: Questionnaire survey for researchers

1. Which university are you from?
Ardhi University ☐   Muhimbili University of Health and Allied Sciences ☐   Mzumbe University ☐
Open University of Tanzania ☐   Sokoine University of Agriculture ☐   University of Dar es Salaam ☐

2. Your gender: Male ☐   Female ☐

3. **Which age profile do you belong to?**
20-30 yrs ☐   31-40 yrs ☐   41-50 yrs ☐   51-60 yrs ☐   ≥ 61yrs ☐

4. Your highest academic qualification
Bachelors Degree ☐   Masters Degree ☐   PhD ☐
Other (*specify)*: …………………………………………………………………………………….

5. What is your academic rank at the university?
Assistant Lecturer/Researcher/Librarian ☐   Lecturer/Researcher/Librarian ☐
Senior Lecturer/Researcher/Librarian ☐   Associate Professor ☐   Professor ☐

6. What is your research discipline? *(e.g. sociology, economics):*
………

7. For how long have you been using the Internet in accessing or disseminating scholarly information?
1–5 years ☐   6–10 years ☐   11 ≥ yrs ☐   No experience at all ☐

8. How did you acquire the Internet usage skills? *(tick ALL that apply)*

Self-learning ☐ Training by the University Computing Centre ☐ Training by the University Library ☐
☐ Others ((*Please specify):* …………………………………………………………………………………………

9. How do you rate yourself regarding Internet usage skills in terms of accessing scholarly information?
(Tick appropriate box)

    Very good ☐   *Good* ☐   *Fair* ☐   *Poor* ☐

10. How do you rate yourself regarding Internet usage skills in terms of   dissemination of scholarly information
(Tick appropriate box)

    Very good ☐   *Good* ☐   *Fair* ☐   *Poor* ☐

11. Please indicate the extent to which you agree or disagree with each of the following statements regarding your Internet usage self-efficacy. (*Tick one   box against each statement - Key: 1 = Strongly agree; 2 = Agree ; 3= Disagree; 4 = Strongly disagree; 5 = Do not know*)

12a. I feel confident in searching scholarly information on the Internet   1☐   2☐   3☐   4☐   5☐
12b. I feel confident in publishing my research output on the Internet   1☐   2☐   3☐   4☐   5☐
12c. I feel confident in designing my personal website   1☐   2☐   3☐   4☐   5☐
12d. I feel confident publishing on the internet even when there is no one around   1☐   2☐   3☐   4☐   5☐
    to show me how to do it

12. What are the main problems you face while using the Internet in accessing scholarly content?
 (Please elaborate and suggest possible solutions to such problems)
……
……
……

13. What are the main problems you face while using the Internet in disseminating scholarly content?
(Please elaborate and suggest possible solutions to such problems).

……

……

……

……

Note: Open access scholarly content is digital, online, free of charge, and free of most copyright and licensing restrictions to everyone for access on the Internet without identification.

14. Have you ever heard about Open Access before this survey? (tick appropriate box)
          1. YES ☐   2. NO ☐
(If your answer is NO, skip #15 go to #16)

15. How did you get aware of Open Access? *(Tick ALL that apply to you)*
Following Internet debate about Open Access ☐   Heard about it from my colleague ☐
Heard about it from publishers' promotion ☐
Other *(Please specify):* ……

16. Have you ever used Open Access outlets to:
16a. Access scholarly literature?   YES ☐   NO ☐
16b. Disseminate your research findings? YES ☐   NO ☐

If your answer is NO for # **16a** *go to # 19;   If your answer is NO for #* **16b** *go to #21*

17. What has been your general impression about Open Access publications you accessed? *(Tick ALL that apply to you against each of the following statements)*
17a. The publications are original and represent high quality research   ☐
17b. The publications represent adequate standards of quality and have scientific merit   ☐

17c. The publications are generally quite mediocre or of little scientific merit   ☐

18. If you have never used open access outlets to access scholarly literature what are the reasons?
………
………
………
………

19. If you published in Open Access outlets, indicate the number of publications you made available through Open access [Public domain] means since 2007 to date in the provided space.

Journal articles: …………   **Books:** ………………   **Chapter in books:** ……………..   **Conference articles:** ……………..
Theses/Dissertation: ………………….   **Research reports:** …………………

20. In which among the following open access outlets your publications on #20 appear? (Tick all boxes as applicable)
1. Open access journal   ☐
2. Institutional repository   ☐
3. Disciplinary/subject repository   ☐
4. Your personal website   ☐
5. Other (Please specify): ....

21. If you have never used open access outlets to publish your scholarly output what are the reasons? *Tick one   box against each statement -* **Key: 1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly disagree; 5 = I do not know/no opinion).**

21a. Lack adequate skills to publish in open access outlets   1☐   2☐   3☐   4☐   5☐

21b. Open access publications are considered of low quality as compared to   1☐   2☐   3☐   4☐   5☐
      subscription based publications
21c. Long-term availability of open access publications is not guaranteed   1☐   2☐   3☐   4☐   5☐

21d. Open access publications are likely to be misused or plagiarised   1☐   2☐   3☐   4☐   5☐

21e. Open access publishing is not compatible with the existing scholarly   1☐   2☐   3☐   4☐   5☐

communication

21f. Other reasons for not publishing in open access outlets [Please elaborate]

……

……

……

……

22. Please indicate the extent to which you agree or disagree with the following statements about your attitudes towards accessing or disseminating scholarly information through open access outlets. (*Tick one box against each statement –* Key: 1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly disagree; 5 = I do not know/no opinion).

22a. Publishing in open access outlets is a good idea   1☐ 2☐ 3☐ 4☐ 5☐

22b. Publishing in open access outlets would make my work more interesting   1☐ 2☐ 3☐ 4☐ 5☐

22c. Accessing and use of open access materials is a good idea   1☐ 2☐ 3☐ 4☐ 5☐

22d. Publishing in open access is easy for me   1☐ 2☐ 3☐ 4☐ 5☐

22e. Open access content is beneficial to the scholarly community   1☐ 2☐ 3☐ 4☐ 5☐

23. How important are the following factors or conditions in influencing your decision to publish in open access outlets in future? *(Tick one box against each statement - Key: 1 = Very important; 2 = Important; 3 = Less important; 4 = Least important 5 = I do not know/no opinion)*

23a. If Leading researchers in your discipline publish in open access outlets   1☐ 2☐ 3☐ 4☐ 5☐

23b.If your close colleagues publish in open access outlets   1☐ 2☐ 3☐ 4☐ 5☐

23c.If your research funding agency that supports you would look favourably on you   1☐ 2☐ 3☐ 4☐ 5☐
       for publishing in open access outlets

23d. If your research funding agency requires you to publish in open access outlets   1☐ 2☐ 3☐ 4☐ 5☐

23e. If your institution would look favourably on you for publishing in open access   1☐ 2☐ 3☐ 4☐ 5☐
       outlets

24f. If your institution requires you to publish in open access outlets   1☐ 2☐ 3☐ 4☐ 5☐

24. To what extent do you agree or disagree with the following statements about the anticipated outcomes of Open Access outlets in scholarly communication. *(Tick one box against each statement - Key:1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly disagree; 5 = I do not know/no opinion)*

24a. Open access outlets enable scholars to publish more quickly (turn around time   1☐ 2☐ 3☐ 4☐ 5☐
     from submission to publishing is short)

24b. Publishing in open access outlets increases research impact by such works being   1☐ 2☐ 3☐ 4☐ 5☐
     highly used and cited

24c. Open access outlets improve accessibility to scholarly literature because it is free   1☐ 2☐ 3☐ 4☐ 5☐
     and without access limitations

24d. Open Access enables researchers in developing countries to access literature more   1☐ 2☐ 3☐ 4☐ 5☐
     easily

24e. Publishing in open access outlets exposes scholarly work to a large potential   1☐ 2☐ 3☐ 4☐ 5☐
     readership

25. To what extent do you agree or disagree with the following statements regarding your expected difficulty or ease of using Open access outlets *(Tick one box against each statement - Key:1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly disagree; 5 = I do not know/no opinion)*

25a. I believe the interaction with open access publication system to be clear and   1☐ 2☐ 3☐ 4☐ 5☐
     understandable for publication of scholarly content (e.g. web interfaces)

25b. It (is) will be easy for me to become skilful at publishing my work in open access   1☐ 2☐ 3☐ 4☐ 5☐
     outlets

25c. Learning to publish my work in open access outlets (is) would be easy for me   1☐ 2☐ 3☐ 4☐ 5☐

25d. I (will) find it easy to access open access scholarly content from the Internet   1☐ 2☐ 3☐ 4☐ 5☐

25e. I clearly understand the implications of publishing in open access outlets   1☐ 2☐ 3☐ 4☐ 5☐

26. To what extent do you agree or disagree about the following facilitating conditions for you to use open access at your institution (*Tick one   box against each statement - Key:1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly disagree; 5 = I do not know/no opinion*)

                                                                    1☐   2☐   3☐   4☐   5☐

26a. I have the necessary knowledge to publish my work in open access outlets

26b. I have the necessary resources to publish my work in open access outlets   1☐   2☐   3☐   4☐   5☐
      (e.g. IT infrastructure, Internet access, …)

26 c. Guidance is available for me to use the Internet effectively for information   1☐   2☐   3☐   4☐   5☐
      access

26d. My institution recognises open access publications for my carrier   1☐   2☐   3☐   4☐   5☐
      development (promotion criteria)

26e. Guidance is available for me to use the Internet for publishing my research   1☐   2☐   3☐   4☐   5☐
      output through open access outlets

27. How likely is it for you to publish in Open Access outlets in the near future (Tick ONE   box for your appropriate answer)

  Very likely ☐   Likely ☐   Unlikely ☐   Very unlikely ☐

*NOTE: It is generally acknowledged that developing countries contribute insignificantly to the global scholarly literature because **MOST of the** research output from such countries is documented in publications with limited circulation [such as conference proceedings, theses/dissertation etc...]*

28. To what extent do you Agree or Disagree with the above observation as far as dissemination of research output from your institution is concerned? (Tick one box for your appropriate answer)

  Strong agree ☐   Agree ☐   Disagree ☐   Strongly Disagree ☐

NOTE: One possible solution to increase visibility and accessibility of scholarly output from developing countries and elsewhere is to establish institutional repositories [digital archive in which researchers can deposit their research output such as research reports, conference papers, theses/dissertations etc.] for wider dissemination.

29. How do you rate the importance of establishment of an institutional repository for archiving and wider dissemination of research output at your University? (Tick one box against your appropriate answer)

Very important ☐　　　　Important ☐　　　Less important ☐　　Least unimportant ☐

30. What type of research materials would you recommend to be deposited in the institutional repository? *(Tick box against ALL that apply to you)*

Peer-reviewed articles published in a journal ☐　　　　Conference/workshop papers ☐
Non- peer-reviewed articles published in a journal ☐　Teaching materials ☐

Articles waiting peer review in a journal ☐　　　　　　Theses/dissertations ☐

Others *(Please specify):* ………………………………………………………………………………………………

31. In your view, what would be the acceptable use of publications in the institutional repository? (Tick All that you support)
31a. Anybody should be allowed to comment and/or add notes on deposited works　☐
31b. Any use of deposited works so long as it is properly acknowledged　☐
31c. Individuals using deposited work should register first so that usage statistics are collected　☐
31d. Others allowable uses *(Please specify):*
………
……

32. How important is the review of publications that have not undergone the peer-review process before depositing them in the repository? *(Tick ONE that applies to you)*

Very important ☐ Important ☐ Less important ☐ Least important ☐

33. If your answer is IMPORTANT or VERY IMPORTANT for # 32, who should do the review process? *(Tick ONLY ONE you think MOST appropriate)*

Departmental Research Committee ☐ Faculty/Institute/Directorate Research Committee ☐

University-wide Research Committee ☐

Other *(Please specify:* ……………………………………………………………………………………………………

34. Which unit do you think is the most appropriate within your university setup that is better placed to manage the institutional repository if established? *(Tick ONE you think MOST appropriate)*

A university-wide unit responsible with research coordination ☐
The university library ☐
Each faculty/institute/directorate/centre ☐

35. What is the reason for your choice in #34 above? Please elaborate
……
……
……

36. Do you have any other comments regarding Open Access publishing in general? (Please elaborate)
……
……
……
……

THANK YOU VERY MUCH FOR YOUR TIME AND PARTICIPATION. IF YOU HAVE ANY QUESTION PLEASE DO NOT HESTATE
TO CONTACT ME AT: fwdulle@suanet.ac.tz OR 0787423399.
     Appendix 4: Interview schedule for university research administrators

Introduction

I'm conducting a study aiming at assessing the acceptance and usage of open access scholarly communication among scientists in Tanzanian public universities. As a member in the university research administration, you are requested to participate in this interview being addressed to representative stakeholders with an interest in improving scholarly communication in the country. The interview is about open access which enables the widest possible dissemination of scholarly content by removing copyright and financial barriers that prevent access to scholarly output. The focus of the interview is to ascertain your awareness of this development within scholarly communication; to seek your views on several aspects of open access; and find out whether your institution is likely to foster the uptake of open access in Tanzania. Results from this survey form a crucial component of my PhD thesis and will provide an important input in recommending a most suitable model for dissemination of scholarly output by capitalising on the current Information and Communication Technologies (ICTs) developments in the country.

I will appreciate the value of your views.

BACKGROUND INFORMATION

B1. Name of University:

B2. Respondent's Position:

B3. Respondent's gender:

Q1. Research is among the missions of your institution, does your university have any strategy to maximise the dissemination of its research output nationally and internationally? Explain.

Q2. How does the university document its research output to ensure its track since the institution was established?

NOTE: Open Access scholarly content is digital, online, free of charge, and free of most copyright and licensing restrictions for everyone to access on the Internet without identification.

Q3. Have you ever heard about Open Access before this survey?

Q4 .If you are aware about open access, among the following, which initiatives or terms about Open Access are you aware of?

Open access journals ☐   Open access repositories ☐   Self- archiving ☐   Biomed Central ☐
Budapest open access initiative ☐   OAISt.org ☐   SHERPA Project ☐   The ArXiv   ☐   Others:

Q5. How did you know about Open Access?
Following Internet debate about Open Access ☐   I heard about it from my colleague ☐
I heard about it from publishers' promotion ☐   Others:

Q6. To what extent do you Agree or Disagree with that observation as far as dissemination of research output from your institution is concerned?

Strongly agree ☐   Agree ☐   Disagree ☐ Strongly Disagree ☐   Do not know/no opinion ☐

*NOTE: Among the suggested options to improve the visibility of scholarly output from developing countries and elsewhere is to establish institutional repositories **[digital archive in which researchers can deposit their research output such as research reports, conference papers, theses/dissertations etc**.] for wider dissemination.*

Q7. How do you rate the importance of establishment of an institutional repository for archiving and dissemination of research output at your University? (Tick one box against your appropriate answer)
 Very important ☐   Important ☐   less important ☐   Least important ☐

Q8. In case your answer is very important or important for Q7, what type of material would you prefer to be deposited in the institutional repository?

Peer-reviewed articles published in a journal ☐ Non- peer-reviewed articles published in a journal ☐
Articles waiting peer review in a journal ☐ Conference/workshop papers ☐ Theses/dissertations ☐
Teaching materials ☐   Others:

Q9 Which do you think is the most appropriate unit within your university setup that is better placed to

manage the institutional repository if established? What are the reasons to support your suggestion?

Q10. Several universities have introduced policies that play a role in strengthening open access initiatives. The following are some representative of strategies included in such institutional statements. Please indicate, in your opinion, which of these measures would you support for implementation by your institution.

10a. Explicit recognition or reward for open access publications published by university staff in same way as traditional documents.

Would support ☐ Would likely support ☐ Would need more information ☐ Would not support ☐

10b. Recommend that researchers retain copyright over their articles, granting publishers a license to publish so as to enable subsequent self-archiving in institutional repository

Would support ☐ Would likely support ☐ Would need more information ☐ Would not support ☐

10c. Establish a policy to require faculty to deposit their research output in institutional repository

Would support ☐ Would likely support ☐ Would need more information ☐ Would not support ☐

10 d. Sponsor author charges in open access journals, where necessary

Would support ☐ Would likely support ☐ Would need more information ☐ Would not support ☐

10 e. Sponsor publication of journals hosted at the university for making them accessible to the research

community free of charge

would support ☐ Would likely support ☐ Would need more information ☐ Would not support ☐

11. Which among the following statements closely matches the current status of your institution's response to open access?

☐ Open access publishing has not yet been discussed at strategic or business meeting
☐ Open access publishing has been raised, but not yet taken forward
☐ The university is developing a policy on open access publishing
☐ The university intends or has already begun to institute an online institutional repository.

Q12. Do you have any other general comment(s) regarding Open Access?

THANK YOU VERY MUCH.

Appendix 5: Data collection sheet for structured records review

A. Institutional website/WebPages analysis

1. Name of institution:

2. Availability of accessible website: **Y/N**

3. URL:

4. Any evidence of research publications accessible from the university front page? : **Y**/**N**

5. Any evidence of research publications accessible from the university library Web Page? :
Y/N

6. Any evidence of research publications accessible from other university Web Pages? : **Y/N**

7. Are there full-text research publications accessible? : **Y/N**

8. Is there any evidence of open access journals hosted by the website? : **Y/N**

9. Is there any evidence of open access repository? : **Y/N**

10. Any other observations from the University website:

B. OAIster Website analysis

1. Name of University:

2. Total number of retrieved documents:

3. Total number of data Contributors:

4. Total number of records with at least one of the authors whose affiliation is the university
under investigation from subscription-based data contributors:

5. Total number of open access full-text records contributed by authors whose affiliation is
the university under investigation:

6. Any other observations from OAIster analysis:

Appendix 6: List of journals published from the six Tanzanian public universities

University	Journal titles
ARU	➢ The journal of Building and land development*
MUHAS	➢ East African journal of public health* ➢ Tanzania dental journal* ➢ Tanzania journal of health research* ➢ Tanzania medical journal*
MU	➢ Mzumbe University uongozi journal of management ➢ Journal of public policy and administration ➢ Economics and development papers journal
OUT	➢ HURIA journal of Education* ➢ The OUT law journal ➢ Journal of issue & practices in Education
SUA	➢ Journal of development studies ➢ Journal of agricultural economics and development ➢ Journal of agricultural education and extension ➢ Journal of agricultural sciences ➢ Tanzania journal of agricultural engineering ➢ Tanzania journal of forestry and nature conservation* ➢ Tanzania Veterinary journal*
UDSM	➢ African review journal

	➢ Business management review journal
	➢ Development management journal
	➢ Eastern Africa law review journal
	➢ Jarida la Kiswahili
	➢ Geographical Association of Tanzania Journal
	➢ Linguistics journal
	➢ MULIKA
	➢ Papers in Education and development journal
	➢ Population studies and development journal
	➢ Tanzania journal of science*
	➢ Tanzania economic trends journal
	➢ Tanzania journal of engineering and technology
	➢ Tanzania zamani journal
	➢ University of Dar es Salaam library journal*
	➢ Utafiti journal

* **Available online through the African Journal Online (AJOL).**